

Private Sector
Performance Contracting
in the Water Sector

The Case of SABESP

Case Study

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Sustainable Development Department

Environment Division

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Working Paper

This working paper is being published with the sole objective of contributing to the debate on a topic of importance to the region, and to elicit comments and suggestions from interested parties. This paper has not gone through the Department's peer review process or undergone consideration by the SDS Management Team. As such, it does not reflect the official position of the Inter-American Development Bank.

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Executive Summary

Water systems in Latin America are inefficient, in part because of very low relative investment, and in part because of the lack of availability of necessary management tools. One way to address both of these issues at the same time is the performance financing of micro-metering by private sector companies. This case study is written to highlight the counter-intuitive fact that the great inefficiencies in Latin American water systems offer strong opportunities for public/private risk sharing.

Unaccounted for water (UAW) in Latin American urban water systems is a serious management issue, and a potential business opportunity. Most systems average between 50% and 60% UAW, while some systems reach levels as high as 80%. Typically smaller municipalities, in the ranges of 10,000 to 50,000 inhabitants have greater incidences of UAW than their larger neighbors.

In terms of cause, studies have shown that on average 50% of this loss is owing to old pipes and connections, and another 50% is owing to a lack of local metering. Investing in meters is both costly, but can be made attractive to both private business and public utilities because of the outsized returns that can be realized by both parties through efficiency gains.

Brazil has begun to experiment with such contracts. While results are in the early stages, performance contracting of micro-metering shows great promise. Sabesp, the water company for the city of São Paulo, is finalizing an initial foray in this area. Over the last three years, under a performance contract this large utility has generated explicit new revenues of 36.7 million Reais per year. This translates into 90,800 *new* water connections, or the ability to operate and maintain roughly 242,000 existing connections.

This model can be extended to other municipalities in Brazil, and throughout Latin America. In addition, there is reason to believe that the model could be extended to two additional areas that have to do with performance and efficiency improvement, pipes and connections (40% of capital investments in Latin American water systems), and energy (proportion of operating costs from 23% to 55%).

Introduction

The Brazilian water sector is extremely large, serving a population of more than 160 million consumers. There are nearly 300 municipalities with populations of 50,000 people or greater – and more than 4,000 total municipal water concessions. Investment in the sector, as a percentage of GDP, is only about 20% of what it was in the 1970's – and is barely enough to cover operations and maintenance costs.

One result is that public utilities, while under constant pressure to make improvements in potable water coverage, and in sanitation, are under even more constant financial pressure. Part of the solution, in an era of austerity, is greater efficiency. In Brazil, estimated metering and billing losses range from 25% to 50%. Physical losses, through antiquated pipes and connections, make up a like range of inefficiency.

Public utilities, lead by Sabesp, have reached the conclusion that one area of potential new investment assistance is the private sector. The private sector – reluctant to supply mid-term, and long-term turnkey solutions to utilities that have not always paid their bills on time – is willing to participate in risk contracts, but only on the condition that such arrangements are properly structured, and that revenue from *their* operations is earmarked for them, and delivered to them on a timely basis.

Decentralization and Liberalizing Policies

The Brazilian water market is undergoing decentralization, opting for a model that is in general much more market-oriented than the formerly state run system. This is true across the board, and even more so in the south where state-owned companies have experimented with a number ownership and management structures, all focused on generating either political (more connections, profits for the state) or financial results. Sanepar, the state utility of Paraná state, allowed a private operator to take a minority share of its system; and Sabesp, fully state-controlled, has sold shares on both the local and international stock exchanges. This limited opening is driving important investments in state water companies – and one of the most critical of these areas is micro metering focused on the twin goals of loss reduction and revenue enhancement.¹

The decentralizing and liberalizing trend is underway throughout the Latin American water sector. Performance contracting offers a way for the private sector to participate, *without* privatization – and to do so attacking the ripest area, inefficiency.

However, because the sector is so decentralized – and because there is so little federal level direction and direct funding – creative efforts at the local level require enormous persistence for development and implementation. The subject of this case study, Sabesp's performance contracting, was successful largely because of an internal decision made by Sabesp, the most powerful utility in the country, to experiment with what is essentially an off-budget efficiency driver.

