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MASTER IN THE ELECTRIC POWER INDUSTRY

MASTER THESIS

Documentation & Optimization of Business Processes in an Energy Management Front & Back Office Team

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Madrid

July 2016

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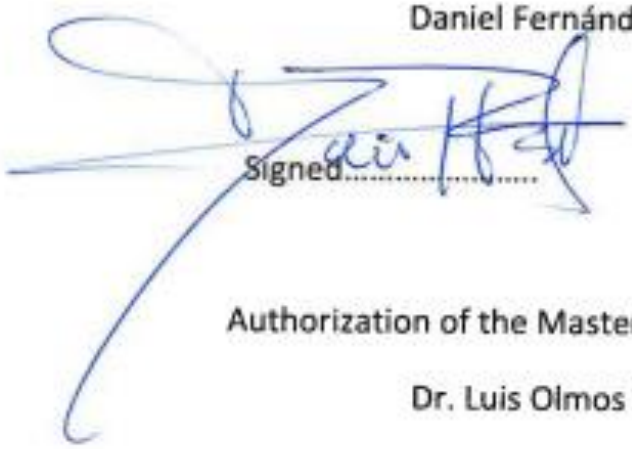

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MASTER THESIS

Documentation & Optimization of Business Processes in an Energy Management Front & Back Office Team

Student: Xosé María Núñez Marcos

Supervisor: Daniel Fernández Alonso

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July 2016

SUMMARY:

This project has been carried out in the Front office department of the Spanish Business Unit of the Energy Management section of an International Company. The Front office of a Company is the main activity of the business, where revenues are created, and the more risky activities are developed. The definition of the process roles and responsibilities and the risk identification and evaluation, are the main drivers of the Process development in a company, as it allows to locate the most sensible activities associated to the process. It is also a key driver of a department structure as it explains the distribution of tasks among the department members, and helps to allocate the different activities in an efficient way.

The project seek two main objectives: the first one is the documentation of the Front-office processes in order to provide a solid base with defined tasks as backup documents supporting the internal Control Mechanisms of the company, because of the need to have a clear view of where the risks are located in the processes. This documentation procedure was completed with the help of the owners and responsible for the processes, defining each of the steps to be developed in order to perform the complete process, and the location of the different risk associated to the operating activities. The main activities studied are: The Gas Supply Dept., Short term Power Optimization, Market operations, scheduling & dispatch, and the Gas settlement & Invoicing. This part of the project has been the most time spending, as the processes must be deeply studied in order to develop a clear and defined document which explains fully the process. It is also the most important part regarding the company, as it provides support to the management and control, in order to have a more clear view over the processes carried out in the department in a transparent manner.

The second objective was, once the documentation part has been finished, to look for possible enhancements, optimization or reduction of the steps in each of the studied and documented processes. The intended optimization is mainly focused in the reduction of the process steps and simplifying the whole process and the interactions between departments, so the main cost reductions will be measured in terms of time savings of the process, which is translated into operating costs. Other savings or earnings derived from the optimization are also obtained.

GREETINGS:

I want to thank Daniel for the opportunity of working in the company, for the guidance and the help provided for the development of the project, the things I learnt from him and the great support that he has extended to me.

I also want to thank all the colleagues with whom I worked and have helped me during my internship, letting me learn from them and sharing their knowledge about the different subjects they are in charge of.

Xosé María

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1

INTRODUCTION

I. CONTEXT

This Project is developed within the framework of the Energy Management (EM) Department of a company carrying out the two liberalized activities in the electricity sector, generation & retail, in the Spanish market.

Energy Management (EM) is in charge of the following activities among others:

- Market-related electricity activities: selling in the market for its own generation & other represented units, optimizing and maximizing de economic output from the market; and buying the electricity for the customers at the best available conditions.
- Gas trade, management & optimization: in order to get the maximum profit from the portfolio and trying to obtain the best prices to be competitive in the market.
- All the activities to support the market tasks: such as the physical dispatch of the assets, forecasting, optimization and financial hedging in order to reduce the risks inherent to his activities, and the Back office activities..

Before entering into details for the functioning of EM, let's describe the current situation of the markets and the system functioning for gas and electricity in Europe and in Spain.

II. ELECTRICITY

a. EUROPEAN PERSPECTIVES

In the context of new the energetic future and the willingness to reduce carbon emissions, a new paradigm arises on the horizon. The regulation on the European Union with the Third Energy Package (2009/72/CE 73) stands for the full liberalization of the energy sector, in order to create a European Energy Market, with the objective of offering better prices and services to the citizens. The first step is the unbundling of activities, in regulated activities with a monopolistic view (transmission & Distribution), and liberalized activities following a market-based approach (Generation & Retail).

Since the late 1990s, all the European countries started to create organized markets such as OMIE in Spain and Portugal, EPEXSpot in France, Germany and other European countries, Nord Pool in the Nordic countries, GME in Italy, and so on.

Competitive prices, security of supply and transparency are the main objectives of the European Regulation in order to avoid market power and dominant positions in the market, benefiting consumers and the system as a whole. Europe stands for a single integrated market, with an increasing capacity of interconnection, which would lead to an increase in competition and to close the gap of prices between countries. Other main principle is security of supply, based on the diversification of the sources, and the network development to ensure the supply to every consumer. Regarding transparency, several mechanisms have been put in place, like the REMIT regulation (EU) No 1227/2011 of the European Parliament, establishing the obligation to report in order to collect all the data regarding transactions and fundamental data of the agents participating in the system. National Regulatory Authorities, such as the Spanish CNMC) are in charge of controlling, collecting data and sanctioning if necessary to the agents acting against the regulation or abusive practices affecting the proper functioning of the wholesale energy markets.

b. SPANISH SYSTEM

The system is unbundled into:

- Two regulated activities: Transmission & Distribution.

- Two liberalized activities: Generation & Retail.

Regulated activities are controlled by the Regulatory Authority (CNMC), who decides its remuneration, quality standards and investments to be made. Liberalized activities are market based activities, following some regulations, in which agents decide how to operate in the system, the management of their assets and how to trade in the system, although the CNMC controls the fuel prices

Regulated Activities.

This project focuses on the study of an Energy Management Department, carrying out just liberalized activities. The regulated activities of the system are not going to be very much described. Just two comments about the nature of regulated activities regarding its regulation:

The Royal Decree 13/2012 regulates the managers of the grid that must be **certified**, and an increasing **protection and rights** for the domestic consumers.

And RD 8/2014 stablishes measures to ensure the **financial sustainability** of the sector, in particular setting that the rates for the use of the infrastructures, which must be revised automatically when the gap between income and expenses surpasses certain limits. Three additional principles are:

- Methodology for the retribution of the regulated activities must recover the costs in an efficient way, with the following criteria:
  - Recovering the investment
  - Incentives in order to improve reliability of the service
  - Avoid problems in the relationship between Last Resource Tariff and regulated tariffs.
- The regulatory period stands for six years.
- Stablishes a global methodology to calculate the retribution on the investment

Market based Activities.

OMIE, the Spanish spot market supervisor, was created in 1998 (RD 54/1997) as OMEL by the Spanish Electricity Sector Law, in charge of the management of the market trade, and the non-discriminatory and transparent use of the market. In 2003 the futures market OMIP was created. In 2007 Portugal entered into the market and the joint operation & dispatch was put in place, launching MIBEL (Mercado Ibérico de Electricidad), harmonizing both systems. In 2014 OMIE was in charge of 11.000 million euros trade for the 80% of the electricity consumed in the Peninsula. More than 13 million operations on the year are carried out by more than 800 agents. The Spanish spot is one of the most liquid markets in Europe, with lower prices than the relevant European markets average.

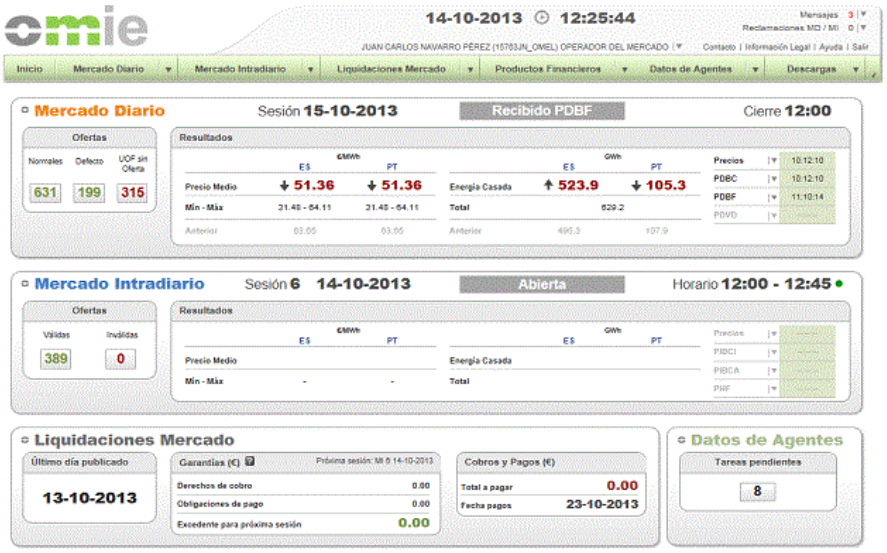


Figure 1. OMIE's Webpage. (1)

The spot market offers known and transparent prices to all the agents willing to buy or sell electricity to other agent. The auction-based market mechanism is divided in several sessions:

- Day-ahead Market: Agents have the obligation of bidding hourly blocks at a price for the following day. Complex conditions can be introduced. Other services for the following day may be offered to the System Operator (REE), in order to allocate generation not matched in the day-ahead market. This services are the ones regarding technical Constraints of the previous market & Complementary services, carried out under market conditions.
- Intraday Markets: Six sessions are established from the closing of the Day-ahead auction to the end of the following day in order to trade the possible deviations from the initial schedule in different hourly periods:
    - From 22h D to 24h D+1
    - From 00h to 24h D+1
    - From 05h to 24h D+1
    - From 08h to 24h D+1
    - From 12h to 24h D+1
    - From 16h to 24h D+1
- In the Real time is the system operator, REE, and not the market operator the one in charge of the management and balance of supply and demand with several services and markets:
    - Tertiary demand.
    - Deviation Management.
    - Intraday technical Constraints.

Figure 2. Electricity Spot Markets in the EU. (2)

On the other hand there is also a Futures Market, OMIP, which is in charge of financial or physical positions for supply in periods greater than 24 hours, in order to hedge operational risk in the spot markets, fixing the prices and avoiding volatility of the market. There are two types of contracts:

- Bilateral contracts built ad hoc for the agents.
- Standard products in organized markets as OMIP, or OTC (Over the Counter), through platforms or brokers (ICAP, CIMD, Tullet, IGH...).

III. Gas

a. The Product

The gas has five main uses:

- Industrial: second source of energy after electricity.
- Residential, commercial and services.
- Power:
  - Combined-Cycle Gas Turbines: Production and Backup as availability to adjust performance of the electric system, due to the speed of the ramps, and the flexible and efficient performance. They have reduced the utilization factor due to the rise of new technologies, especially renewables.
  - Cogeneration: additional income coming from electricity or heating surplus.
- Transport: specially regarding maritime transport.
- Raw material (Fertilizers and other chemicals).

The market for gas, as in electricity, is divided in regulated and liberalized activities.

b. Europe

The gas market in Europe has been developed since 1998, the Directive 98/30/EC, which established the principles in order to liberalize and carry out the unbundling of the different activities of the gas sector.

The Second European Directive for Gas, 2003/55/CE, was implemented in order to achieve an effective liberalization and the opening of competition in the market, letting the consumer freely choose the retailer. It is also focused on the third party access to the infrastructure, and the security of supply.

One of the main objectives in the European Union regarding gas are to reduce the imports coming from Russia, which represent nearly 39% of the gas consumed in Europe. Europe 28's consumption in 2013 was coming from the following sources:

	Natural gas										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Russia	44.1	43.6	40.7	39.3	38.7	37.6	33.0	29.5	31.5	32.0	39.0
Norway	25.5	24.3	23.8	25.9	28.1	28.4	29.3	27.5	27.4	31.2	29.5
Algeria	19.8	18.0	17.6	16.3	15.3	14.7	14.2	14.0	13.0	13.6	12.8
Qatar	0.7	1.4	1.5	1.8	2.2	2.3	5.5	9.7	11.0	8.5	6.7
Nigeria	3.1	3.6	3.4	4.3	4.6	4.0	2.4	4.1	4.3	3.6	1.8
Libya	0.3	0.4	1.6	2.5	3.0	2.9	2.9	2.7	0.7	1.9	1.8
Trinidad and Tobago	0.0	0.0	0.2	1.2	0.8	1.7	2.3	1.5	1.0	0.9	0.8
Peru	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.5
Turkey	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2
Others	6.5	8.6	11.0	8.8	7.3	8.2	10.1	10.9	10.8	7.5	6.9

Table 1. Gas Imports by Origin in Europe from 2003 to 2013 (3)

The diversification of sources of supply is one of the main issues to reach the complete liberalization of the European Gas system, in order to obtain more competitive prices and reduce the downstream risk due to upstream events, increasing Security of supply.

In 2009, the last step was implemented, with the so called Third Package, in order to fully unbundle the activities of production, transport and commercialization, the increase of competences of the independent regulator, in a European cooperation institution, ACER, with a supranational manager of the physical system.

