A NEW PRIORITY FOR GAS DISTRIBUTION R&D: DATA MANAGEMENT FOR THE GAS ALLOCATION PROCESS IN THE LIBERALISED GAS MARKET

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ABSTRACT

Background
The liberalised gas market (after the running in Italy of the liberalisation process in the past five years) is showing new activities and needs for the gas distribution companies; among them, one of the most relevant is the data collection and management for the allocation process (the process by which gas, measured at the entry points of the network and at the points of delivery, is assigned to Shippers for accounting purposes), together with the distribution service billing process. This is a need not merely for the distribution companies, but mainly for all the operators along the gas chain, as information on gas consumption is used for the definition of the various economic relations.
Of course this is a new activity for the gas distribution companies, not approached before, that needs significant investments in terms of IT instruments.

Aims
The project developed by AEM Gas S.p.A., together with e-utile S.p.A., aimed to design and operate two IT “tools”, based on SAP IS-U platform, being able to manage the diverse information coming from various sources (e.g. meter readings coming from the selling companies, meter readings coming from our maintenance activities on the delivery points, information from remote read gas meters and remote controls on gas receiving stations, information coming from selling companies related to consumption characteristics of the delivery points, etc.), with different timings and communication channels, together facing various issues, among them:
- Tools flexible enough to be adapted with respect to the changing of the rules (not completely defined yet);
- Simulate the gas consumption of all delivery points in order to settle data needed;
- Interact with outside information sources;
- Possibility to use the same set of data to allocate and to submit the invoices to the selling companies;
- Using of available HW, in order to control investments.

Method
The starting point has been to analyse the situation “as is”, in terms of information available, hardware and software in use, processes already running (completely or partially), set of rules available (coming either from the Regulator or from other operators, mainly those on the transmission side), etc.; then conducting a gap analysis, to understand what was needed to be able to draw the new instruments; then defining the reference scenario (used to design the instruments) and the possible different evolutions of the rules and other influencing factors, in order to have flexible instruments, finally designing and realising the allocation tool and the billing tool.

Results
It has been obtained a set of tools that are fully compatible with all other IT instruments in use, that exchange information with other processes already running and that are flexible enough to manage different scenarios that can be foreseen in the next future (e.g. a variation on the maximum time horizon available to communicate variations in allocation data to the reference transmission company, and rules to distribute mismatching of consumption between forecasts and real meter readings, etc.).
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1. LIBERALISATION OF THE GAS INDUSTRY IN ITALY AND NEW NEEDS

1.1 THE LIBERALISATION PROCESS OF THE GAS INDUSTRY IN ITALY

The adoption of the European Directive n. 98/30/CE (Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas) by the Italian parliament through the Law n. 164 23/05/00 (known as “Letta Decree”) has represented a milestone in the development of the Italian gas industry. The Decree has established the basic rules for the liberalisation process of the gas market, starting a process that, although yet not completed, has reached a wide diffusion level, and in some areas it’s showing all its power (mainly in the downstream, towards the final customers). The starting point of the Decree is the separation of the activities of the business, that have become free where possible, or regulated (e.g. distribution activity).

So we can see new specialisations: integrated distribution/selling companies split originating new selling companies, operators from other businesses take advantage of the liberalisation to widen their portfolio with natural gas, meanwhile distribution companies focus on their specific business, the distribution of gas.

Distribution companies’ mission is now to transport gas through local transportation networks (managed by them) for third parties (selling companies, mainly) with regulated safety, quality and continuity, however through the payment of a tariff, established by the Energy Authority.

1.2 NEW NEEDS COMING FROM THE LIBERALISATION PROCESS

The liberalisation process (referring to distribution/selling, or downstream side) had been designed in a two-step phase:

Since 31/12/2002 final customers that could change their gas supplier were only the larger ones (with an annual consumption higher than 200,000 cubic meters/year). So this first step involved a small part of the total amount of final customers, (18,5 millions in total). The second step, regarding the complete opening of the market to all the final customers, was fixed at the date of 01/01/2003, but until the end of 2004 we've been observing a very slow opening of the market, so not showing specific needs to introduce new management tools and system requirements.

We can say that until 2004 the gas sector in Italy didn’t have radical changes, but a slow transition towards the real opening of the market. During this period (2001-2004) the gas system has worked throughout a management by “adaptation” that is making single changes to the old standards to fit new needs. Starting from year 2005, due also to different commercial strategies developed by some larger players, we’ve been assisting to a more significant dynamism of the commercial development, involving also the mass market. This phenomenon, together with the separation of the activities of the gas industry, has brought to new players and to the emerging of new needs and requirements to allow a correct and efficient operability of the industry, both on the technical and commercial side. From the distribution company point of view, these new needs mean three development areas (to be implemented quickly):
- Effective and efficient management of the switching of the gas supplier on the single delivery point;
- Monthly billing of the distribution service to the selling companies, made for each single delivery point;
- Determination for each selling company of the monthly total amount of the gas delivered through the city gate, starting from the gas delivered to each delivery point (allocation).