There is evidence that a solution from 'outside' would not have been so successful (see appendix 1 – the case of Porto Ferreira). One initial lesson is that this kind of change is most successful – or at least quickest – when it is developed as an internal initiative, rather than driven by an external change agent.

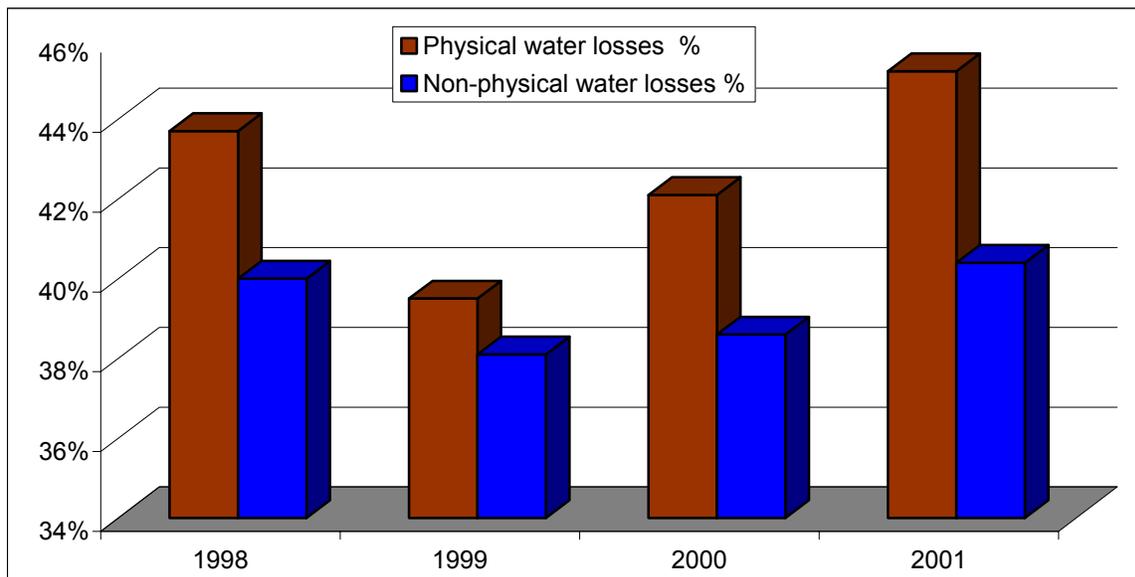
¹ Sanepar's Water Loss Reduction Program started with an initiative by the technical department within the company that oversaw new technologies. The group successfully commissioned a US Trade and Development Agency grant agreement in August 1997, to assess the water loss reduction potential in the capital city of Curitiba. The evaluation was conducted by Black & Veatch and ETEP. Among the principal recommendations was a phased replacement of all 430,000 micrometers in the system and an immediate action to revert the 15.6% leakage through the pipe infrastructure. The study was completed in January, 1999, and the project has been structured as a series of procurement bids, administered by Sanepar.

The Efficiency Problem – Unaccounted for Water

Brazil’s unaccounted for water (UAW) has increased significantly over the past years, and is now an obvious problem that must be tackled in the very short term. At base the UAW problem, in a system that is under pressure to improve management performance, is a problem of lack of investment. In Brazil, of the total unaccounted for water, approximately 45.2% is physical and another 40.4% non-physical losses. Sabesp’s average is 37.9% physical water losses and 31.7% non-physical losses.

Sabesp decided to address this issue.