The businesses are divided in:

- Companies in charge of transport, storage and regasification facilities (Enagás)
- Companies in charge of the distribution to the consumption points (Shippers)
- Retail
- TSO, or Transmission System Operator, managing and maintaining the conditions for the correct operation of the system.
- Some gas infrastructures can be treated as regulated or as negotiated activities, such as exemptions given by the European Union to use the LNG terminal for 20 years. (4)

As stated in the European Directives, third party access, transparency and security of supply must be ensured, but under some conditions. In order to access the network, some rules must be followed:

- Request of access to the grid.
- Request of access to the storage and regasification facilities.
- Payment of the tariffs and the regulated payments.

Gas Hub

A hub is a location, virtual or real, in which agents can exchange different products and services, in this case related with gas. These products can be physical or financial products that are not necessarily related with the transfer of a physical product.

The existence of a hub has one main objective; which is to facilitate the different services and transactions that are taken in place, to be a reference in price and products, and speed up those transactions.

In Europe, there are both physical and virtual hubs, the first one have a set of pipelines interconnected, with storage facilities, while the virtual ones represent just a balancing point, to set agreements of transport to a given point, and can also trade capacity rights.

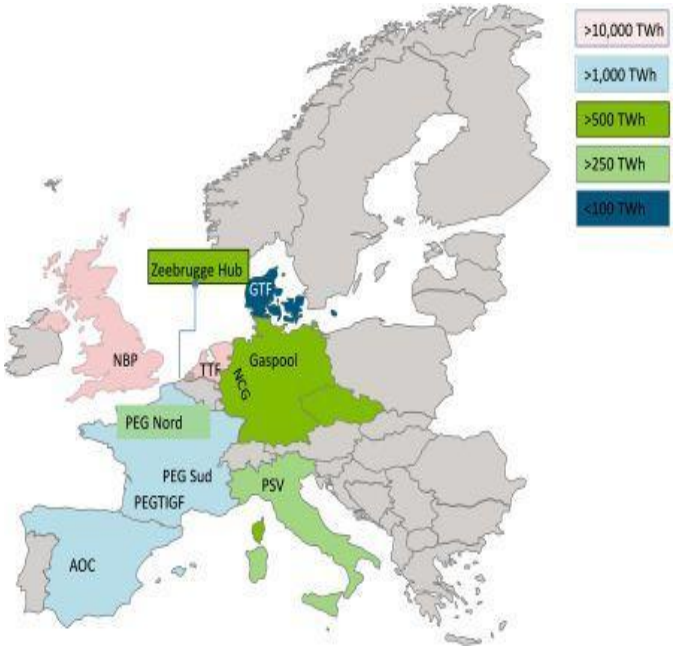


Figure 3. European Gas Hubs (5)

c. Spain

Gas was introduced in Spain in the sixties when the city of Barcelona started to import gas from Libya, and in the seventies from Algeria. In 1985, "*Protocolo Del Gas*" was signed, to increase the consumption of natural gas in the country. In the following years more LNG regasification plants were built, and pipeline interconnection with France (gas coming from Norway) and Algeria. Actual consumption of Spain is served in a 40% by pipeline and the 60% by LNG. Little reserves of national gas where already exhausted, and now used as gas storage facilities.

The Spanish regulation is based on the European Directives regarding the gas sector. There was also a development of the regulated tariff to ensure the supply to all the consumers, a regulation on the minimum amount stored in the country for strategic and security reasons. A period was set in order to adapt the existing model to the new one.

Spain counts with the following gas facilities:

- Three main gas fields.
- Six Regasification plans, and two under construction.
- Four Underground Storage facilities

- Six international connections:
  - Two with Algeria.
  - Two with France.
  - Two with Portugal.
  - More than 12.000 km of transport pipelines.
  - More than 67.000 km of distribution pipelines.
  - Other facilities, as compression stations & LNG satellite plants.

The Spanish market is has a recently stablished hub spot market, called MIBGAS, which started operating in the second half of 2015, is not yet liquid enough to be a European relevant hub. It took close to 10 years to other markets to be liquid enough.

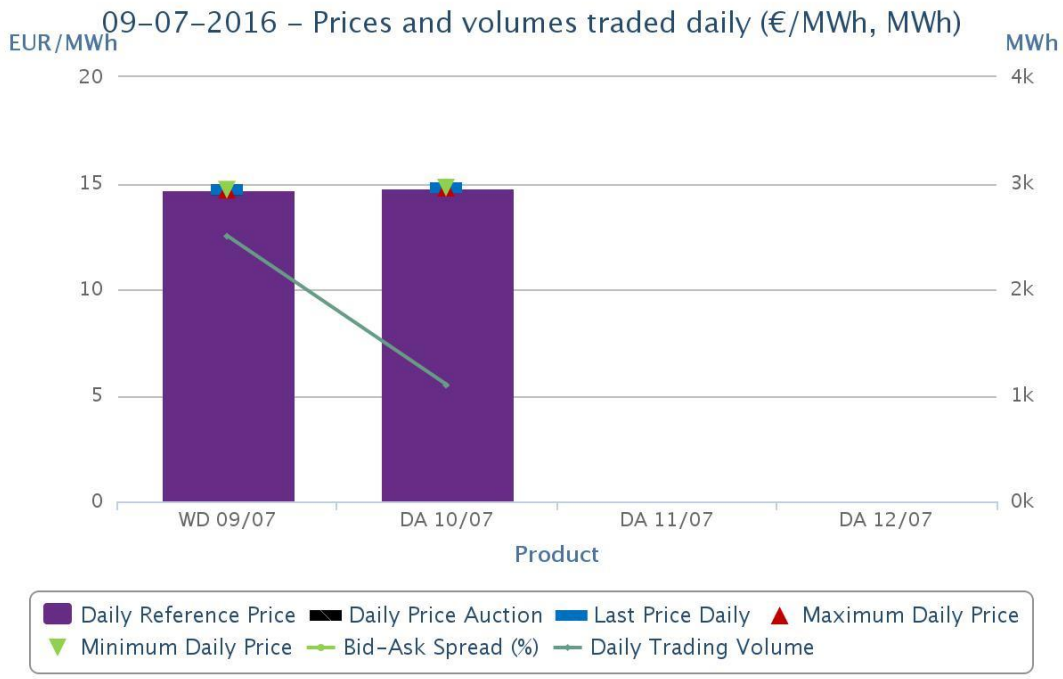


Figure 4. Mibgas auction daily result. (6)

IV. Energy Management Department

a. Structure

This Project is developed to document and optimize processes in the Front and Back Office of the Energy Management Department's, whose structure to be studied is described below. An Energy Management department is usually divided in four main sections, Optimization, Gas Supply, Operations and Sales Portfolio Management, including the support activities. The structure is subdivided by teams as in the following image:

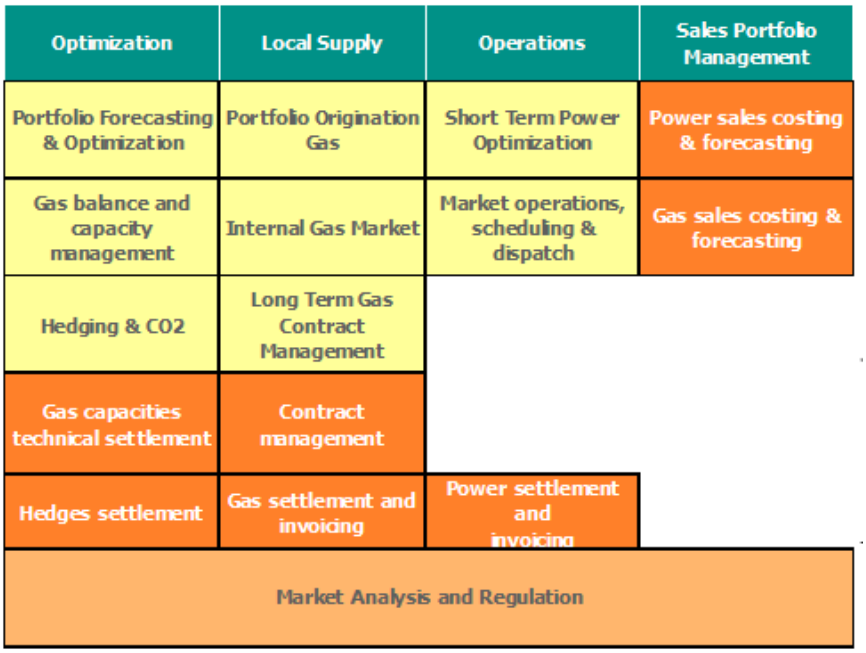


Figure 5. Front Office Structure.

b. Assets of the Company

The company has a standard generic mix in the portfolio that consist on the following assets:

- Renewable Assets
- Thermal Assets
- Represented units (Cogeneration, solar, wind...)

c. Clients

Regarding the clients of gas & electricity:

- Industrial clients
- Cogeneration plants

V. Objectives

The aim of this Project is to study, document and optimize the Front & Back office activities of an Electricity and Gas company. The steps to develop are the following:

1. Recompilation of all the information related to the processes to be studied, interviewing and carrying out some activities, and analyzing the tools used from:
    a. Market Operations Scheduling & Dispatch
    b. Short Term Power Optimization
    c. Gas Supply
    d. Gas Settlement & Invoicing
2. Elaborate the Documentation regarding the different processes studied with a clear and standard process methodology.
3. Assessment of the previous information.
4. The Optimization of the processes, evaluating the possible enhancements and saving.

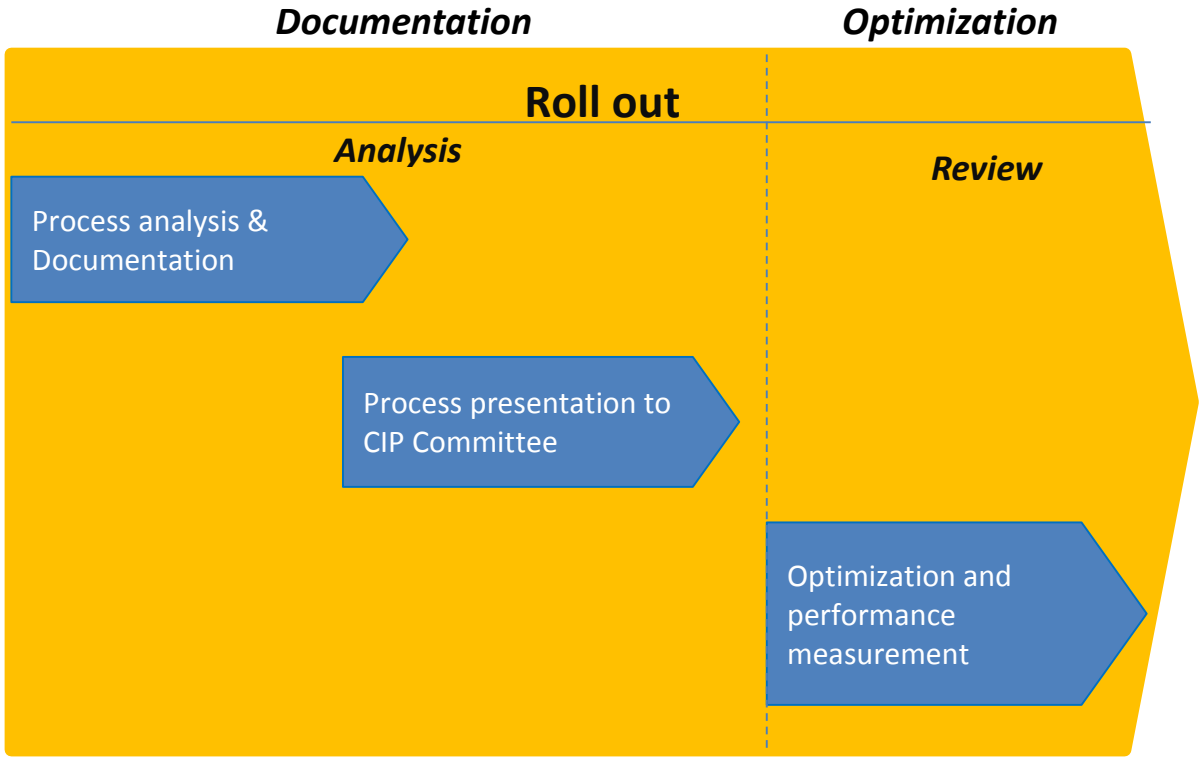


Figure 6. Methodology Diagram

VI. Results: Process Quality & Optimization

The aim of this study:

1. To analyze, explain, document and systematize the processes, which is by itself an output of the project and the main point of interest for the company.
2. To stablish strong a reliable measures to reduce the influence of the process on the results and the time and structure of this processes in order to achieve some savings in terms of time and costs, avoiding redundant or unnecessary activities developed by the department.

The adoption of a quality standards brings itself the design and implementation of the activities, as a measure of the reliability in order to comply with the requirements that may be demanded by the management, clients or regulatory bodies or other stakeholders.

A Process-based approach has as an objective the continuous control of the relationship between individual processes in a system. In order to develop a reliable system there are four things to consider (7):

- The comprehension and compliance of the requirements.
- Consideration of the inherent value of the processes.
- Obtaining a performance analysis.
- Continuous improvement.

Several steps will be measured in order to implement the study:

- Determination of the Relevant Processes
- Determination the sequence and interaction between processes.
- Establish the criteria and method to be followed.
- Ensure the availability of information for the processes studied.
- Study the potential enhancements applicable in each case.

2

DOCUMENTATION

I. Object

This step of the project is the most important and useful for the company, in order to stablish a clear methodology, define the responsibilities and task to be developed by each of the agents that support the process. The process design and documentation is the base from which an organization is structured, it determines the roles of each department in order to avoid conflicts between them.