Concerning the first item (switching) it must be said that up to now is still in evolution and the main requirement is to define a national standard communication protocol between selling and distribution companies, in order to speed up communications and help to identify easily and quickly the objects (delivery points). Second and third items (billing and allocation) are the purposes of the paper.

Why only with the real opening of the market these themes have become so crucial? The main reason is likely connected with the total amount of delivery points involved in the liberalisation process. If we consider billing and allocation processes, coming from the liberalisation process, running since year 2001, we can say that up to year 2004 had been adopted “simplified” procedures, through a different approach towards the main selling company in the network (the one coming from the splitting between distribution and
selling) and the other selling companies. To better understand how it could occur, we must consider that both processes start from the need of knowing the amount of gas that must be attributed to the different selling companies.

For the allocation process, the huge numerical difference between delivery points supplied by the incoming selling companies and the incumbent one, allowed to calculate gas volumes for a certain period (month) only knowing the consumption of the delivery points supplied by the incoming selling companies, reading the consumption at each end of the month; for the incumbent, the amount of gas was determined calculating the difference between the inlet in the city gate and the total of the measured consumption (the first ones), so including also the unaccounted for gas.

For the billing process, two different methods had been applied: for the incoming selling companies, as monthly data were available due to the allocation process, monthly billing had been realised using the same data; for the incumbent, as the same data weren’t available, billing was made using information coming from its billing process towards the final customers (as also IT instruments were common for both the incumbent selling company and the distribution one): it means that distribution company billed not monthly volumes (as typically for domestic customers billing frequency is every three months) and non-monthly frequency.

These two methods (for allocation and billing) were extremely asymmetric and, for this reason, it was not possible to go along with them; on the other hand they were admitted, as monthly consumption data were not available for the main part of the delivery points.

With the evolution of the market scenario, with the increase of selling companies and delivery points switched, it has been necessary to change the approach, reviewing both rules and tools used. This has happened together with the introduction of SAP IT solutions throughout all the activities managed by the company, so implementing the new tools in the existing SAP framework.
2. THE NEW BILLING PROCESS

2.1 OBJECTIVE OF THE PROJECT

The objective of the project related to the billing process is to adapt business software application SAP IS-U, already in use in AEM group to manage their business, to the new billing requirements for all the delivery points, smaller ones included (up to 5.000 cubic meters/year, now with billing every three months).

2.2 THE NEW REQUIREMENTS

The new requirements for the billing process, and key points for the development of the project are:
- Billing frequency: monthly for every delivery point;
- Time frame for each bill: 1-31 of each month;
- Monthly bills must be prepared not later than the end of the month after the one involved by the bills;
- Introduction of an estimating tool to define the consumption at the end of each month if a reading is not available;
- Realigning of the estimated amounts as a reading is available.

The two different subjects AEM Energy – or AEN (the selling company) and AEM Gas – or AGA (the distribution company) manage their billing activities through two different technical objects chains.

Both chains share the technical object “device”, as both processes of selling and distribution billing are based on the common data measured by the device. All the activities connected with the acquisition of reading data and validation activities are shared by both distribution and selling chains.

2.3 THE EXISTING MODEL – DELIVERY POINTS FAMILIES

The different kinds of Delivery points that were managed in SAP IS_U were (total number: 903.361, as of November 2005):
- Domestic (cooking, with annual consumption not more than 500 cubic meters, reading frequency of 1 time/year, billing frequency of 4 times/year): 646,730
- Domestic (heating, with annual consumption between 500 and 5,000 cubic meters, reading frequency of 2 times/year, billing frequency of 4 times/year): 207,302
- Standard monthly (with annual consumption greater than 5,000 cubic meters, reading frequency of 12 time/year, billing frequency of 12 times/year): 17,296
- Business (reading frequency of 12 time/year, billing frequency of 12 times/year): 3,521
- Business other selling companies (reading frequency of 12 time/year, billing frequency of 12 times/year): 28,512

2.4 THE NEW DATA MODEL

The new needs required introducing a new data model, with management of billing plans for distribution and selling not synchronised. The new model allows the selling company to bill its delivery points with the frequency already in use, while the distribution company can bill monthly. So the new data model requires a total independence between distribution and selling sides for billing purposes, allowing, on the other end, a real separation between the distribution company and the selling one.

