**Water Loss Reduction and Change Management**

J. Pocas Martins,

FEUP and Aguas do Porto, Porto, Portugal, E-mail: pocasmartins@gmail.com

**Abstract:** Water loss reduction is a common goal of most water companies around the world: large or small, public or private, in developed or developing countries.

The context of each specific problem and the stage of development of each water company dictate the nature and extent of the solution. Many water companies, mostly in developed countries, are well run but have their performance indicators limited, for instance, by older assets or steep topography. In such cases, the critical factors are investment, technical knowledge and technology. However, in the majority of the water companies worldwide, this process primarily requires organizational change and the commitment of top management.

The non-revenue water, together with other indicators, helps to position the stage of development of each public water supply system in a convenient pre-efficacy/efficacy/efficiency/excellence rating scale. The evolution along this rating scale is a common pattern of water companies in search of excellence.

The main objective of this paper is the definition and application of the basic principles of change management to water companies, with an emphasis on the reduction of non-revenue water. Based on case studies – that did not include situations of generalised poverty or non-payment of the water bills – it is argued that five to six years is sufficient, in ideal conditions, to approach excellence, but also that every window of opportunity to improve on the existing situation, great or small, must be taken.

In previously less efficient companies, it is possible that a tipping point – a level at which the momentum for change becomes unstoppable – may occur in the first year, with the production of great tangible results. Each water company has its unique complex context, but political support, leadership and time are prerequisites for success.

**Keywords:** water loss; change management; water companies

**Change Management Processes**

Tolstoy, in Ana Karenina, says that "happy families are all alike, every unhappy family is unhappy in its own way." Similarly, all good water companies look similar: efficient, profitable, low levels of water loss and satisfied clients, shareholders and employees, whilst poor performing ones have many different excuses to explain, for instance, why they have to produce or acquire more than twice the water they actually sell.

Unlike other organizations subject to market forces, in the absence of competition, many water companies have managed to avoid change and survive over long periods of time providing a poor service, an expensive service, or both. This situation is changing, as more stringent water regulations are enforced and the consumers, the regulators and the media are putting an increasing pressure on management. Interruptions of supply and failure to meet water quality standards are not tolerated and performance indicators and tariffs are compared between utilities. Change, therefore, is becoming more and more the rule in water companies: externally driven or simply the result of a strategic management decision.

Under permanent change, traditional management is just not adequate: leadership, rather than management, is really the primary force behind successful change. Most of the successful change management processes reported in the literature have one thing in common: the appointment of a change agent, a leader who was given political support, authority and time.

Change management became a discipline in its own right and there are many books and manuals of practice on how to manage change in organizations. John Kotter (1996), a leading author in this field, recommends that the following steps are followed, in this exact order:

1. Create a sense of urgency
2. Put together a strong enough team to direct the process
3. Create an appropriate vision
4. Communicate the new vision broadly
5. Empower employees to act on the vision
6. Produce short term results
7. Build momentum and use that momentum to tackle the tougher change problems
8. Anchor the new behaviour in the organizational structure

From Kotter’s recommendation and personal experience, missing some of them or changing their order of implementation is likely to lead to failure. The sense of urgency that triggers the change process of a water company may be just a political option or a generalized public complaint about quality of service or high tariffs. In a comparatively small number of cases, there is an independent regulator who periodically sets the targets for the performance indicators, and which, therefore, overcomes the internal and external forces that impede the above mentioned change process. The selection of the leader of the process is crucial to overcome the second step: previous experience in similar projects, knowledge of the water business and the possibility of contracting out good professionals and rewarding the best collaborators are essential at this stage. The new corporate vision should be clear, mobilizing and agreed with the person or body that appoints the leader: “becoming a nationally and internationally recognized top water company” is an example of a successfully tested vision, but less ambitious statements may be more adequate if the context is less favourable. The communication of the vision to the collaborators has a multiplying effect on the efficiency of each employee: the plumber, for instance, is not just fixing a pipe: he is delivering water to the city. Showing results early may be overwhelming: rapid victories with tangible results – like reducing the water loss by 10% or the electricity bill by 5% in the first month – can make a difference, giving the process external credibility and boosting the morale of the workers.