As stated before, there are four different processes to analyze:

- Market Operations, Scheduling & Dispatch
- Short Term Power Optimization
- Gas Supply
- Gas Settlement & Invoicing

Each of this processes must be detailed and studied to determine the different activities in which each process is divided. The definition of the activities integrated in one process, and their interaction is the key cornerstone from which the optimization can be implemented.

The process is defined with the combination of two methods, first, the detailed description of the relevant agents with a role in this process and their responsibilities, of every activity developed by the responsible of the process, and the linked processes necessary to carry out the whole process in an efficient way. This has been achieved by observation and interviews to the main actors in each of the processes. Second, the development of a flow chart that explains the relationship between departments and activities in the process. The following shapes and arrows represent different types of actions or steps in a process, or relationship between them:

Process Activity	**Linked Activity**	**Decision**	**Data Input or Output**	**Step Jump**
Defines the activities carried out by the process owner.	Describes an activity carried out by other agent with some responsibility in the process.	Denotes a decision to be made (the format IF will be used in this case)	It means either the input of data to be used, either the storage of output data from the process.	Shows the jump from one step of to another. The content of the shape defines start/end point.

Table 2. Flow diagram shapes.

This method has been defined following the standard used in internal control departments, as a unique and transparent way of analyzing processes. (8)

II. Process Description

a. Market Operation, Scheduling & Dispatch

Dispatch & Operations Team in charge of the relationship and direct interaction with the markets, activities and generation units.

Its duties are:

- To execute the bidding and to the Market Operator (OMIE).
- Send the nominations TSOs (Enagás for gas and REE for power) ensuring that the nominations are correct.
- Send optimum program to the units after the different market sessions.
- Manage retail daily scheduling & re scheduling and updated forecasts.
- Provide the necessary information to forecast.

i. Roles & Responsibilities

Department	Responsibilities in process
Operations / Market Operations, Scheduling & Dispatch	**Execute bidding & nominations of Power and gas to OMIE & REE.** **Ensure & Validate nominations.**
Operations Management	**Supervise and manage operations.** **Supervise and develop strategy.**
Operations/ Short Term Power Optimization	**Perform Weekly to intraday optimization of production assets to develop the strategy.** **Reporting to institutions.**
Gas Supply	**Provide the updated strategy for Gas nominations for the following days.**
Optimization / Portfolio Forecasting & Optimization	**Perform economical gas & power portfolio optimization on a weekly, monthly budget & PAMT horizon, taking all contractual/ physical constraints into account on a reference scenario.**
Optimization / Gas Balance & Capacity Management	**Propose & implement the most optimized TPA contracted of the whole portfolio, including CCGTs.** **Optimize gas logistics and making gas available for portfolio demand.** **Ensure balanced & optimized position on gas portfolio.**
Power Plants	**Communication of the actual state of the units, in order to calculate the availability for the following day.**

ii. Linked Processes

Linked process	Short description of the link
Strategy Formulation	**Gas Supply provides the updated strategy for Gas nominations for the following days.**
Gas Operations	**Enagás, Distributors & Importers, carry out the operations demanded by EM related with gas transport, imports & delivery of gas.**
Gas Balance	**Enagás daily publishes the results for the gas balance in their assets for each company.** **Enagás reports D-1 gas consumption for industrial consumers.**
CCGTs D+1 Program	**The Operation of CCGTs is settled the day before. Daily operation must be taken into account in order to set the gas nomination for D+1 for each unit.**
Strategy Formulation & Update	**Short Term Power Optimization provides the updated strategy for the Day-ahead, Intraday and Adjustment Markets, regarding the state of the units and the system.**
Reprogramming, Hydro & Retail Forecast	**Counterparties update information of its units & forecast periodically.** **Plants real time availability & Retail consumption forecast are also received and included in the IT SYSTEM.**
CCGTs Availability	**The availability program & conditions (Temperature & pressure) provided by the CCGTs are the basis for analyzing the D+1 price & power schedule each hour for each unit.**
DA Market	**OMIE carries out the Day-ahead auction and provides the information regarding the result of hourly prices and volumes for the following day.**
Constraints Market	**After each session of the market carried out by OMIE, REE studies the physical result of the whole system and modifies the market outcome and solves infeasibilities in the best economical way.**
Reserve Market	**REE studies the demand forecast and compares it with the market outcome and offers secondary & reserve volumes to manage the deviations on real time, and ensure balance between generation and demand in every moment.**
ID Market	**OMIE carries out the Intraday auction and provides the information regarding the result of each agent's units and price for each hour of the intraday period covered by each session of the market (7 sessions).**

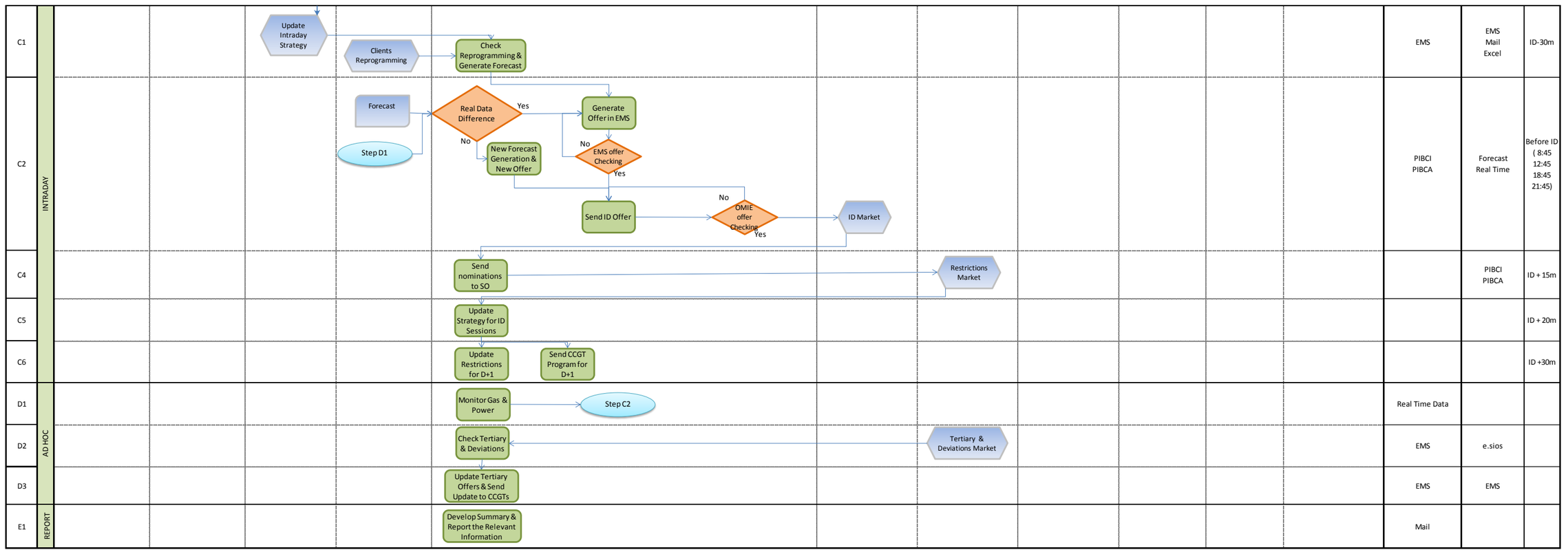
iii. Process flow and narrative

Ref.	Activity	Description
GAS OPERATIONS		
A1	**Generate & Send Gas Daily Nominations.**	Check the reserves, transport & counterparty nominations, following the Strategy set by **Short Term Power Optimization & Portfolio Forecasting & Optimization**, D+1 nominations must be send to **Enagás** (**TSO) and Gas Suppliers.**
A2	**Validate Daily Share & Residuals.**	After the publication of the results of D-1, consumption must be checked, and the value of the residuals validated. In case one value does not match, distributor must be contacted. In order to store the information regarding gas nominations, we must check and copy data from **Enagás** and from **LT Suppliers**.
A3	**Complete ATR hiring.**	Introduce in SL_ATR the consumption forecast for **CCGTs.**
A4	**Insert Closing CCGTs' Gas Nomination**	Once D+1 Nominations are settled, insert final result in IT System.
A5	**Check ATR, Nominations & Modify "Gas Follow Up".**	Check the final values for the D+1 daily nominations in **SL-ATR** for D and **Medgaz** webpage for D & D+1 (take care of the hourly gap of 8 hours), to update the position in « Gas Follow Up », ensuring that data is correct. If necessary re nominate in SL-ATR.
ELECTRICITY DAY AHEAD		
B1	**Check Reprogramming & Generate Forecast.**	Receive Reprogramming for Consumption or Generation. Check forecast for represented units and generate the bids that must be sent to **OMIE**.
B2	**Generate Offer in IT SYSTEM & Send Hydro Capacity.**	After checking the estimations of production & consumption, reprogramming & the strategy for the following day, bids must be included in IT SYSTEM, in order to send them to **REE**. Before the Day-ahead market closing, check reprogramming & send the final bids to **OMIE**. According to the regulation, Available Hydro Capacity for D+1 must be send to **REE**.
B3	**Check Day-ahead Result & Send Insular Nominations.**	Check Day-ahead result in **OMIE's** webpage. Insular nominations are also generated for D+1 (on Tuesday weekly insular nominations).
B4	**Send nominations to SO. Analysis of the Market Output.**	After Day-ahead market results, the nominations & situation of the generation & delivery point must be sent to **REE** in order to check if the physical result is feasible. Market output may be modified so results must be checked. After the reception of D+1 program, an analysis of the results is carried out.
B5	**Send & Check Constraint Offer.**	Analysis of the results in the Day-ahead market, and send Constraint offer according to the previous result and strategy.
B6	**Send CCGT D+1 Program.** **Send I3D to REE.**	Send **CCGTs** D+1 program, including reserve position & gas nomination. Send the Estimations of production of the units and consumption for the following three days to **REE.**
B7	**Check Constraints Matching & send Offer to Secondary & Reserve Market.**	Check the results in the Day-ahead Constraints market, and if Reserve Market is opened, send offer according to the previous result and strategy. If needed, send secondary reserve offers and send results. Inform **CCGTs** with their new schedule once secondary band reserve is set.
B8	**Validate Results & Send Final Program Result.**	After the reserve offer is sent, validate and send program result including Day-ahead, Constraints and reserve.
B9	**Generate FAD.**	After the reception of the forecast of pressure, temperature & availability of the units, the FAD must be calculated for each of the **CCGTs** and loaded in IT SYSTEM.
B10	**Send Program & Validation to CCGTs.**	Send Closing Program to **CCGTs** for the following day, including the reserve conditions in case they are called.
B11	**Send Initial Tertiary Reserve Offer.**	Send **CCGTs** Tertiary reserve first offer for D+1 following the strategy, this offer must be updated in each of the tertiary market sessions according to the strategy.

Ref.	Activity	Description
ELECTRICITY INTRADAY		
C1	**Check Reprogramming & Generate Forecast.**	In each intraday market, **Retail** may update its consumption or Generation must be checked and introduced in the System. Forecast for represented units must be updated. Bids are sent to the **OMIE**, following the strategy.
C2	**Generate Offer in IT SYSTEM & Send.**	Bids are generated following the strategy in IT SYSTEM, and sent to **OMIE** & **REE**. Bids must be checked, corrected, and contrasted with real data. In case of mismatch, new offers must be generated.
C3	**Send nominations to SO.**	After Intraday market results, the nominations & situation of the generation & delivery point must be updated & sent to **REE** in order to check if the physical result is feasible. Market output may be modified, so results must be checked.
C4	**Update Strategy for the Following Intraday Sessions.**	After the Constraints market clearing, the program for the day is gradually closed, Data must be included in the IT SYSTEM in order to update the information for the following Intraday sessions.
C5	**Update Constraints for D+1.** **Send CCGT Program.**	Once the Security Market is closed and PDVP has been published, Constraints offer can be changed in real time following strategy (Secondary, Tertiary) If **CCGTs** have been matched in intraday markets, contact **CCGT** to modify output.
AD HOC		
D1	**Monitor Gas & Power**	Real Time checking of Gas & Power positions in order to modify or adapt the profile following the strategy and manage possible deviations. Monitor prices & verify production plans.
D2	**Check Tertiary & Deviations.**	Check periodically in **REE webpage, e.sios,** the different sessions for Tertiary and deviations (Deviations market may open in the hours after Intraday in which agents cannot trade anymore), and proceed to calculate the offers following strategy.
D3	**Update Tertiary Offers & Send Update to CCGTs.**	Send tertiary offer for the following day if indicated in the strategy. **CCGTs** must be informed as quickly as possible in IT SYSTEM.
REPORTING		
E1	**Develop Summary & Report the Relevant Information.**	Before the end of the session, the **Operator on duty** must report with the relevant information of the session, developing a summary with significant events.

Process flow can be found in the next page.