2.4.1 The effects on domestic delivery points (four bills/year)

The billing schedule for domestic delivery points has been completely redeveloped, with monthly billing frequency and planned calculation date at the last day of the month (figure 1).
The consumption data of the last day of the month, if a reading is not available, is calculated using the DPC tool (Dynamic Periodic Control) already available in the calculation engine of SAP IS-U. Reading is used to realign estimated amounts both on distribution and selling sides. If the reading is available in a date during the month, it is used to realign and calculate volumes for the corresponding part of the month, while for the remaining part of the month the consumption is calculated in such a way to cover all 31 days of the month.

In case of delivery points starting or ending during the month, only the part of consumption related to the days of operation is considered (figure 2).
2.4.2 The effects on standard monthly points (twelve bills/year)

The billing schedule for standard monthly delivery points has been redefined, with planned calculation date at the last day of the month.

For this kind of delivery points the reading is planned to be held monthly. But, as it is not possible to read every delivery point the last day of the month, DCP is used to calculate the consumption to arrive at the end of the month.

2.4.3 The effects on business delivery points of other selling companies

For this kind of delivery points DPC is planned to run every time a reading at the last day of the month is not available (supplied by the selling company or by the metering company in charge of reading), in order to allow the monthly billing also with a last day reading not available.

2.4.4 The effects on business delivery points

As for standard monthly delivery points, reading frequency is monthly. But as the reading is not always related to the last day of the month, and in such case up to now the DPC option is not available yet, the billing, although monthly, could not refer exactly to the period 1-31 (e.g.: 1-24, or 1-3 of the next month).

This difference is going to be cancelled as soon as DPC will be implemented also for this kind of delivery points (planned to be completed during year 2006).

2.5 REVIEWING THE MASTER DATA

In order to develop the new billing process, it has been necessary to review all the structure connected with the definition of reading and billing processes on the distribution side. It has been necessary to introduce some changes to master data. The objects affected by these changes have been:
- Portions (logical groups for billing purposes)
- MRU (logical groups for reading purposes)
These objects have been approached with a complete re-engineering of database and processes. In more details, have been changed number and structure of MRUs and Portions dedicated to the distribution side in order to have an homogenous distribution of work-loads connected with daily billing, and assigning each delivery point to a specific MRU depending on its assignment to a selling MRU.

2.5.1 The program for massive MRU changing and start-up of the new billing schedule
The massive switching of MRUs on the distribution side has been realised through the running of a specific program, developed for the purpose. This program has identified all delivery points with the need to change the MRU, creating in a specific table a time slice starting from the defined moment of change (01.n.2006) with the new MRU registered.
Through the first calculation run after the changing, for each delivery point all the period between the last calculation and the planned date (31.n.2006) has been covered. In such a way all delivery points now are in the same situation, so starting the standard condition, having concluded the start-up phase (figure 3).

2.6 REVIEWING THE PROCESSES

2.6.1 Reading management: general observations
As described before, the existing Data Model in SAP IS-U of AEM was organised through the management of two chains of technical objects for the billing of selling and distribution activities, correlated to separate companies: the selling one (AEN) and the distribution one (AGA). Both chains share the device and it means that, although on one side this simplifies some processes logically and in the reality shared (e.g. recording and validation of readings), it has a great influence on the possibility of a complete independence of management of readings of the same delivery point.

On this basis it has been chosen to separate completely the processes between distribution and selling, and keeping the two chains as connected as possible, always sharing readings on both sides as soon as they are available (through a specific interface tool).

Sharing reading can bring, in some cases, to non-standard distribution billing processes, e.g. if a validation of a reading not in the standards is delaying, it means that stops both selling and distribution
billing. These situations are tracked through a specific report that helps keeping the phenomenon under control (in terms of number, time, causes). It’s not advisable to separate this management in order to avoid significant impacts on all processes and workflow already implemented.

2.6.2 Management of scheduled readings for domestic delivery points
The reviewing of the process has brought to the generation of a reading order for the selling side only. The reading will be considered as scheduled on the selling side, and as a not scheduled one on the distribution side, through a specifically designed engine. Also readings not in the standards will be shared and they will be effective for both selling and distribution sides.

2.6.3 Management of scheduled readings for business delivery points
The process doesn’t need changes. As explained before, the billing period can be different from standard 1-31, but DPC is going to be implemented during year 2006.

2.6.4 Management of non-scheduled readings
With “non scheduled” reading is meant a reading coming from a communication by the final customer, or from a technical control/operation on the meter. Now they are registered on the device, so they are shared by both selling and distribution sides. Distribution billing of these readings will be done with the first available billing run.