In every process of change there will be small and large obstacles to overcome. It is crucial to evaluate them carefully, to gather sufficient support and wait for the right moment to tackle them. The prospects opened by the change process itself are likely to motivate the best collaborators, but human nature makes it difficult for some of them – directly responsible for the previous poor performance of the company – to be committed with the new project and It would be better to replace them as soon as possible for the sake of the global success. The nature of the change process requires that the previous organizational structure is fragmented and that many procedures and routines are abandoned. Leadership is essential to make sure that the collaborators that direct the process keep their motivation and help each other achieve the new corporate objectives. Specific restructuring projects with suitable team leaders may replace many of the former ways of organization but there is a limit in time for the transition period. At some stage, when the major objectives are met, it is necessary to reassemble a new organizational structure, to select the intermediate managers and to consolidate what has been achieved. It is the time for certification and to anchor the new behaviour in the new organizational structure.

It is important to stress that maintaining a good or excellent water company and managing a change process towards excellence are two completely different processes, requiring different approaches, methodologies, organizational structures and types of leaders.

Excellent companies, especially if they became excellent long ago, should certainly be studied for best practices, but they actually may not be the most effective agents to provide guidance to poorly managed ones aiming to improve. Indeed, in such companies, activities are already segregated and settled, procedures are well established and documented, and they developed an organizational culture that cannot easily be transferred elsewhere.

From personal experience, it is important that the leader of a change process adheres to a clear set of rules, for instance John Kotter’s (1996), with the following hints (Pocas Martins, 2009):

- Adopt a simple and flat organizational structure
- Set a restructuring team you trust to coordinate the change process and meet them weekly as a group
- Define restructuring projects for your key objectives and assign each one to a member of the restructuring team
- Trust your team members: give them freedom to act according to the new vision, but not the authority to alter the vision, the objectives or the priorities
- Plan and act in short intervals and avoid lengthy studies
- Decide quickly and make others decide quickly too: if a problem takes more than a week to solve, it is sufficiently difficult and important to deserve your attention and should be brought to you
- A certain amount of chaos is inevitable during change processes due to the fragmentation of the former organization
- You don’t really manage change, sometimes you just surf it
**Stages of Development of Water Companies**

Water companies are primarily expected to provide potable water and/or looking after the sewage in which it is quickly transformed by use. Standards and quality of service may vary widely from company to company and make the whole difference: for instance, providing a continuous high quality service, 365 days a year, 24 hours a day, requires an organization and tariffs that are totally different from those in a situation where occasional interruptions and failures are still accepted by the customers.

The management must maintain at all times a delicate balance to satisfy their clients, shareholders and employees and to comply with increasingly complex and demanding legislation, regulations and standards. The weight given to each of the stakeholders in the management decisions says much about the company and its context. For instance, a private undertaking is more likely to privilege the shareholders — and profits — than a public one, although this does not mean that a public company treats their clients better than a private one.

Although the development of any water company is a continuous process, it is convenient to define intermediate stages as follows: Pre-Efficacy, Efficacy, Efficiency and, finally, Excellence (Table 1).

**Table 1:** Stages of Development of Water Companies

<table>
<thead>
<tr>
<th>Stages of Development</th>
<th>Decision Times</th>
<th>Calculation of Performance Indicators</th>
<th>Centralized Control Room</th>
<th>Control of Water Inputs and Outputs</th>
<th>Active Leakage and Pressure Control</th>
<th>Control of Night Flows</th>
<th>Response to Clients and Bursts</th>
<th>Non-Revenue Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-efficacy</td>
<td>Months</td>
<td>Yearly</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Months</td>
<td>&gt; 50%</td>
</tr>
<tr>
<td>Efficacy</td>
<td>Weeks</td>
<td>Monthly</td>
<td>No</td>
<td>Monthly</td>
<td>Occasional</td>
<td>No</td>
<td>Weeks</td>
<td>30 - 50%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Days</td>
<td>Weekly</td>
<td>Office hours</td>
<td>Daily</td>
<td>Systematic</td>
<td>Daily</td>
<td>Days</td>
<td>15 - 30%</td>
</tr>
<tr>
<td>Excellence</td>
<td>Hours</td>
<td>Daily</td>
<td>Permanent</td>
<td>Real Time</td>
<td>Permanent</td>
<td>Real time</td>
<td>Hours</td>
<td>&lt; 15%</td>
</tr>
</tbody>
</table>

Pre-efficacy is really a euphemism to describe a water company that does not do what it is supposed to do, for instance with lack of coverage, frequent interruptions of supply, poor water quality or not listening to customer complaints. Efficacy means that the company fulfills its major objectives but uses too many resources for it. As a result, tariffs are higher than they should, or it requires public subsidies to survive. Efficiency is a lengthy stage of improvement, indeed it is a never ending process that leads to savings in every aspect of the water company without affecting its efficacy. Excellence is the ultimate goal, the unachievable perfection one should try to reach. Reliability, innovation, special attention to customers, social responsibility, the welfare of the employees, certification and sustainability are certainly among the management concerns at an excellent water company. Some of these concerns may be also present in inefficient public companies, but these are certainly not sustainable.