Ref.		GENERATION /OPERATIONS	LOCAL SUPPLY	OPERATION/ Short Term Power Optimization	Counterparty	OPERATION/ Market Operations, Scheduling & Dispatch	OMIE (Market Operator)	REE (Power TSO)	GAS DISTRIBUTOR	GAS IMPORTER	GAS SUPPLIER	ENAGAS (Gas TSO)	Output	Application system type	Timing
A1	GAS OPERATIONS		Gas Procurement			Generate & Send Gas Daily Nominations				Gas Operations	Gas Operations	Gas Operations	Nominations: -SCH: D - Medgaz: D & D+1	EMS	9:15 -9:30
A2						Yes Validate Residuals D-1 No; Contact Distributor; Fulfill Gas Follow Up			Revision & Claims			Gas Balance	EMS	SL-ATR Mail	14:10
A3		Step B10				Complete ATR Hiring							SL-ATR	EMS	16:40
A4		CCGTs D+1 Program				Insert CCGTs Closing Gas Nomination							EMS		17:15
A5						Check ATR & Nominations.; Send Gas Balance D to D+3					D+1 & D+2 Nominations	Gas Balance	Mail	EMS	17:45
B1	DAY AHEAD			Update Strategy	Clients Reprogramming Hydro & Retail Forecast	Check Reprogramming & Generate Forecast							EMS	Mail Excel EMS	Before 11:30
B2		CCGTs Availability; Step B9				Generate Offer in EMS; No EMS offer Checking Yes; No OMIE offer Checking Yes		Send Hydro Capacity					Forecasting Tool	EMS	Before 12:00
B3						Check DA & Send Insular Nominations		DA Market					PDBC	EMS	12:40
B4						Send nominations. Market Analysis							e.sios e.sole REE Canarias	EMS PDBC	13:10
B5						Send & Check Restricctions Offer		Restrictions Market					e.sios	e.sios	
B6						Send CCGT D+1 Program; Send I3D to REE							Mail I3D	e.sios	14:35
B7				Update Strategy		Check Restrictions Matching; Send Offer to Reserve Market		Reserve & Secondary Market					e.sios	EMS	15:45 - 17:20
B8						Program: DA+Security+ Restrictions; Validate the Result							EMS	e.sios	16:00- 17:00
B9					Step B2	Generate FAD							EMS	Mail Excel	17:10
B10						Send Program to CCGTs for D & D+1; Step A5							Mail	Excel EMS	19:30
B11						Send Initial Tertiary Reserve Offer							e.sios	EMS	22:25


C1
C2
C4
C5
C6
D1
D2
D3
E1
INTRADAY
AD HOC
REPORT
Update Intraday Strategy
Clients Reprogramming
Check Reprogramming & Generate Forecast
Forecast
Step D1
Real Data Difference
Yes
No
Generate Offer in EMS
New Forecast Generation & New Offer
No
EMS offer Checking
Yes
Send ID Offer
No
OMIE offer Checking
Yes
ID Market
Send nominations to SO
Restrictions Market
Update Strategy for ID Sessions
Update Restrictions for D+1
Send CCGT Program for D+1
Monitor Gas & Power
Step C2
Check Tertiary & Deviations
Tertiary & Deviations Market
Update Tertiary Offers & Send Update to CCGTs
Develop Summary & Report the Relevant Information
EMS
EMS Mail Excel
ID-30m
PIBCI PIBCA
Forecast Real Time
Before ID (8:45 12:45 18:45 21:45)
PIBCI PIBCA
ID + 15m
ID + 20m
ID +30m
Real Time Data
EMS
e.sios
EMS
EMS
Mail

b. Short Term Power optimization

This department is in charge of the forecast, study & optimization of the market bids to be implemented, and the daily and MT strategy in order to maximize benefits.

Their duties are:

- Calculating & deciding the bidding strategy.
- Monitoring the adequate execution of nominations & bidding.
- Manage the daily events, in order to provide the best solution for each circumstance.
- Carry out forecasts in order to have the necessary information to provide the best optimization.

i. Roles and responsibilities

Department	Responsibilities in process
Operation/ Short Term Power Optimization	- Perform Weekly to intraday optimization of production assets to develop the strategy. - Reporting to institutions.
Operations / Market Operations, Scheduling & Dispatch	- Execute bidding & send nominations of Power and gas to the OMIE & **SO.** - Ensure & Validate nominations.
Head of Operations	- Supervise and manage operations. - Supervise and develop strategy.
Optimization / Portfolio Forecasting & Optimization	- Perform economical gas & power portfolio optimization on a weekly, monthly budget & PAMT horizon, taking all contractual/ physical constraints into account on a reference scenario.
Optimization / Gas Balance & Capacity Management	- Propose & implement scheme of TPA capacities contracting of the whole portfolio, including CCGTs. - Optimize gas logistics and making gas available for portfolio demand. - Ensure balanced & optimized position on gas portfolio.
Power Plants	- Communication of the actual state of the units, in order to calculate the availability for the following day.

ii. Linked Processes

Linked process	Short description of the link
CO2.	**Optimization/ Hedging & CO2** provides the information regarding CO2 prices to take into account when defining **CCGTs** offers in the market.
Gas Availability.	**Gas Balance & Capacity Management** is in charge of balancing of the portfolio and provides the information of the gas availability in the system.
Gas Procurement.	In case there is not enough gas and flexibility in the system to supply to the **CCGTs** if a startup is set in intraday periods or complementary services, **Gas Procurement** is asked to buy or swap gas, at competitive prices, taking into account ATRs.
Unit Availability & State	The availability program & conditions (Temperature & pressure) provided by the **CCGTs** are the basis for analyzing the D+1 price & power schedule each hour for each unit. They must also inform in case of unexpected situations during the day.
Consumption Forecast, Client Reprogramming & Hydro & Solar Forecast.	**Counterparties** updates information of its unit's consumption or production, & forecasts periodically. Hydro Available, Solar forecast & Retail consumption forecast are also received. This information may be received by mail or in the IT SYSTEM.
Market Data & Regulation	**Market Analysis & Regulation** provides market data to perform market analysis in order to develop the strategy & information about existing or new regulatory measures affecting the process.
Market Outcome & Information.	**OMIE & REE** publish historical data regarding demand, production of the different technologies, and prices in different time frames. Some data is not published until 90 days after the auction.
Market Dispatch.	**Market Operations, Scheduling & Dispatch** is in charge of sending the bids contained in the strategy to the OMIE & the information of this offers to REE in the different time frames (DA, Constraints, Intraday & Complementary services).
Market & Constraints.	**OMIE** carries out the auction and publishes the results in the different time frames (DA & Intraday) for volumes and prices for the different agents. **REE** carries out the physical study of the market outcome and changes the market result in the most technical & economical way if necessary. It also sets the Complementary Services market opening and carries out the auction.
Gas Validation	When **CCGTs** match in the market, before starting up, **Gas Balance & Capacity Management** must approve and the contract of ATR in order to provide gas to the units.
Deviations	**Counterparties** may inform of possible deviations on their consumption/production. These deviations on the different forecast that must be taken into account when updating the strategy in the different intraday market sessions.

iii. Process flow and narrative

Ref.	Activity	Description
STRATEGY		
A1	**Forecast Development & Data Analysis**	Forecast: - Consumption. - Production: hydro, wind & solar forecast. - Market Prices & possible deviations. Performance of analysis for the following external action that may impact our optimization: - Gas position. - Unavailabilities & behavior of competitors. - Intraday prices.
A2	**Weekly & Day-ahead Strategy**	In order to develop the strategy for prices, offers and **CCGT's** functioning, the following data must be taken into account: - Previous Forecast & Analysis. - CO2 prices. - Gas availability & price. - Units Availability & state (pressure & temperature). - Client Reprogramming. - Market Data & Regulation. All the opportunities must be considered in order to make profit.
A3	**Strategy Update**	When market sessions are closed, market outcome is analyzed in order to update the strategy for the following market sessions, using the previous information and: - Market Outcome & Information. - Market Dispatch of our units. - Constraints. In case **CCGts** are not matched in the market, power plant self-consumption must be included in the strategy to be bought in the market.
A4	**ID Strategy**	The Intraday strategy depends on the result of the Day-ahead & Constraints market outcome, and, if there have been, previous intraday & deviation markets. the information is the one regarding: - Update units' state & availability to produce or be as reserve in the remaining hours. - Deviations from customers' production or from forecast. The objective is to close position, following the evolution of the market as the sessions finish.
REPORTING & CONTROL		
B1	**Dispatch & Gas Nominations Controlling**	All activities developed by the dispatchers related with the operation of gas & power in the market must be supervised and checked in order to have the most accurate possible result, since any little deviation in the bids may cause a big impact on the result and on profits. Nominations calculated by **Optimization** and carried out by operators in SL_ATR must be checked & incorporated to the strategy. Ensure that data introduced in the system and nominations sent to **REE & OMIE** is correct. In case we don't agree with the market result, we can claim to the concerned parties.
B2	**Official Bodies Reporting**	Elaboration of the documentation based on the available data of the activity of the company. The concerned institutions that must be reported are: **Ministry of Energy & Industry:** - CCGTs Production & gas procurement→ monthly & annual. **REE:** - Hydro Information → Daily, weekly, and monthly generation (M-1) & forecast (M+1). - Unit's Production, consumption, self-consumption & availability→daily & monthly. - Gas Consumption: price, power, stock & delivery→ Daily and monthly consumption (M-1) & forecast (M+1). - I3D: Following three days forecast → Daily. The report must be sent for the period with a maximum delay determined by each of the **institutions** in their instructions.

Ref.		LEM Support/ Market Analysis & Regulation	GENERATION/ OPERATIONS	Counterparty	LEM/ OPTIMIZATION/ Gas Balance & Capacity Management	LEM/ OPTIMIZATION/ Hedging & CO2	LEM/ LOCAL SUPPLY	LEM/ OPERATION/ Short Term Power Optimization	OMIE (Market Operator)	REE (Power TSO)	LEM/ OPERATION/ Market Operations, Scheduling & Dispatch	Output	Application system type	Timing
A1	DAY AHEAD STRATEGY	Market Data & Regulation	Unit Availability	Consumption Forecast, Client Reprogramming, Hydro & Solar Forecast	Gas Availability; Gas Reserve (No / Yes)	EMS; CO2 Price	Gas Procurement	Forecast Development; Weekly & DA Strategy	Market Outcome & Information; DA Market	Restrictions Market	DA Market & Restrictions Dispatch; Step B1	Excel	EMS Mail Excel e.sios OMIE	Before 12h D-1
A2	DAY AHEAD STRATEGY				Gas Validation			CCGT Startup (Yes / No); Update Strategy			Reserve, Secondary Reserve & Initial Tertiary Dispatch	Excel	EMS Mail Excel e.sios OMIE	After DA Market Outcome D-1
A3	INTRADAY & REAL TIME STRATEGY		Unit State	Deviations	Gas Reserve (Yes / No)		Gas Procurement	ID Strategy	ID Market		ID Market Dispatch; Step B1	Excel	EMS Mail Excel e.sios OMIE	Before 1each intraday Session
A4	INTRADAY & REAL TIME STRATEGY							Real Time Strategy			Tertiary Update & Deviations Dispatch; Step B1	Excel	EMS Mail Excel e.sios OMIE	After each ID Market
B1	REPORTING & CONTROL							Dispatch & Gas Nominations Controlling; Step A1,A2,A3,A4					Excel e.sios OMIE	Daily
B2	REPORTING & CONTROL							Closing Data Collection; Institution Reporting				Report	EMS Excel	Daily Weekly Monthly Annualy

c. Gas Supply

This team is in charge of Origination, Costing and Gas Management, for the portfolio.

Its duties are:

- Gas Portfolio Origination: Buy & sell gas from/to external counterparties at the best economic conditions in order to reduce risks. Develop a portfolio of counterparties to enter into market transactions within master contract agreements.
- Costing: Providing Marketing & Sales with the accurate price in order to buy/sell & enter into new supply contracts with other counterparties.
- Gas Management: Ensure the operational management of Long Term gas contracts & Negotiation Processes.

i. Roles and responsibilities

Department	Responsibilities in process
Gas Supply	- **Market transactions** - **Costing & ensuring the best economic conditions.** - **Active agent in negotiations** - **Ensure operational management of LT contracts.** - **Relationship with the brokers for prices and volumes.**
Optimization	- **Perform Analysis on Market Prices.** - **Build Bollinger Curve**
Retailing (Marketing & Sales)	- **Receive & study counterparties' supply contracts & contact LS for costing.** - **Apply Margins & TPA to EM's Transfer price.** - **Negotiate with the Counterparties.**

ii. Linked Processes

Linked process	Short description of the link
Daily Prices	**Gas Supply** should receive from **brokers**, Long Term contract and current market prices.
Bollinger Curve	**Optimization** is in charge of building the Bollinger Curve, which studies the volatility of the indexes for the Long Term contract with respect to the market prices.
Supply Request	**Counterparties** contact **Marketing & Sales** and ask for a price for the annual or quarterly profile of consumption.
Send Profile & Relevant Data	**Marketing & Sales** send **Gas Supply** the profile and relevant data of the **counterparty** in order to calculate the most accurate price for the supply.
Send Quotation	**Broker** sends quotation to **Gas Supply & Marketing & Sales** in order to build the price and calculate the quotation of the different sources of supply. Quotation is also essential for the Price Engineering Process.
Apply TPAs	**Marketing & Sales** is responsible for including the TPAs in **EM's** Transfer Price: Imbalance Cost: Individualized cost of the total imbalance of the consumption. Capacity Term: Cost of entrance in the system. LNG Regasification, Storage & Capacity Term: if LNG usage. Hedging Risk Premium: Financial Cost of the deviation. Conduction Term: Cost of delivery to the consumption point.
Apply Taxes & Margin	**Sales** is in charge to include all the taxes and other terms applied depending on the location and use of the gas. It includes: - Local Tax - Green Cent - FNEE: Fondo Nacional de Eficiencia Energética - Credit Risk

Linked process	Short description of the link
	- Margin
Report Deal	When a Firm Offer is accepted, **Marketing & Sales** must inform **EM,** in order to report the Deal.
Standard Costing	Gas contracts with small consumers. **Marketing** updates prices from **EM's** predefined tables (**Local Gas Supply),** which are updated when price conditions change or there is a regulatory change. All the remaining process is responsibility of **Marketing,** who applies al the premiums to the defined price. When the process starts, there is a validity Term that takes into account the time between the first Indicative Offer & the Firm Offer, and the indexation of the contract, adding this term. As opposed to the Giant product, **Marketing** can send a Firm Offer without asking **Local Gas Supply** due to the lower amount consumed that a B2B contract represents, and the high volume of transactions, which should lead to economies of scale.

iii. Process flow and narrative

Process flow can be found at the end of the document.