CHART: PHYSICAL WATER & NON-PHYSICAL LOSSES 1998-2001



Micro metering

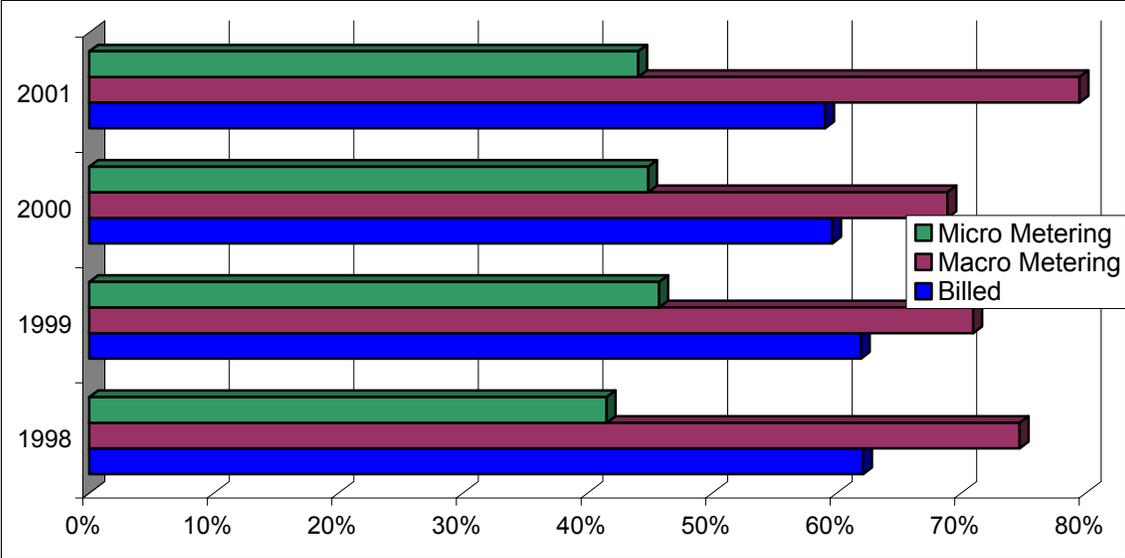
Brazil as a whole averages only 44% of micro metering; many countries in Latin America average much less – especially as one cascades down in terms of (a) size of municipality, and (b) wealth of country.

The chart below illustrates billed, macro metering² and micro metering as a percentage of total water produced system-wide. Ratios are higher in Brazil’s south, a region that is much richer

² “Macro metering” refers to the metering at the point where Sabesp measures total water supplied – i.e. at the potable water pumping station.

than the north. If micro metering is seen as key to developing an efficient system, both in terms of reducing water loss and in terms of the capability of managing a public water company as an on-going *business*, then what is the best way to do it?

CHART: SYSTEM-WIDE BILLED, MACRO & MICRO METERING



The major micro-metering initiatives in Brazil were initiated during the last 8 years, with the trend towards privatizing utilities and municipal systems. Political will was mustered to increase the net income of utilities in order to attract higher bids. While privatization eventually lost momentum, micro-metering initiatives have continued across the well-run utilities, namely, Sabesp, Sanepar, Corsan and Casan.

The case of Sabesp provides one means of addressing micro metering in a developing country, where there are significant investment constraints, high levels of inefficiency and very aggressive political requirements for increased potable water coverage.