The evolution of a water company is really a continuum and there is some degree of arbitrariness in any classification, but it is possible to use simple indicators to position any water company in this rating scale. For instance, a company that does nothing special to control its water loss, that only calculates it in the end of the year to include the figure in the annual report, typically will show a value well above 50%.

Water loss (or, rather, non-revenue water) is a convenient indicator to help classify the water companies: it is widely used, simple to calculate, easy to understand and says much about the organization, as it is necessary to mobilize all the departments of the company to improve it. It has been expressed in a variety of forms in the past, but the IWA Water Loss Task Force developed a Water Balance methodology that became internationally accepted, not only for benchmarking, but also for monitoring non-revenue water reduction processes at water companies (Brothers, 2003 and Lambert, 2003).

There are comprehensive books and manuals (Farley and Trow, 2003; Farley, 2001; and Waldrom et al., 2005) covering virtually every aspect of water loss reduction, but the gap between the available knowledge and technology and the practical applications is still surprising.

**International Experiences**

Regulators and international water organizations regularly present the results of benchmarking studies of water utilities. They tend to use more and more the IWA performance indicators and this fact, on its own, is extremely important to allow for some meaningful comparisons between utilities and between studies.
Some of these studies, however, are based on non audited information supplied by the utilities themselves, therefore their results must be analysed with caution (Asian Development Bank, 2007).

In recent World Bank publications (Ginneken and Kingdom, 2008; Muller, 2008), based on 11 case studies on well performing utilities, it is concluded that there is no perfect model for public utilities that guarantees good performance, but well functioning utilities share the following main attributes:

- Autonomy, accountability and consumer orientation
- Separation of the political realm from the service provision (although full isolation is neither attainable nor desirable)

It is also referred that the following attributes are essential to successful change processes:

- Installation of a champion within the utility who functions as an agent of change
- Reforms should be incremental and focus on areas where prospects for early success are high, within tangible results within one political cycle: best-fit is more important than best-practice

The context of the water company is crucial to the change process: in cases of generalized chaos and poverty it may be virtually impossible to improve a water company, or indeed any other organization, but even under very difficult circumstances it has been shown that it is possible to lead a change process towards efficacy, efficiency or even excellence.

Where poverty prevails it is particularly important to set objectives in line with the availability of transfers and with the customer’s ability and willingness to pay, leading to sustainable, bankable solutions. Stakeholder dialog, supported by a financial model to build a consensus on what services the country can afford over 20-30 years, including the definition of the affordable and social tariffs and of the adequate mix of tariffs, taxes and transfers are essential (Scatasta, 2009). The public or private ownership, on its own, does not appear to have a definite impact on the levels of performance of the water companies, as there are many good and bad examples of both around the world.

**Case Studies**

Examples from two case studies will be presented next to confirm the general recommendations and findings above, pointing out a number of positive and negative details and experiences: they both refer to average size water and wastewater companies in Portugal (120,000 and 150,000 clients) that changed very fast from Pre-Efficacy to Efficiency, according to the evaluation protocol presented in Table 1.

At Company 1 (Table 2), the percentage of Non-Revenue Water (NRW) moved from 47% to 19% in six years. The corresponding savings helped to finance, without tariff increases, a new wastewater system, built almost from scratch: 700 km of new sewers, 5 wastewater treatment plants and 100,000 new home connections.