Ref.	Activity	Description
WEEKLY CURVES		
A1	**Transfer Price**	In order to build the Weekly Curves for the costing process, the Transfer Price for Calendar & Quarter products must be built in order send the adequate price at the current levels of the market and the portfolio. Counterparties can be supplied with the Gas Portfolio or Portfolio+Market, depending on the price scenario. In order to build the curves at the best possible Price, accurate daily prices are used from brokers and the portfolio.
A2	**Scenario A**	When the Market Price is lower than the Portfolio. Market Blocks are allocated with the volumes available in the market, and the remaining volume is supplied with the portfolio.
A3	**Scenario B**	When the Portfolio Price is between Market Offer & Market Bid Weekly Curves are build following the Portfolio Mandate.
A4	**Scenario C**	When the Portfolio Price is lower than the Market Bid. Weekly Curves are build following the Portfolio Mandate, and adapting it to the current market conditions.
GIANT COSTING AD HOC		
B1	**Costing Blocks**	When the profile of a **Counterparty** is received from **MARKETING & SALES,** and regarding the previous price scenario, blocks of the Weekly Curves are included in the profile in a merit order to send an indicative offer. This process is also valid for the Firm Offer. Seasonality effect is included in order to hedge its risk.
B2	**Costing Parameters**	Other terms are included in order to calculate the Transfer Price. - The profile is filled with the Weekly Curves Transfer Fee. - Ask the **broker** for quotation in order to build a price regarding the amount supplied with the market and the portfolio.
B3	**Final Costing & Check**	After several rounds of negotiation between **MARKETING & SALES** and the **Counterparty,** and **Gas Supply** updated the costing each round, when it is accepted and a Firm Offer is sent, **Gas Supply** must check if the values in the final offer are correct.
STANDARD COSTING		
C1	**Standard Tables**	**Gas Supply** is responsible for developing the standard costing for small consumers in standard tables, updated when price or regulatory changes occur. **Marketing** is responsible for applying this tables for the costing process for small consumers.

d. Gas Settlement & Invoicing

Back Office department that supports the business activities related to gas, performed by the Energy Management Team.

The main duties are:

- Support all the gas contracts made by the Front Office, carry out the invoicing & settlement of the transactions.
- Control & validate intra group and external for the operations and related services.
- Provide all the information of the business to the concerned institutions, i.e. REMIT.

i. Roles & responsibilities

Department	Responsibilities in process
Operational Coordination/ Gas Settlements & Invoicing	- Control, register and invoice the gas contract. - Communicate the contract information & invoicing. - Validate the data included in the invoice.
Team Management	- Provide objectives, guidance & means in order to perform Invoicing and Settlement tasks. - Supervision of the process.
Gas Supply	- Responsible of managing & communicating new gas contracts. - Provide information regarding gas master agreement.
Finance/ Controlling	- Validate the information regarding contracts.
Finance/ Accounting	- Sets Fast-Closing Date

ii. Linked Processes

Linked process	Short description of the link
Gas Supply Contract Emission	- **Gas Supply** sends information regarding new supply/consumption and **Optimization** swap gas contracts & fees to **Gas Settlements & Invoicing.** - **Gas Supply** provides information regarding gas Master agreement to **Gas Settlements & Invoicing.**
Index Calculation	- **Middle Office Department** publishes periodically, indexes, current & forward prices.
Counterparty Billing Calculation	- **Counterparty** are in charge of calculating the amount that must be charged with the amounts, prices & conditions settled in the contract and the Master Agreement.
Publication of Gas Delivered	- **Enagás** is in charge of publishing the data related to gas withdrawals from the grid.
Finance Accounting & Database	- **Finance** must approve the invoicing and add it to the Database, in order to account the payment & communicate **Treasury.**
Counterparty Late or Not-Payment	- In case **Counterparty** don't carry out their payment duties on time**.** Late/No reception of the payment and notification of the **Financial Department** to **Gas Settlements & Invoicing.**
Ordinary Mail to Counterparty	- **Office Assistants & Reception** must send by ordinary mail the invoices to **Counterparty.**
Billing	- **Treasury** is in charge of receiving the payments from **Counterparty.**
Finance Billing Reception	- **Finance** receives gas bills, TPAs to be paid to **Enagás, Counterparty** fees, service contracts, or hedging positions due this month. The bills concerning **Gas Settlements & Invoicing** are sent to be checked & validated.
Payment	- Once **Gas Settlements & Invoicing** validates the bills, **Finance** proceeds with the payment. If the information contained in the bill is not right, **Counterparty** must be contacted in order to correct the error.
Market Invoices Publication	- On Mondays, **Mibgas** publishes all the information regarding the trades in the market taking place the previous week. **Gas Settlements & Invoicing** must download credit & debit bills and the detailed document with the net amount to be accounted.
Fast-Closing Date	- **Accounting** sets the Fast-Closing scheduled date for the current month at the beginning of the month, and sends it to **Gas Settlements & Invoicing.**
Counterparty Data	- **Enagás** publishes all the information regarding the exchanges taking place in the grid so far this month. **Gas Settlements & Invoicing** must download the information.
Swaps & Deals information	- **Gas Supply** sends information regarding new supply/consumption and **Optimization** swap gas contracts & fees to **Gas Settlements & Invoicing.** - **Gas Supply** provides information regarding gas Master agreement to **Gas Settlements & Invoicing.**
CCGT Invoicing	- **Accounting** receives the TPA information from **Gas Settlements & Invoicing** regarding the CCGTs in order to invoice their consumption & TPAs.

iii. Process flow and narrative

Ref.	Activity	Description
INVOICING		
A1	**Contract Information Reception & Validation. Corrective Invoices**	Collect information submitted by Supply in *The IT system* or swap contract fees by Optimization. Validate data. If there have been errors invoicing or some changes in the terms of the contract, the previous invoice must be canceled, generating a credit note & a new invoice.
A2	**Complex Invoice Calculation & Validation**	If a contract with Counterparty has complex conditions, like indexed prices, flexibility options, billing amount must be calculated following the contract conditions. Some contracts are fixed to some indexes that must be downloaded from the relevant databases. Once this billing amount is calculated, it must be validated with Counterparty, which must also determine this value.
A3	**Gas Delivery Validation**	Checking the amount that Counterparty has withdrawn from the grid, using Enagás' nomination platform.
A4	**Include in Updating Document**	In order to upgrade the information into IT SYSTEM, it must be included and organized as needed in the tracking document.
A5	**Insert data in IT SYSTEM & Validation**	Generation of the final invoice in *The IT system*, with the previous information. Second validation of the information and terms of the invoice. Introduction in the tracking document.
A6	**Invoicing & Delivery**	Emission of the document in *The IT system*, with delivery & payment date. Send to the Counterparty and Accounting department the notification of the invoice for accounting & billing. Checking that the information included in the invoice is the same as the one in the contract.
A7	**Reporting & Communication**	Report Counterparty and Accounting department of the emission of the invoice. Counterparty must be also reported by ordinary mail. There are some exceptions in which data must be included in the Counterparty system.
A8	**Backup Copy & Monitoring**	Saving copy in the backup folder to file all the operating contracts. Update tracking document & Check that all have been sent.
A9	**Invoice Checking**	In case the bill is no collected, the previous process must be checked in case there is some error in any activity. If there is any error in the process, proceed with the correction.
A10	**Contact with Counterparty**	Communicate the counterparty the problem, in case the process has been followed correctly, and ask for a solution.
ACCOUNTS PAYABLE VALIDATION		
B1	**Complex Formulas Calculation**	If the contract sets some complex formula calculations for the billing, the amount and cost must be calculated in order to check that Counterparty calculations are correct.
B2	**Validation**	This calculations must be validated with the information included in the contract and the bill received from the Counterparty. The N+1 must also validate the result.
B3	**Sign & Send to Finance Deprtment**	After validation, sign & send the information to Finance, to confirm that the data is alright.
B4	**Contact Counterparty**	If the bill received from the Counterparty and the calculations do not coincide, contact the Counterparty in order to check the process.

Ref.	Activity	Description
MIBGAS		
C1	**Mibgas Invoice Download**	Mibgas publishes each Monday the data & invoice related with the market operations for the previous week. Download Credit & Debit bills, and the detailed document with the net amount to be paid, to be checked & validated. Send Finance the information to be accounted.
C2	**Validation & Payment confirmation**	Credit & Debit Bills must be confirmed, and sent to Finance to proceed with the payment.
C3	**Claiming**	If the information in the bill is not correct, proceed with the payment on one hand, and on the other hand send a claim to Mibgas.
TPA CALCULATION		
D1	**Fast-Closing Scheduling**	Accounting sets the Fast-Closing scheduled date for the current month at the beginning of the month in order to schedule the TPA calculations & delivery.
D2	**TPA Calculations & Delivery**	Before the date arrives, information regarding nominations, deals, AOC level & swap contracts is collected in order to calculate the monthly data and predict the behavior in the remaining days of the month, sending Accounting the estimated closing data.
D3	**Closing TPA Calculation**	Collect closing month information regarding nominations, deals, AOC level & swap contracts is collected in order to calculate the monthly data.
D4	**Send Closing Information**	After the closing date, real data is collected in order to generate a document with the real information of the TPAs in the month. TPAs expenses must be divided among the different agents for the allocation of the costs. Summary must be sent to Accounting
	REPORTING	

E1	**Prepare Documentation**	Elaboration of the documentation based on the available data of the activity of the company. The concerned institutions that must be reported are:
		CNMC:
		- Gas Procurement Cost →monthly & annually.
		- Retail Price to final consumers → monthly.
		- Provisional Result → Half Month
		- Final Result →Closing Month
		- Invoices → Half M+1
		Ministry of Energy & Industry:
		- Input & outputs in the system
		  - Inventories
		  - Storage
		  - Prices & operations
		- Monthly
		Cores:
		- NG questionnaire →monthly.
		- Interruptible clients & Diversification of NG→annual.
		- NG sales statement →Ad hoc.
		Sedigas:
		- Transactions & consumption → monthly.
		- Estimated sales of NG → quarterly.

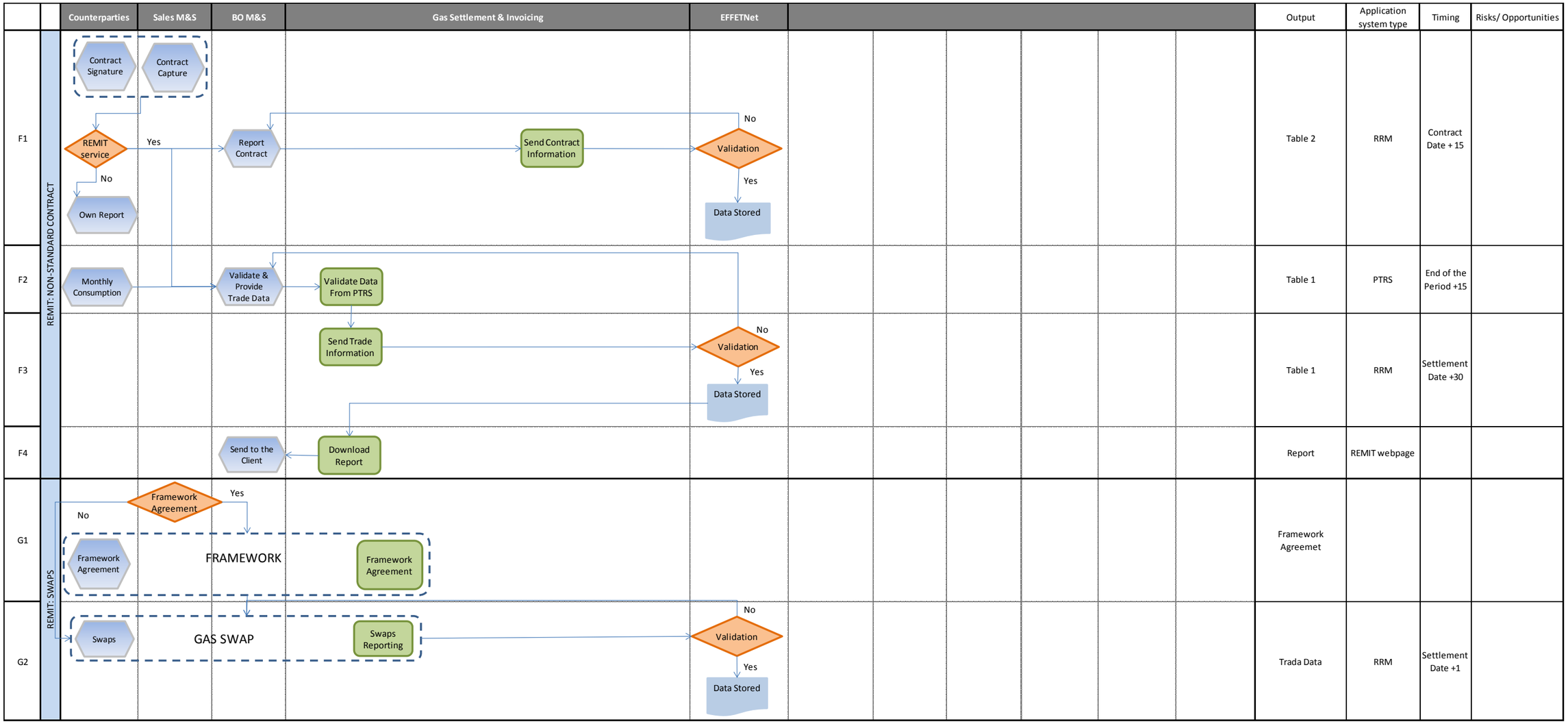
E2	**Send Reports**	The report must be sent for the period with a maximum delay determined by each of the concerned official bodies in the instructions.