2.6.5 Management of readings for delivery points of other selling companies
This process has been changed in this way:
- delivery point directly read by the selling company: the reading order isn’t generate anymore; incoming readings are managed as “non scheduled”. MRU connected are changed in order to produce an estimated value if a reading is lacking, or if the reading is not exactly corresponding to the last day of the month.
- delivery point read by the metering company of the distribution company: incoming readings are managed as “non scheduled”, with the same possibility as before to generate a “last-day” value. If the reading is related to a day after the “last-day”, it will be considered for the next month, while the consumption for the month will be calculated.

2.6.6 Management of readings coming from technical or commercial processes
Processes generating a non-scheduled reading are:
- removal, changing, installation of a meter;
- opening and closing of the supply;
- move in; move out (due to switching activity)
All those readings will be shared by both distribution and selling sides.

Some readings require a billing process; these are:
- reopening: on the selling side they are used as soon as they are available, while on the distribution side they are used once the first next scheduled reading will be available;
- Removal, substitution: on the selling side they are used as soon as they are available, while on the distribution side they are used once the first next scheduled reading will be available;
- Move out: on the selling side they are used as soon as they are available, while on the distribution side they’ll be billed at the first next billing run.

2.6.7 Management of non-standard situations
As explained before, in some cases it’s possible to have non-standard distribution billing processes, which can stop the billing activity for the specific delivery point. These situations are tracked through a specific monthly report that helps keeping the phenomenon under control (in terms of number, time, causes). With the information available it will be possible to evaluate if there is the need to develop specific tools to manage these situations, always keeping in mind the target of preserve the close parallelism between selling and distribution sides.
3. THE NEW ALLOCATION PROCESS

3.1 OBJECTIVE OF THE PROJECT

The objective of the project related to the allocation process is to adapt business software application SAP IS-U, already in use in AEM group to manage their business, to the new allocation requirements for all the delivery points, those related to domestic customers included.

3.2 THE NEW REQUIREMENTS

The new requirements for the allocation process, and key points for the development of the project are:
- “Real” allocation is managed by the transmission company;
- The distribution company must send to the transmission company data for allocation every month;
- Data must be sent not later than the 5th day of the next month;
- Consumption data must be determined for each delivery point;
- Two different scenarios to manage data correction: within one month or three months.

3.3 THE PRELIMINARY SOLUTION

3.3.1 General comments

The solution has been realised through the construction of a report that enables to determine the consumption of each delivery point, working independently from the billing process. The consumption data that are used for allocation are produced using the same functions allowed by the calculation engine of SAP IS-U (so using the possibilities offered by the Dynamic Periodic Control), but the process is completely independent from the one for billing purposes, both in terms of timing and data produced.

To obtain this result the project has been organised in two different steps:
- Realisation of a “preliminary report” (in order to be ready at the starting of the new rules)
- Realisation of a “standards report”

3.3.2 Realisation of the “preliminary report” – step 1 – report to extract data

The report to extract data has been realised through a specific program that analyses, for each delivery point, the situation of the month considered for the extraction. The report checks the situation of the delivery points, to allocate them in one of these scenarios:
- No readings during the month
- Reading of a business delivery point (either of AEN or of the other selling companies)
- Reading of a domestic delivery point.

For each scenario the report applies a specific extraction method:

**No readings during the month:**

The report produces a calculated consumption for each delivery point for the period 1-31 of the considered month. The report uses the calculation tools available by SAP IS-U, shared both by the calculation and billing processes. The calculated consumption is then multiplied by the factor M or K, depending on gas meter size (M and K are correction factors, to keep in consideration the temperature and pressure characteristics of the gas under measurement); this because the calculation engine works on the meter reading and not directly with the actual consumption, in terms of standard cubic meters.

**Reading of a domestic delivery point:**

The report produces the consumption of the months: N, N-1 and N-2. In order to obtain the consumption of the specific months, the report distributes the total consumption (obtained from the difference between the reading of the month and the last one available) and the consumption already allocated in the months before, starting from month N-2, and distributing it, using the calculation tools, in the three available months (N, N-1, N-2, as these three months are those available for allocation by the transmission company’s rules).

If the reading is not at the end of the month, the report calculates the consumption in order to arrive to the end of the month, using the calculation tools available. The calculated consumption is then multiplied by the factor M or K.
**Reading of a business delivery point:**

Also for this kind of reading, the report produces the consumption of the period 1-31 of the month. If the reading is not at the end of the month, the report calculates the consumption in order to arrive to the end of the month, using the calculation tools available. The calculated consumption is than multiplied by the factor M or K.