**Table 2:** Company 1 (Gaia, Portugal, 1998-2004)

<table>
<thead>
<tr>
<th>Functions</th>
<th>1998</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply + Sewerage (No Wastewater Treatment Plants)</td>
<td>Water + Sewerage+ Wastewater Treatment+ Stormwater + Stream Rehabilitation+ Beaches (Full Urban Water Cycle)</td>
<td></td>
</tr>
<tr>
<td>Water Clients</td>
<td>80 000</td>
<td>120 000</td>
</tr>
<tr>
<td>Wastewater Clients</td>
<td>10 000</td>
<td>110 000</td>
</tr>
<tr>
<td>Wastewater Treatment Plants</td>
<td>0 (0%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Investment 1998 - 2004</td>
<td>150 million euros</td>
<td></td>
</tr>
<tr>
<td>Average Water Tariff (1998 Constant Prices)</td>
<td>0,75 €/m³</td>
<td>0,73 €/m³</td>
</tr>
<tr>
<td>Production/Acquisition Cost of Treated Water (1998 Constant Prices)</td>
<td>0,10 €/m³</td>
<td>0,28 €/m³</td>
</tr>
<tr>
<td>Non-Revenue Water</td>
<td>47%</td>
<td>19%</td>
</tr>
<tr>
<td>Number of Workers</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

At Company 2 (Table 3), the most interesting point is perhaps the speed of change, for instance halving the volume of NRW in just eight months, without any major investment.
Table 3: Company 2 (Porto, Portugal, 2006-2008)

<table>
<thead>
<tr>
<th></th>
<th>October 2006</th>
<th>October 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Input Volume (m³/day)</td>
<td>104,000</td>
<td>70,500</td>
</tr>
<tr>
<td>Revenue Water (m³/day)</td>
<td>48,000</td>
<td>48,000</td>
</tr>
<tr>
<td>Non-Revenue Water (m³/day)</td>
<td>56,000</td>
<td>22,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(savings of 11,000 €/day, 10% of the annual turnover)</td>
</tr>
<tr>
<td>Functions</td>
<td>Water + Supply + Sewerage + Wastewater Treatment</td>
<td>Water + Sewerage + Wastewater Treatment + Stormwater + Stream Rehabilitation + Beaches (Full Urban Water Cycle)</td>
</tr>
<tr>
<td>Tariff Increases</td>
<td>n.a.</td>
<td>0% in 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.75% in 2008</td>
</tr>
<tr>
<td>Number of Workers</td>
<td>574</td>
<td>512</td>
</tr>
<tr>
<td>Net results</td>
<td>- 3,500,000 € (Loss)</td>
<td>+ 800,000 € (Profit)</td>
</tr>
</tbody>
</table>

Both cases share the following features: initially municipal departments with limited autonomy, followed by the appointment of new reform oriented mayors, who decided to create new municipal water companies to run their water and wastewater systems. Although both companies were overstaffed, it was impossible to reduce the workforce, therefore it was decided to expand their range of activities to include also the operation of the storm water systems and the rehabilitation of urban streams and beaches. These new functions were transferred without any additional resources and had to be financed from efficiency and productivity gains. Reassuring the stability of the workforce in the initial stages of the organizational transformation was the first priority, as it was vital to keep the water and wastewater systems running at least as usual. In the first month the best workers were identified, invited to assume more demanding or coordination responsibilities and offered pay rises and performance incentives. During the first year, about 15% of the workers were given a promotion for merit. It was promised – and actually delivered since the first year of operation – an annual bonus, worth up to a month salary, as a share of the profits due to higher productivity. The relation with the clients was given special attention and the workers were invited to adopt an entirely new attitude towards them.

Another interesting aspect that contributed to increase the level of client satisfaction was the adoption of a 24 hours deadline to directly answer and effectively solve any technical problem such as lack of water, lack of pressure or a dripping meter. All complaints except those regarding billing or involving complex legal matters were recorded, coded and displayed in the company Internet site until they are solved. In this way, a simple transparent and powerful control tool was set to steer and monitor the most critical aspects that affect the clients/company relationship. The relation with the unions and the local representatives of the workers is particularly sensitive during processes of change. Keeping an open line of communication avoids the building up of unnecessary tension. However, the nature of the unions requires that they must always keep a number of demands alive. Solving them too quickly will create an unnecessary problem for them and for the management. The fact that the communication line was also kept open to listen to the complaints and suggestions of every worker and the fast implementation of the corrective measures suggested by them, individually, also contributed to ease the relations with the unions.

In Companies 1 and 2, the starting point was at about 50% NRW. Priority was given to the reduction of real losses: elimination of the visible leaks, fast repair of the bursts and active leakage control. This was done before approaching the customers who were failing to pay their bills or who had illegal connections and faulty meters. In both cases, the NRW dropped from over 50% to less than 30% during the second year of the change process, with minimum pipe and consumer meters replacement.