Ref.	Activity	Description
		REMIT: NON STANDARD CONTRACTS
F1	**Send Contract Information to REMIT**	The report containing contract information must be sent at the latest 30 days after the acceptance of the contract (not the signature of the contract) via RRM. This table is made by **MARKETING & SALES BO** and must be validated by **EM BO,** which **g**enerates xml file from Table 2 and sends it via **RRM**. ACER publishes the acceptance or not of the information received in REMIT.
F2	**Validate Trade Data from REMIT**	**EM BO** receives Table 1 including Trade Data. Information must be download from the IT SYSTEM in order to validate with Table 1.
F3	**Send Invoiced Information to REMIT**	Generates xml file from Table 1. The report containing invoiced data must be sent at the latest 30 days after the invoicing via **RRM**.
F4	**Download Report**	After the validation of ACER of the data, the acceptance report must be downloaded to store and send it to the **Counterparties** which contracted the REMIT service.
		REMIT : SWAPS
G1	**Framework Agreement**	Swap contracts may or may not be in the context of a master framework agreement.
G2	**Swap Reporting**	The reporting schedule must be agreed with the counterparty in order to send the same data to REMIT. The report containing trade data must be sent the days after the swap has been completed via EFFETNet with the ERRLite tool. **ACER** must validate the data reported.

In the following Page we have the flow chart explaining the previous interactions.

Ref.		LOCAL GAS SUPPLY	MIBGAS	Optimization	Gas Settlement & Invoicing	Middle Office (Brussels)	Counterparty	TSO (Enagás)	Finance/ Accounting	Office Assistants & Reception	Institutions	Deputy CFO & Treasury	Output	Application system type	Timing	Risks/ Opportunities
A1	INVOICING	Contract Information Reception		Swap Operation Fees	Download Deals Data; Validation (Yes / No); Corrective Invoices; Tracking Document								Tracking document	PTRS Mail	1st to 10th	
A2					Complex Offers (Yes / No); Invoice Calculations for Complex Formulas and Flexibility; Counterparty Validation (No)	Indexes	Counterparty Calculation						Excel Mail	PTRS Excel	1st to 10th	
A3					Checking that Amount Invoiced & Delivered Coincide (Yes)			Publication of Gas Delivered						SL-ATR	1st to 10th	
A4					Include in Uploading Document											
A5					Tracking Document; Insert Data in PTRS; Validation N+1 (Yes / No)				No				PTRS	Excel -Tracking Document	1st to 10th	
A6					Invoicing & Delivery				Finance Accounting & Database				Invoice	PTRS	1st to 10th	
A7					Reporting & Communication					Ordinary Mail to Counterparty			Mail Ordinary Mail *(Or Counterparties System)	Invoice	1st to 10th	
A8					Backup Copy & Monitoring; Tracking Document								Tracking document	Excel -Tracking Document	1st to 10th	
A9					Invoice Checking (No / Yes); Process Checking (No / Yes)						Billing		Excel	Excel -Tracking Document	20th to 25th	
A10					Contact Counterparty								Mail	Invoice	20th to 25th	
B1	SWAPS & ACCOUNTS PAYABLE VALIDATION			Buying Tracking Document	Complex Formulas Calculation				Finance Billing Reception				Complex Formula Calculation in Excel	Zainet Sas		
B2					Validación (No / Yes)								Check	Invoice		
B3					Second Validation, Send to Finance				Payment				Mail	Invoice		
B4					Contact Counterparty & Accounting								Mail	Invoice		

Ref.		LOCAL GAS SUPPLY	MIBGAS	Optimization	Gas Settlement & Invoicing	Middle Office (Brussels)	Counterparty	TSO (Enagás)	Finance/ Accounting	Office Assistants & Reception	Institutions	Deputy CFO & Treasury	Output	Application system type	Timing	Risks/ Opportunities
C1	MIBGAS		Market Invoice Publication		Download from Mibgas Webpage → Send Information to Finance								Credit & Debit Bills	Mibgas Webpage	Each Monday	
C2					Validación → Yes: Confirm Payment Finance; No: Send Claim To Mibgas								Mail	Credit & Debit Bills	Each Monday	
C3					Send Information to Finance				Payment				Mibgas Webpage	Credit & Debit Bills	Each Monday	
D1	ATR				ATR Calculation Scheduling				Fast-Closing Date				Scheduling	Mail	1st to 5th	
D2		Deals information		Swaps & Deals Information	ATR Calcullation; Send Fast-Closing			Counterparty Data					Excel	Enagás SL-ATR	25th-28th	
D3					Closing ATR Calcullation								Excel	Mail		
D4					Escatron Invoicing; Send Closing Information				CCGT Invoicing				Mail	Excel	15-20th M+1	
E1	REPORTING				Prepare Documentation						Publication of duties and procedures		Report	M-1 Data	Monthly Annualy	
E2					Send Report								Ministry Cores CNMC Sedigas	Report	Monthly Annualy	


Counterparties
Sales M&S
BO M&S
Gas Settlement & Invoicing
EFFETNet
Output
Application system type
Timing
Risks/ Opportunities
REMIT: NON-STANDARD CONTRACT
REMIT: SWAPS
F1
Contract Signature
Contract Capture
REMIT service
Yes
No
Own Report
Report Contract
Send Contract Information
Validation
No
Yes
Data Stored
Table 2
RRM
Contract Date + 15
F2
Monthly Consumption
Validate & Provide Trade Data
Validate Data From PTRS
Table 1
PTRS
End of the Period +15
F3
Send Trade Information
Validation
No
Yes
Data Stored
Table 1
RRM
Settlement Date +30
F4
Send to the Client
Download Report
Report
REMIT webpage
G1
Framework Agreement
Yes
No
Framework Agreement
FRAMEWORK
Framework Agreement
Framework Agreemet
G2
Swaps
GAS SWAP
Swaps Reporting
Validation
No
Yes
Data Stored
Trada Data
RRM
Settlement Date +1

3

OPTIMIZATION

I. Object

It must be stated that all the information documented in the previous chapter is already an output of the project by itself. It documents the business processes of an Energy Management department, both from a task/checklist viewpoint and from a flow viewpoint. It is worth noting that the flowchart includes adequate timings and schedules for each of the activities, providing valuable information for the process implementation and improvement.

The aim of this study is to stablish strong a reliable measures to reduce the influence of the process on the results and the time and review the structure of these processes in order to achieve some savings in terms of time and costs, avoiding redundant or unnecessary activities developed by the department. The study focuses in the changes in the processes that could provide potential global enhancements. Each of the previous processes is studied, looking for possible redundant or unnecessary activities. The problems to be investigated are:

- **Assignation** problems: Inefficient management of the resources and assignation of the task in the process.
- **Execution** problems: Incorrect development of the activity.
- **Relationship** problems: This problem arises when there are resources impeding the correct interaction between activities or departments.
- **IT** problems: inefficiencies coming from the flow of information within the organization processes.

Each of this processes must be detailed and studied to determine the different activities in which each process is divided.

II. Optimization Proposals

Propositions:

- **Proposal 1: Gas Settlement & Invoicing** A4 → Insert data in IT SYSTEM & Validation.
  - Problem: In the invoicing process for gas Operations, the main problem lies in the way the data is introduced in the IT system. The process is as follows: first, the information must be downloaded from the database into a tracking document, where the information is organized and then copied to the upgrading document, just to include it in the IT SYSTEM.
    - As we can see in the process highlighted in red in the following figure, the information is moved three times into different documents before entering the invoicing information in the system:
      - First, downloaded from Database to Tracking Document.
      - Then, copied from Tracking Document to Uploading Tool. Upgraded into IT SYSTEM.
  - Type of problem: IT problem.
  - **Solution: In order to optimize the flow, some internal processes can be removed. The Tracking document and the Upgrading document, can be consolidated in just one document in order to avoid the loss of information while copying data, in order to have just one source of information.**
    - Advantages:
      - Reduction of time in the Invoicing process.
      - Simplification of the process, avoiding possible errors and loss of information.

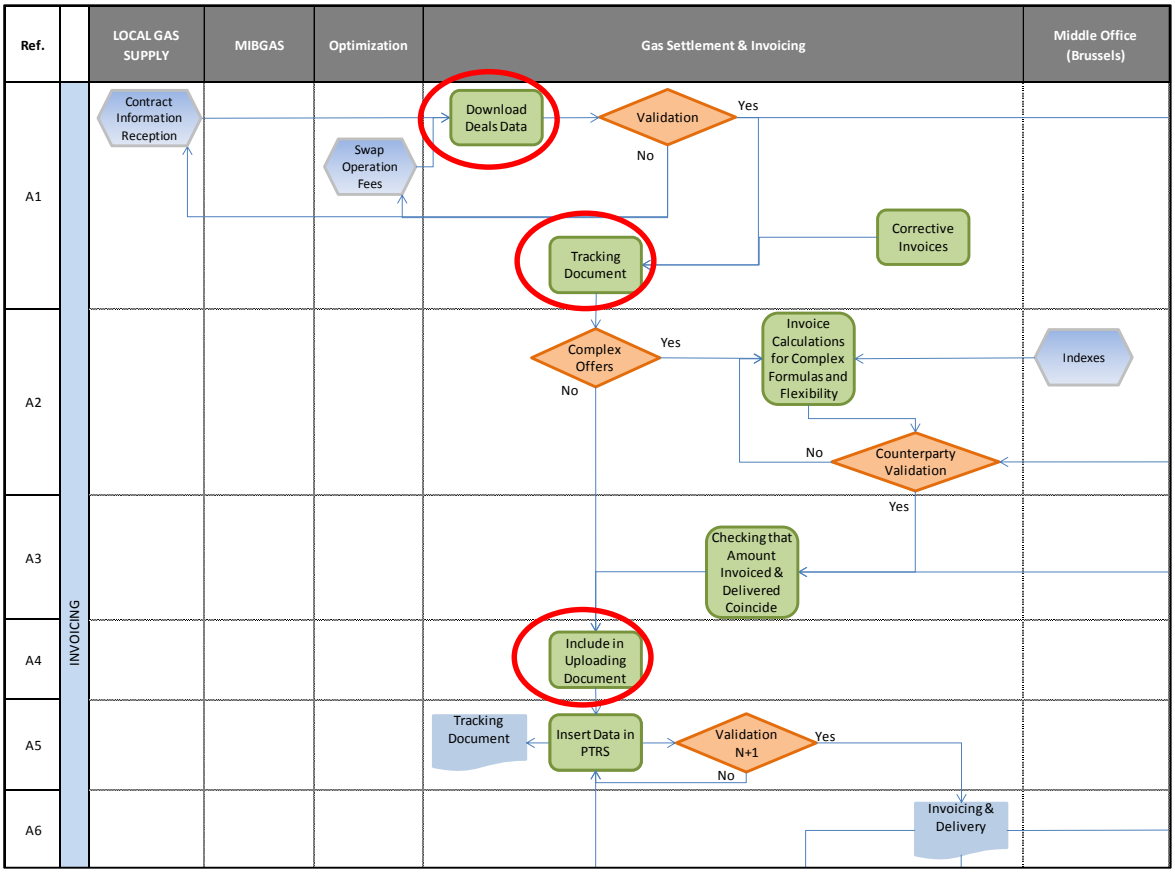


Figure 7. Optimized Invoicing Process.

- **Proposal 2: Gas Settlement & Invoicing** F → **REMIT NON-STANDARD CONTRACTS**
    - Issue: The proposal is the design and development of a new process, because of the new regulation in place. This process describes the interaction between EM and MARKETING & SALES and the flow of information necessary to report to REMIT the trade information.

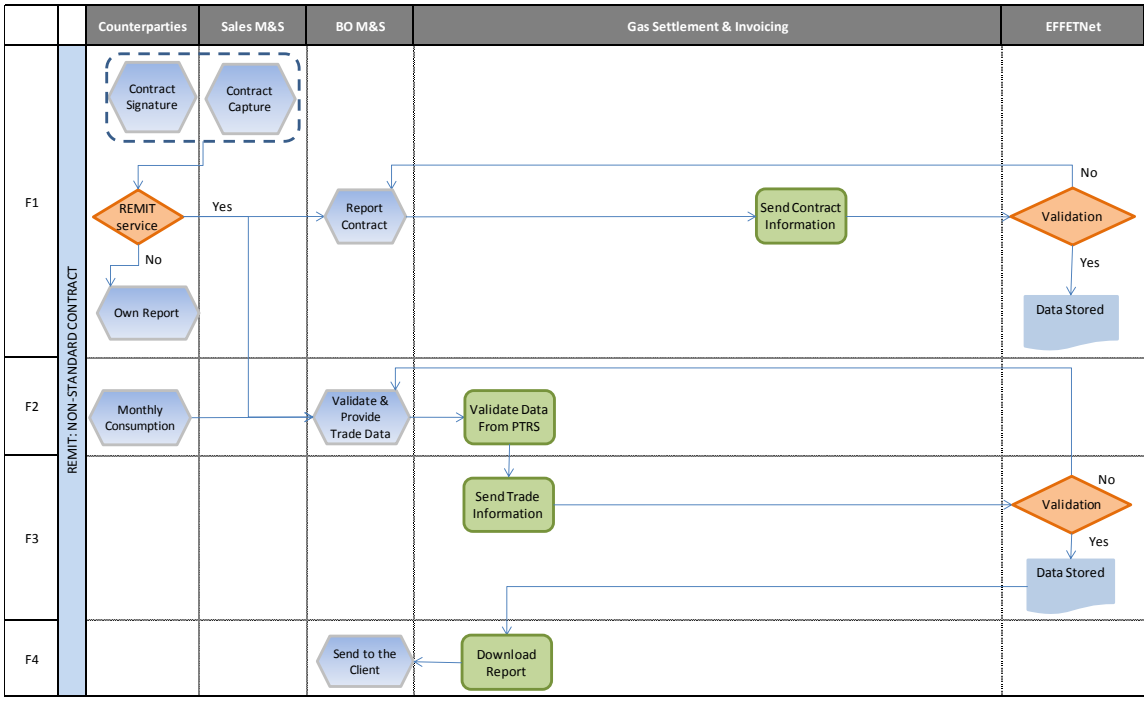


Figure 8. Optimization of the REMIT reporting for clients.