3.3.3 **Realisation of the “preliminary report” – step 2 – storage in a custom table**

The report organises data in a table containing the data:
- Delivery point number
- Consumption characteristic (real, calculated, etc.)
- Consumption
- Month
- Delivery point characteristics

The consumption is already expressed in standard cubic meters, as determined by the report.

3.3.4 **Realisation of the “preliminary report” – step 3 – Report production**

The report produces a TXT format file containing the data (and source):
- Delivery point number (table)
- Consumption characteristic (table)
- Consumption (table)
- Month (table)
- Delivery point characteristics (table)
- Selling company (Master Data)
- City Gate (Master Data)

The report is available to AEM Gas for the following activities.

3.3.5 **Actions by AEM Gas**

The distribution company gets the TXT file and organises the information through a Data Base program (Access) in order to communicate them to the transmission company.

3.4 **THE STANDARD SOLUTION**

3.4.1 **General comments**

The standard solution (now in development, ready for the next season October 2006 - September 2007), starting from the part already developed (the preliminary report) allows to aggregate data and transmit to the different interested parties (transmission company, selling companies) (figure 4).
3.4.2 Loading the Info Cube
The Info Cube will use two different data sources:

The first source is the table as already described before. The second one is IS-U Master Data, which will be used by the Info Cube to extract these data:

- City Gate code
- Selling Company
- Delivery Point Category

3.4.3 Analysis through BEX (Business Explorer)
The front-end solution available through SAP BW will allow to aggregate data in Info Cube following the variety of rules defined by the user. The standard layout for the aggregations is Excel, which allows to analyse information and to make queries.

3.4.4 Data transmission
Transmission of allocation data to the interested parties will work through an integration middleware. This tool will enable the reading of the information in Info Cube and in BW, and to prepare, using a standard communication protocol, the different files to be sent to the interested parties.

4. MANAGEMENT OF THE SCENARIOS

4.1 MANAGEMENT OF PRE-ALLOCATION AND FINAL ALLOCATION

As the transmission company allows to correct data for a period of three months, the target of the report is to manage a kind of “pre-allocation”, so meaning that data transmitted at day 5 of month N (5 days is the dead line to transmit data to the transmission company for each month) will be considered definitive at month N+2. As shown in the example, if a reading is available during month N-1, consumption for months N-2 (1.400 cubic meters) and N-3 (1.300), that had been calculated, will be calculated again during report run in month N. The calculation engine will distribute the difference between the two readings and quantities already allocated, distributing it in the three available months (so it’s possible to avoid losing gas). This
distribution will be realised using loading diagrams in order to be as near as possible to real consumption profiles. In the example Y is the calculated value of consumption to arrive to the end of month N-1. Quantities of months N-3, N-4, N-5 won’t be modified (figure 5).

The difference between the amount already communicated and the amount coming out from the real readings is distributed in months n-3, n-2 and n-1 using load profiles:

\[ \Delta = 8000 - 1500 - 1300 = 5200 \]

New allocation, using load profiles:

- N-3: 1600
- N-2: 1800
- N-1: 2800 + Y (calculation till the end of month N)

Figure 5

4.2 MANAGEMENT OF ERRORS
The concept of “pre-allocation” is used also to manage errors. Errors referring to months N-3, N-2, N-1 will be considered during the run of the report during month N, while errors referring to month N-4 and before won’t be considered.

### 4.3 CITY GATE

The information related to the city gate number (either pool or single) was not managed yet by the information system. It has been introduced using the object “grid” of SAP IS-U, and the information is “attached” to the set of data related to a delivery point as soon as it is created. It will then be used by the report in order to gather information on this basis.

### 4.4 LINK WITH THE SHIPPERS

Another information introduced in the set of data related to each delivery point during the development of the project is the shipper (on the transmission side) connected with the selling company operating on the distribution side. It has been organised in order to avoid the creation of a new contract if this commercial link changes during time.

### 5. CONCLUSIONS

Changes in the regulatory and market scenario have induced AEM Gas to develop new IT tools to manage new incoming tasks. The approach has been to implement the tools in the existing SAP IS-U system in order to take advantage of all the information already available, as well as instruments already existing in SAP IS-U. What has been obtained is a tool that is fully compatible with all other IT instruments in use, that exchanges information with other processes already running and that is flexible enough to manage different scenarios that can be foreseen in the next future (e.g. a variation on the maximum time horizon available to communicate variations in allocation data to the reference transmission company, and rules to distribute mismatching of consumption between forecasts and real meter readings, etc.).