Looking back, it would have been a better decision to massively replace consumer water meters in the second semester of the change process, immediately after the elimination of the larger visible leaks, because of the impact of this measure on the annual results. As the majority of the meters were located inside the apartments, the generalized option for AMR – Automatic Meter Reading to replace the traditional meters appeared to be obvious. However, in both cases the companies were overstaffed and the number of clients who failed to provide access to the readers was limited. In Company 2, therefore, it was decided to limit the installation of new AMR to about 10% of the clients: the larger consumers and the properties of more difficult access. An option was made for simple drive-by and walk-by meter readings. The status of the meter readers was raised, transforming them into Client Managers, each one...
made responsible for a supply zone. This proved to be a good decision, because, for the vast majority of the clients, they are the sole contact with the water company. The ongoing change management process of Company 2 will be presented next in greater detail.

Company 2 Case Study
The city of Porto has one of the largest and oldest water systems in Portugal, with 152,000 clients. At the end of 2006, the municipal department in charge of the system was subject to a corporatization process and became a municipal water company.

The new company was also made responsible for the management of the rainwater system and for the rehabilitation of the urban streams and beaches. Therefore, the whole of the urban water cycle was put under unified management.

The challenge was to improve the quality of service and perform the additional tasks with the existing employees, without redundancies, and to move from loss to profit without tariff increases.

New Organization
In the first week of the newly created water company, the previous organizational structure, of a typical pyramidal model, with many levels of decision, changed to a much simpler and flatter one. The most distinctive feature of the new organizational chart is the Restructuring Commission, with extended powers to implement the process of change over a three year period. The leadership of the Restructuring Commission and of the process of change was contracted out to the author as an external consultant. This Commission includes an executive member of the Board and twelve members of the staff from all the areas of the company. It operates in a very flexible way, with general meetings typically once a week and as many steering meetings as required. About thirty Restructuring Projects have been defined, each one with a leader, a clear objective and a deadline. Some are standalone projects whilst others overlap with the routine activities of the water company. For instance, the creation of the central control room was accomplished, as scheduled, in 100 days, and the completion of the sewerage system is to be developed over 3 years, with the participation of many collaborators from different areas of the company and external contractors. Change, in this case, meant questioning every aspect of the organization, appointing new managers and redefining new routines in line with the following water supply objectives, previously agreed with the Board:
- Drastically reduce water loss (from 54%);
- Move from loss to moderate profit without tariff increases.

New Attitude and Transparency
The adoption of a generalized, proactive, client oriented attitude, and the introduction of transparency in every process of the activity of the company, are crucial to the process of change. The target is answering and solving almost 100% of the questions and problems within 24 hours and responding immediately to bursts and similar emergencies.

Making real time information available via Internet on the situations that affect the continuity of the service and on the follow-up of complaints avoids unnecessary building up of tension and accumulation of service, saves valuable time and stimulates the employees to do things better and faster (Figure 1).

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Number</th>
<th>Oldest</th>
<th>Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occurrences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clients without water</td>
<td></td>
<td>200</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Clients with insufficient pressure</td>
<td></td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Pipe Bursts</td>
<td></td>
<td>1</td>
<td>30-05-2008</td>
<td>11:11</td>
</tr>
<tr>
<td>Service Connections Bursts</td>
<td></td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Active Leakage Control Interventions</td>
<td></td>
<td>10</td>
<td>30-04-2008</td>
<td>20:28</td>
</tr>
<tr>
<td><strong>Complaints</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Sewage</td>
<td></td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Billing</td>
<td></td>
<td>60</td>
<td>27-08-2007</td>
<td>0:00</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>74</td>
<td>09-03-2007</td>
<td>0:00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>134</td>
<td>09-03-2007</td>
<td>0:00</td>
</tr>
</tbody>
</table>

Figure 1: Example of Real Time Information Chart Available to Clients through the Internet
Water Loss Halved in Eight Months
In 2006 the System Input Volume was 104,000 m$^3$/day and the Revenue Water was 48,000 m$^3$/d, therefore the Non-Revenue Water was 56,000 m$^3$/day, 54% of the water entering the system. Some eight months later, buying 76,000 m$^3$/day was already sufficient to distribute the same 48,000 m$^3$/day, therefore, the Non-Revenue Water was halved from 56,000 to 28,000 m$^3$/day, almost entirely through the reduction of real losses, with very little investment (Figure 2).