- **Proposal 3: Gas Settlement & Invoicing** C1, C2 → **Mibgas & Enagás Invoice Download, Validation & Payment Confirmation**
    - Problem: The process is manual and very time consuming. **EM BO** downloads manually every Monday the invoices from Mibgas Webpage, and monthly from Enagás, validates and send them to finance in order to sign. As the payment must be done before Wednesday, even if there is an error and a claim must be sent. So the signing validation process is not necessary as the payment is mandatory if you want to continue operating in the market, as in power with OMIE.
    - Type of problem: Execution problem.
    - Solution:
        - First, developing a tool that automatizes the download of the information in a shared folder with finance, in order to reduce the time and to have a common folder.
        - Secondly eliminating the signing process, as it is paid anyway, and also in order to unify the process with the net power invoices of OMIE in the market.
        - Advantages:
            - Time Saving
            - Unifying the Process
            - Automatization
            - Reduction of paper documents

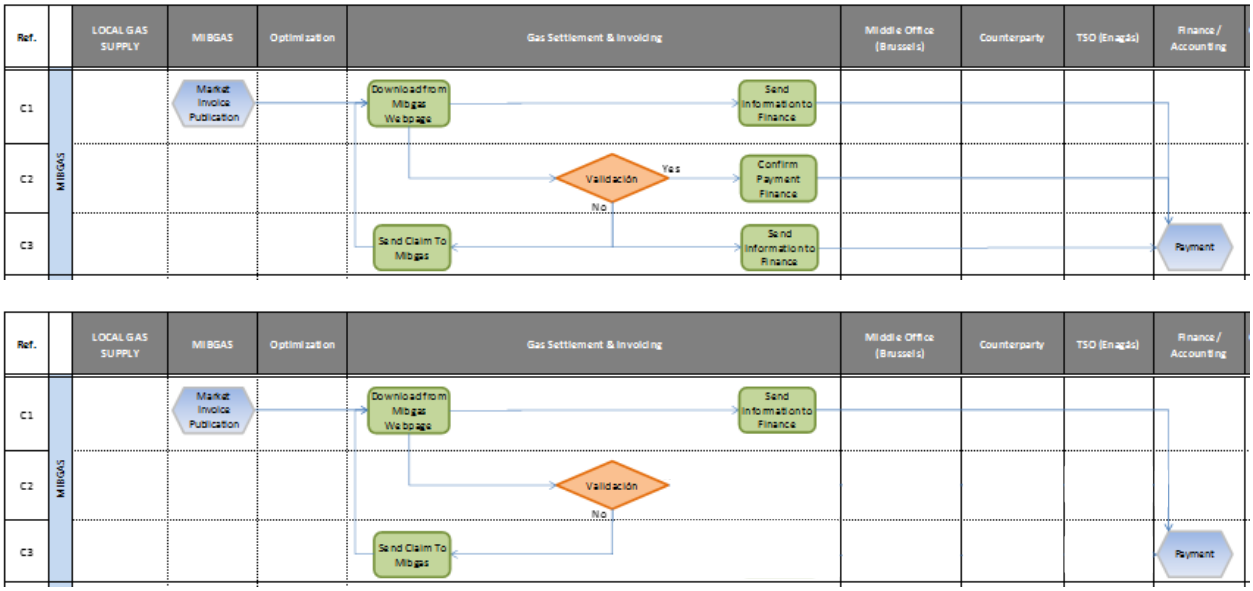


Figure 9. Reduction in the process steps with Mibgas.

- **Proposal 4: Market Operations/ Scheduling & Dispatch** B1 → Generate Nominations in IT SYSTEM & Send Insular nominations.
    - Regulation: Regarding Special Regime units, the agents are obliged to send the program for their special regime production units one hour before the day-ahead market auction and the injection point in the grid.
    - Problem: In this process **Optimization** sends **Market Operations** the forecast regarding wind, solar and run-of-river hydro in a daily and weekly basis. After receiving the forecast, **Market Operations** generates the Offer in IT SYSTEM and send it to the market and the system operators.
    - Type of problem: Assignation problem/ IT problem.
    - Solution: As an alternative, the person in charge of the generation of the forecast from **Optimization,** instead of sending them by mail to the Operator, who sends them to the market & system operators via IT SYSTEM, **Optimization** would upload the forecast directly to IT SYSTEM, as some clients introduce in IT SYSTEM their forecast or reprogramming directly.
        - Advantages:
            - Time process reduction, as the flow of information is just passing by one person, instead of two in the previous process, as **Optimization** has direct access to IT SYSTEM, and not being additional work for them, as they usually send it by mail.
            - Reduction of flowing information→over processing.
            - Avoiding loss of information, or missing data.
        - Disadvantages:
            - In some cases, such as restriction markets, the Operator modifies the forecast output, following the strategy defined by **Operations/ Optimization.**
            - Responsibility of the task would change, where it should remain in **Operations.**
            - On the other hand, the **Operator** must do the forecast on the weekends. This ends up in a shared responsibility depending on the day of the week**.**

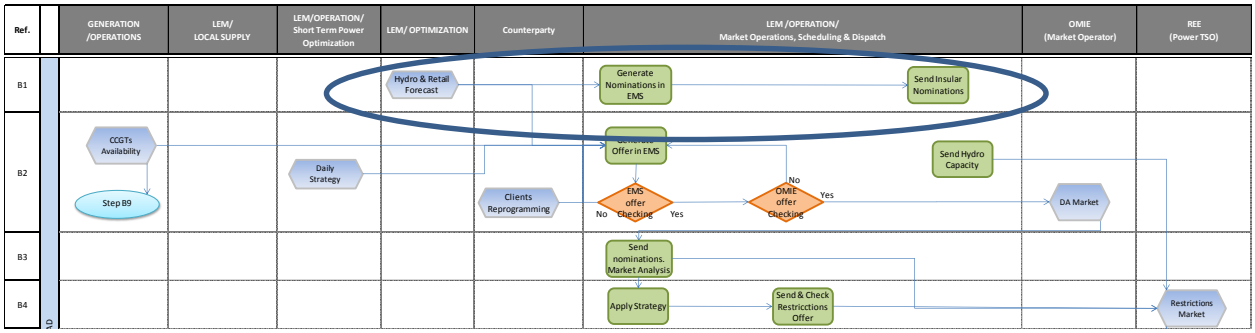


Figure 10. Forecast Process Optimization.

- **Proposal 5: Market Operations/ Scheduling & Dispatch** A3, B2, B3, C2, C3 y D3 → Generate Offer & Send Nominations, for Day-ahead, Intraday and balancing Markets.
    - Problem: The daily and intraday nominations and bids are sent to the OMIE and REE through different agents, doing the same process once for each agent separately. There are retail (buying) agents and representing (selling) agents.
    - Type of problem: Execution problem
    - Solution: Creation of a single Agent operating in the market (OMIE) and the system (REE).
        - Advantages:
            - Time Saving in the process.
            - Trade-off with the deviations of the different production or consumption units.
        - Disadvantages:
            - New Agent Creation. Difficulties due to the nature of each agent.
            - Operation in complementary services:
                - Remuneration for balancing and reserve capacity may be difficult to allocate between production units in the same agent.
                - Settlement complications.

Regulatory Feasibility of the Proposal (9) (10)

Following the rules of the Market, the Market Operator (OMIE), is in charge of the settlement of the market output for the day-ahead and intraday market, indicating the account to be paid or received to each market agent by Production Unit, as the accumulated hourly settlement in the different sessions in a daily basis.

The regulation defines the requirements for Production Units and Market Agents:

- Production Units must be registered in the system as the representing agent registered it in the register for Production Installations. Selling agents send economic offers for each of the Programming Units.
- After the Results of the auctions, Market Agents must nominate the buying or selling units result to the System Operator. The owners of Programming Units composed by several Physical units (Production Units) must facilitate REE the information regarding the disaggregated program of each of the units in order to study the security of the system.
- The units must be integrated in a Programming Unit taking into account the following obligations:
    - It is not possible to integrate in a production unit different production technologies.
    - Divided by Exempted from Deviation payment or Not.
- Deviations (11):
    - There are two types of selling units concerning deviations:
        - Installations exempted from payment of the deviations.
            - According to Law 2018/1997 *«Estarán exentas del pago del coste de los desvíos aquellas instalaciones que habiendo elegido la opción a) del artículo 24.1 no tengan obligación de disponer de equipo de medida horaria, de acuerdo con el Reglamento de puntos de medida de los consumos y tránsitos de energía eléctrica, aprobado por el Real Decreto, de 26 de diciembre»* (12) → *T*he units with Nominal Power lower than 15 kVA.
        - Installations not exempted from payment of the deviations.
    - The procedure regarding the deviations at the end of the Daily schedule is the following:
        - For Producers or consumers deviating against the system (if the demand is lower than expected, they produce more and consume less and vice versa), the cost would be the result of the Upwards & Downwards Reserve Market.

        - For Producers or consumers deviating in favor of the system (if the demand is higher than expected, they produce more and consume less and vice versa), they are compensated with the marginal price, and the cost is null.
    - Settlement: may be of two types:
        - Consolidating all the Programing Units
        - Separated Settlement of each Programming Unit.

Representing Agents:

"*Aquellas instalaciones de auto productores, con una potencia superior a 5 MW, que utilicen la cogeneración u otras formas de producción térmica de electricidad asociadas a actividades no eléctricas siempre que supongan un alto rendimiento energético y satisfagan los requisitos de rendimiento que se determinen tanto acogidas al Real Decreto 2366/1994, de 9 de diciembre, como al Real Decreto 2818/1998, de 23 de diciembre, podrán realizar ofertas económicas al operador del mercado para cada período de programación, a los efectos de verter sus excedentes de energía eléctrica, de forma individualizada o por mediación de un Agente vendedor.*"

So every producer with an installed power higher than 5MW can send the Offer individually through an agent, and installations with power lower tan 5MW must be consolidated in an agent. In order to represent another production unit in the system, an agent must be validated as such and confirmed in a declaration by the represented unit.

III. Proposal number 6: Controls

The objectives of this controls is indicating in which steps of the process, there are critical activities. This control code is established in order to locate the critical activities with a potential effect on the economic results of the company.

C1	Procedure for the preparation of the portfolio's short-term position and management of the physical position	Ensure that the preparation of the portfolio's short-term position and the management of the physical position is set up in a procedure validated by the appropriate level of management	Dispatch: - Check Reprogramming & Generate Forecast Optimization: - Forecast Development Weekly & Day-ahead Strategy - Strategy Update - ID Strategy
C2	Supervision of the input data used for the preparation of the portfolio's short term position	Ensure that the analysis of the portfolio's short-term position is exhaustive, accurate and validated by the appropriate level of management	Optimization: - Forecast Development Weekly & Day-ahead Strategy - Strategy Update - ID Strategy
C3	Control of data published / nominated to infrastructure operators	Ensure that the analysis of the portfolio's short-term position is exhaustive, accurate and validated by the appropriate level of management	Dispatch: - Send nominations to SO. Analysis of the Market Output. - Insert Closing Gas Nomination for CCGTs Optimization: - Dispatch & Gas Nominations Controlling
C4	Control of data exchanged with regulatory bodies	Ensure that the analysis of the portfolio's short-term position is exhaustive, accurate and validated by the appropriate level of management	Optimization: - Institution Reporting
C5	Procedure for physical nomination to infrastructure operators	Ensure that nomination data were correctly transmitted to the counterparty and to the infrastructure manager and recorded	Dispatch: - Send nominations to SO. Analysis of the Market Output - Generate & Send Gas Daily Nominations
C6	Supervision of reconciliation between physical nomination and confirmation	Ensure that nomination data were confirmed by the infrastructure manager and the counterpart and that mismatches are solved	Dispatch: - Validate Daily Share & Residuals. Fulfill “Gas Follow Up”. - Send nominations to SO. Analysis of the Market Output. - Check ATR, Nominations & Modify “Gas Follow Up”. - Send Gas Balance D to D+3.
C7	Procedure for deal initiation and capture	Ensure that deals are in accordance with guidance and / or operations to conclude, documented and validated by the appropriate level of management	Dispatch: - Generate Offer in IT SYSTEM & Send. - Send Bids to MIBGAS.
C8	Supervision of deals initiated and captured	Ensure that deals are in accordance with guidance and / or operations to conclude, documented and validated by the appropriate level of management	Optimization: - Dispatch & Gas Nominations Controlling
C9	Supervision of Curve Marking	Ensure that data, market prices and parameters are accurate	Optimization: - Market Results

IV. Economic and Time Savings of the measures.

The objective of this section is to provide numerical data of the savings that would be achieved with the implementation of this measures. For this measures, an hourly cost is calculated as following:

- Total cost of the department: 900.000 €/year
- 22 workers
- 1680 hours/year

$$\frac{900.000}{1680 \cdot 22} = 24.35\ €/hour$$

a. Proposal 1

The total time spent in the process from the moment the information is downloaded from the database, to the moment it is included in the IT SYSTEM for the invoicing is measured carrying out the process, which includes:

- Download data from the Database (include downloading tool from operations)→ 5-10 minutes
- Validate data with the emails received from Gas Origination → 40-60 minutes
- Manual copy in the Uploading Document → 60-120 minutes
- Checking the values are correct → 30-60 minutes
- Upload invoicing information in IT SYSTEM and check it is correct (develop checking list) → 20 minutes

This process is carried out for both invoicing obligations: Swaps and Sales. Also corrective invoices must be taken into account (with a potential saving time of 60 minutes). The process saving would be focused in Copying & checking that the information to be uploaded is correct. The total time of this savings is 1 hour and 30 minutes for the manual copy, and 40 for the checking part, for each of the processes, and a total of 4 hours and 20 minutes. We could also include a reduction in Corrective invoices of 20 minutes, so a total of 4h and 40 minutes each month.

$$Total\ savings = 24.35€/hour \cdot \frac{280\frac{minutes}{month}}{60\frac{minutes}{hour}} = 113{,}63\ €/month$$

The annual savings would increase to 1.363,12 €. Another of the relevant issue of this measure is the amount of information that can be missed in the process, which will be reduced to 0% of lost information. In order to measure this impact, a KPI may be developed, as the amount of Modified Invoices because of errors in the invoicing process with respect to the total amount of invoices.

b. Proposal 3

The proposal number 3 is the one with the lower impact in economic terms in the process. It eliminates the manual downloading from Mibgas Webpage, printing and signing.