![Non-Revenue Water](image1)

**Figure 2: Evolution of the Non-Revenue Water**

The evolution of daily consumptions presented in Figure 3 clearly shows different patterns before and after January 2007, when proactive leak detection and location actually started. Most of the reduction occurred in the first semester, but it has continued afterwards at a lower rate.

![System Input Volume](image2)

**Figure 3: Evolution of the System Input Volume**

The reduction of minimum night flows (an indicator of real losses), shown in Figure 4, follows a similar pattern, with peaks indicating large bursts.
The whole process of reducing the non-revenue water was inspired on the well established IWA Water Balance, developed by the IWA Water Loss Task Force and included the main following activities:

- Data mining in the corporate information system, namely the clients and assets databases
- Local inspection of the system (every time there is an unexplained increase of the night flows on two consecutive days) and consumer meters (at least once or twice a year)
- Billing of all consumptions and services
- Taking legal action in cases of theft or non-payment
- Replacement of old or suspicious consumer meters
- Installation of meters with automatic reading in places of difficult access
- Replacement of pipes with frequent bursts and high levels of background leakage
- Fast repair of operational bursts
- Active leak detection and location using both the traditional listening sticks and state of the art technology
- Real time flow and pressure monitoring at key points of the distribution zones
- Pressure control, through a redefinition of the distribution zones and the installation of programmed PRV – Pressure Reducing Valves

In 2006, the System Input Volume was 104,000 m$^3$/d, and the Revenue Water was 48,000 m$^3$/d and it was envisaged that, in the future, these values may reach 60,000 and 55,000 m$^3$/d, respectively. Departing from the baseline situation (104,000 m$^3$/d; 48,000 m$^3$/d) at the beginning of 2007, for each combination of the System Input Volume and Revenue Water, it is possible to calculate the corresponding gross impact on the annual results of the company (Figure 5).
In this exercise only the price of acquisition of treated water and the average marginal price paid by the consumers for each additional cubic meter of water invoiced were considered. The corresponding additional investment and operating costs were not taken into account, and it was assumed that the tariffs remain constant.

Assuming, from similar systems reported in the literature, an economical level of leakage between 15 and 20% of the System Input Volume, it is possible to reach it in many different ways, certainly at very different costs, namely giving priority to the reduction of real losses or apparent losses. In this case, an option was made to start with the reduction of real losses first, because there were many leaks, very damaging in terms of the image of the company, that could be repaired internally in the short run, practically without investment. Indeed, in less than a year, it was possible to reduce the water purchased by 3.1 million euros and, because this was made without additional investment and with the existing employees, this value was fully reflected in the annual results. The priority to the reduction of apparent losses, would have produced similar economic results but with a much greater waste of water. It is clear from Figure 5 that quantifying the water loss as percentages is meaningless in terms of setting targets. Daily volumes are also not adequate, because of the different prices of the water purchased and sold. It is interesting to note that in practice, when you are leading a process of reduction of non-revenue water, you do not really have to fix a precise target and plan precisely how to reach it.

Indeed you progress from an existing situation through a number of coordinated actions, carried out by a number of teams, using a certain amount of available resources, over the available length of time. The teams are composed of different people, each of them operating independently, with priorities defined, except for emergencies, in decreasing order of cost-effectiveness. You develop each activity until it becomes clear that there is no net gain in going further. Therefore, this approach is likely to lead to a near optimum solution without the application of a formal optimization algorithm, although this may be a very interesting applied research topic.

Conclusions

Many water companies around the world need to go through change processes to overcome chronic unacceptably low levels of effectiveness and efficiency, wastage of resources, high tariffs and poor quality of service. There are little possibilities of success without the following prerequisites: clear high level political or shareholder support, strong leadership, ambitious but achievable objectives and time. The lack of any of these, almost inevitably leads to failure. Some sort of privatization may be an alternative, but this is not always politically acceptable or legally possible.

Management of change requires leadership, skills, organization and methodologies different to those which would be adequate in a steady, less demanding situation. If there is not sufficient internal expertise, contracting out the leadership of the change process may be an option.

Poverty related issues introduce an additional level of complexity and require a specific approach, hopefully leading to sustainable and bankable solutions.

References