Eliminating the signing, and avoiding one step in the process, accounts for a total time of half an hour every week for Mibgas, and once a month for Enagás, so the total amount saved is around:

$$Total\ savings = 24.35€/hour \cdot \frac{30\frac{minutes}{week} \cdot 4\frac{weeks}{month} + 30\frac{minutes}{week}}{60\frac{minutes}{hour}} = 60{,}87\ €/month$$

The annual savings would increase to 730, 50 €. This time reduction would imply a cost saving in inefficient processes, but would be invested in increasing the validation process.

c. Proposal 4

The savings associated to this measure are related to the time savings obtained from the redefinition of the process.

The time saving of the operator is of 10 minutes on a daily basis, and other 10 minutes weekly. So the monthly total savings assuming 22 days is:

$$10\ minutes/day\ \cdot 22\ days/month\ + 10\ minutes/week\ \cdot 4\ week/month = \ 300\ minutes/month$$

$$Total\ savings = \frac{24.35€/hour\ \cdot\ 300\ minutes/month}{60\ minutes/hour}\ =\ 121{,}75\ €/month$$

The annual savings would increase to 1.461 €.

d. Proposal 5

This measure has two potential savings:

- The first one in terms of time saving for the process
- The second must be studied in order to settle if the consolidation of the buying and selling agents leads to a deviation saving.

Time saving

The total process of sending the bids for the agents is around 5 minutes for each agent, 3 agents in total, for the Day-ahead Market, and 5 times for the intraday markets, accounting for a total daily time of 75 minutes. Including all the bids with one agent would be the third part, so a potential saving of 50 minutes every day.

$$Total\ savings = 24.35€/hour\ \cdot \frac{50\ minutes/day}{60\ minutes/hour} \cdot 22\ days/month = \ 446{,}42\ €/month$$

The annual savings would increase to 5.357,04 €.

Deviation trade-off

The methodology to study the saving regarding the fee to be paid because of the deviation from the schedule is the following:

- Obtain the deviation value for the selling and buying agents.
- Compare the cost of the deviation of the agents separately and the consolidated agent.
- Calculate the Savings obtained from the consolidation.

According to REE and market rules, there are deviation in favor or against the system. The favorable deviations are when the system deviates in one sense and agents deviate in the other, so compensating partially the deviation of the system, and being remunerated because of that deviation with the marginal price of the system. Deviations against the system are when agents are deviating in the same sense than the system, and the cost of that deviation is the one corresponding to the result of the Upwards or Downwards reserve market. So the results depending on the case are the following:

		Generation Agent Deviation (+)	
		Upwards	**Downwards**
System Deviation	Generation > Demand	- D · MP	D · (MP + URP/ ∑D)
	Generation < Demand	D · MP	- D · (MP + DRP/ ∑D)

Table 3. Remuneration of the Deviations in favor of the system. (13)

D: Deviation [MW]
MP: Marginal Price [€/MW]
URP: Upwards Reserve Price [€/MW]
DRP: Downwards Reserve Price [€/MW]

As we can see in the next figure, as an example obtained in OMIE, from hour 14 to 21 the estimated demand is lower than the scheduled, so the operator would compensate to those agents which reduce its output, and penalize those which increase their production.

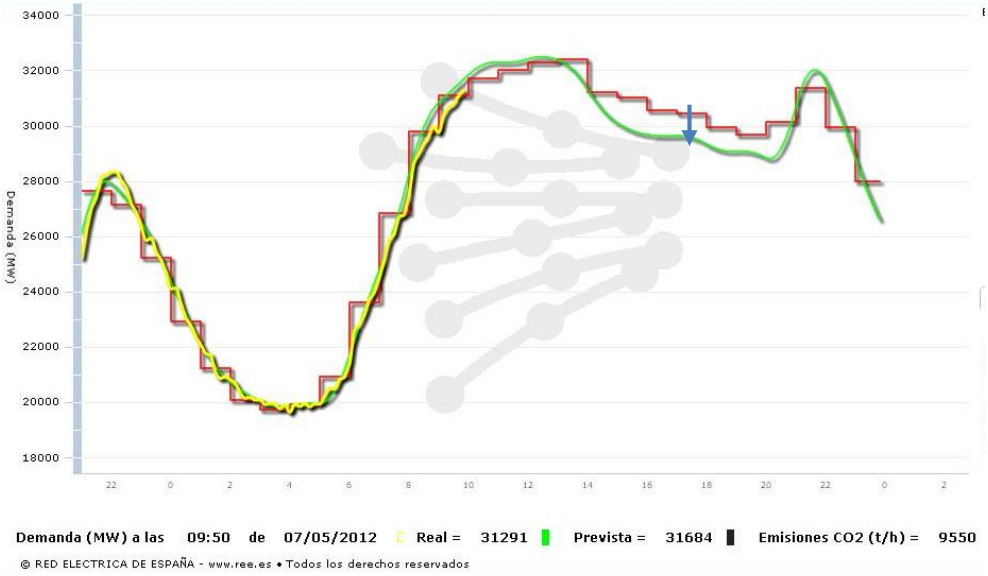


Figure 11. Real and Estimated Production. (14)

For the purpose of this study, according to the total value of the deviations provided by the Optimization Department, the different agent's deviation in hourly values from the last year are taken into account (1st May 2015 – 30th April 2016). The total amount deviated from the system is, being positive in favor of the system, and negative when it is against the system:

Agent	*Deviation [MWh]*
Consolidated Agents	65.566,5556
Buying/ Retail Agent	67.733,0496
Selling/Representation Agent	-2.159,0928

Table 4. Deviation of the agents.

In every moment the deviation of one agent can be compensated with the other, as the fee to be paid if the deviation is against the system, is almost always higher than the price received from the system, 98.77% of the hours as we can see in the following table, as the price of the Upwards Deviation is equal or higher than the marginal price in the system, and the price for the Downward Deviation is lower or equal than the marginal price in the system, the remaining hours is when the price of the reserve is the same as the marginal price:

	Hours
Nº hours in opposite sense	4.084
Nº hours fee>Price	4.034

		RETAIL					PRODUCTION				CONSOLIDATED/NET OUTPUT			
FECHA	h	Desvio MWh	Saldo agente €	Media €/MWh	A favor/ En contra		Desvio MWh	Saldo agente €	Media €/MWh	A favor/ En contra	Desvio total MWh	Desvio €/MWh	A favor/ En contra	Saldo Total €
01/04/2015	1	-7,4012	-405,4353	54,7800	En Contra		-2,7070	-148,2895	54,7800	En Contra	-10,1082	54,78	-1	-553,725
01/04/2015	2	-7,7796	-389,1343	50,0200	En Contra		-4,4860	-224,3897	50,0200	En Contra	-12,2656	50,02	-1	-613,524
01/04/2015	3	-7,5508	-353,6033	46,8300	En Contra		-2,4940	-116,7940	46,8300	En Contra	-10,0448	46,83	-1	-470,397
01/04/2015	4	-8,1784	-343,7367	42,0300	En Contra		-3,8640	-162,4039	42,0300	En Contra	-12,0424	42,03	-1	-506,141
01/04/2015	5	-11,2274	-422,0361	37,5900	En Contra		-4,1900	-157,5021	37,5900	En Contra	-15,4174	37,59	-1	-579,538
01/04/2015	6	-12,1710	-605,5076	49,7500	En Contra		-2,7530	-136,9618	49,7500	En Contra	-14,9240	49,75	-1	-742,469
01/04/2015	7	-12,3646	-460,0858	37,2100	En Contra		-4,3180	-160,6728	37,2100	En Contra	-16,6826	37,21	-1	-620,759
01/04/2015	8	-14,6552	-548,6909	37,4400	En Contra		-4,2330	-158,4835	37,4400	En Contra	-18,8882	37,44	-1	-707,174
01/04/2015	9	-18,6144	-632,1453	33,9600	En Contra		-11,3170	-384,3253	33,9600	En Contra	-29,9314	33,96	-1	-1016,47
01/04/2015	10	-15,9013	-604,2481	38,0000	En Contra		-6,1180	-232,4840	38,0000	En Contra	-22,0193	38	-1	-836,732
01/04/2015	11	-11,4707	-426,3646	37,1700	En Contra		-1,4050	-52,2238	37,1700	En Contra	-12,8757	37,17	-1	-478,588

Figure 12. Example of consolidated Output in some hours.

The effect of this difference is the gain of the margin between the fee and the price when the deviations from one agent and the other are in opposite senses, and are compensated between them. The Price of the consolidated deviation in the previous excel file is calculated as the price in the sense of the net deviation.

	Remuneration [€]
Separated Agents	2.154.406,251
Consolidated Agent	2.310.868,048
Increase in Earnings	156.461,796

Table 5. Remuneration of the agents.

So as we can see in the results, this ends up in an increase of the benefit of 156.461,79 €, so a 7.26% increase in the benefits.

e. Total benefit from the process.

The accumulated benefit from this measures is the following:

Proposal	*Benefit*
Proposal 1 Time	1.399,56 €
Proposal 2 Time	730,50 €
Proposal 4 Time	2.061,00 €
Proposal 5 deviations	156.461,80 €
Proposal 5 Time	5.357,04 €
Total	166.009,9 €

Table 6. Total savings obtained with the optimization.

The main source of this impact is the unification of the agents in the market, but this measure, provides a variable output, but as the positive deviation in lower than the negative deviation, the output is always a benefit.

4

CONCLUSIONS

The main objectives of this project have been fully satisfied. The principal objective of documentation part has been largely finished, providing a strong support to the department activities, defining the roles and responsibilities in each step of the processes, and determining the risk location, though helping to the control and offering support to the management team. It is a critical point to the efficient and reliable functioning of a department, and the most valuable output for the company due to its helpfulness for the processes.

Regarding the secondary objective of optimization, the methodology and enhancements proposed provide an extra value to the documentation, showing possible benefits in the processes adaptation. Noticeable results have been obtained in economic terms, offering a wide variety of feasible solutions for the different problems. It is true that the economic benefit obtained by the consolidation of the agents relative to the deviation income, must be studied, as the annual income would vary and the benefit must be split efficiently among the different production units.

So in summary, the project output has a great value for the company, providing reliable information about the processes studied and proposing several measures potentially applicable in order to obtain some saving from the daily operation, in terms of quantitative and qualitative enhancements of the processes and as example of the methodology for further process studies.

ANNEX 1: Definitions & Abbreviations

Term or Abbreviation	Definition
EM	**Energy Management**
EM BO	**Energy Management Back Office**
M&S	**Marketing & Sales**
M&S BO	**Marketing & Sales Back Office**
TSO	**Transmission System Operator**
MO	**Market Operator**
IT SYSTEM	**Energy Management System, Database**
Mi1	**Intraday Market number 1**
D-1, DA	**Day Ahead**
ID	**Intraday**
CCGT	**Combined-Cycle Gas Turbine**
RoR	**Run-of River hydro plants**
FAD	**Maximum Output that Units can provide along the day.**
REE	**Red Eléctrica de España, Spanish TSO**
e.sios	**Spanish TSO backup page**
OMIE	**Spanish MO**
PDVC	**Provisional Daily Viable Program**
SL_ATR	**Enagás, Gas TSO web page**
TPA	**Third Party Access Premium**
AOC	***"Almacenamiento Operativo Comercial"*: Commercial Operating Storage**
Mibgas	**Gas Market Operator**
Enagás & SL-ATR	**Gas TSO & Logistic System for Third Party Access to the Grid**
ACER	**European Agency for the Cooperation of Energy Regulators**
REMIT	**Regulation on Energy Market Integrity and Transparency**
RRM	**Registered Reporting Mechanism for REMIT**

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