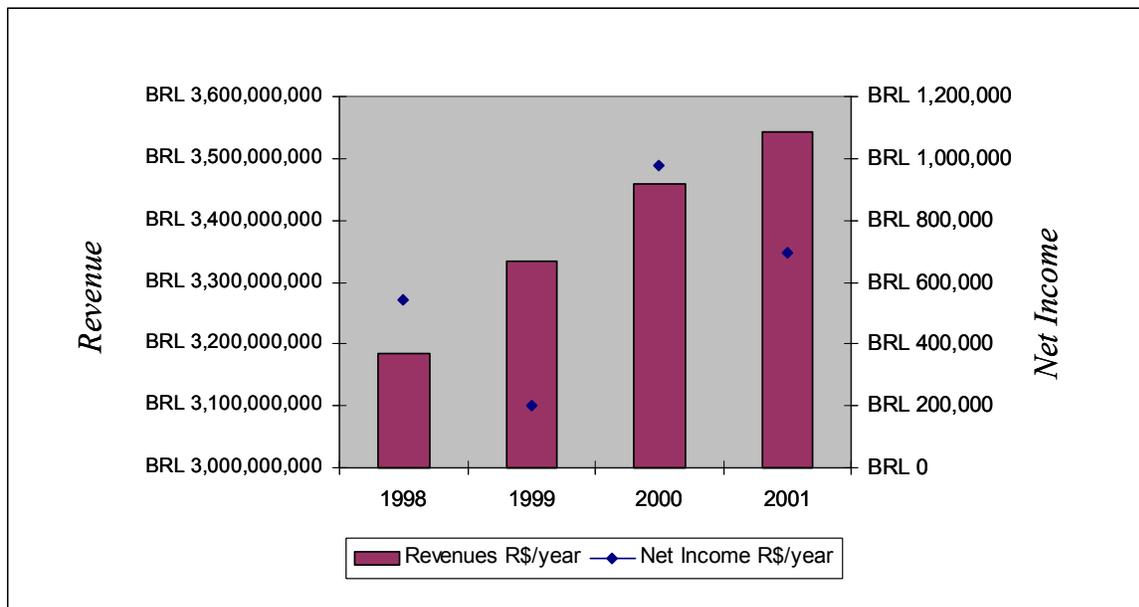
THE CASE OF SABESP

Sabesp is a large and complex company, managing the water and sanitation system of the city of São Paulo, Brazil and 320 municipal systems in the state of São Paulo. System-wide the average UAW is about 32%, which is relatively low by Latin American standards, but about average for southern Brazil.³

Overall, the company has 19,000 employees, and serves more than 23 million people, through a highly professional, very decentralized, management structure.

Sabesp has is under significant pressure to grow its connections and improve service, and has managed to successfully grow its connection base by an average of 4% per year since 1998, and has become the premier utility in Brazil in terms of procurement and services rendered. The firm is profitable (see chart below), and has a consistent and rapidly growing revenue base.

CHART: FINANCIAL PERFORMANCE REVENUES & NET INCOME



Sabesp is a dynamic enterprise, operating in a challenging environment, in which growth in service capability is required on a constant basis. This must be achieved through organic growth, since external funding is something that is both costly and risky – subject to currency deterioration (recall Brazil's January 1999 devaluation).

³ Latin America's average UAW, as mentioned, is between 50% and 60%; Chile and the U.S., on the other hand, are in the 8-14% range.

As it happens, the best way to find efficiency is by stemming water loss and improving connections – it is the same for Sabesp as it is for all large and mid-sized municipalities in Latin America.

Creating Performance Contracts for Metering Investments – The Steps

Sabesp is the only water utility in Brazil with ready access to international capital. The company installed a businessman, Ariovaldo Carmignani, as president in 1995 with the charge of making the company a world class enterprise. During his tenure the company reached \$1 billion per year in capital spending, and modernized its administrative system, moving from a loss making to a profitable entity. Despite the difficulties of running a public company in Brazil, Sabesp stock is traded on the New York Stock Exchange, and is held by key mutual funds around the world.

In 1998, Sabesp’s executive team began to consider privatizing the company; in that context they decided to take steps to increase the revenue base, and to increase profitability. Before they could make informed decisions they needed a roadmap – in what areas would action yield revenue and profit results?

Step 1 – The Diagnostic: In order to understand that actual state of the system, and where to apply effort, an internal geographic study was commissioned. Management decided, at the outset, that they needed a system-wide consumer profile – focused on the extent and effectiveness of micro-metering. The initial audit was conducted internally, by Sabesp’s technical arm in charge of metering.

The results were striking. In particular, one result stood out starkly -- 30% of the company’s gross revenues were generated by 1% of the meters⁴.

Step 2 – The Strategic Decision: Based on that fact, the company decided to structure a new project for the installation of meters, and to do so in the most promising areas. This might be called the “ripe fruit” strategy.

Two significant reasons counseled Sabesp management to structure the project as a performance contract, at risk, rather than as a tender:

1. **The Need to Leverage Private Sector Knowledge:** Sabesp wanted to leverage the know-how of the private sector to implement this project. Specifically they believed that the engineering and technology know-how of the metering companies would compliment the internal skills of Sabesp staff. They were aware that this is an area of extraordinary technological change, and wanted to make sure they received the best possible product – the biggest bang for their buck. Only in that way, they reasoned, would Sabesp staff come to understand and dominate the technology.
2. **The need Develop a Major Efficiency Project “Off-Budget:”** Capital constraints imposed by the Government of Sao Paulo, meant that Sabesp had limitations in its capital expenditures, especially as it related to non-core projects – additionally, this project would require a sustained feasibility study, prior to implementation. Sabesp preferred to

⁴ Sabesp has averaged 800,000 new meters per year during 1999-2001. During 2002, Sabesp meter purchasing fell to 300,000, and 2003 projections are for 550,000.

outsource this directly to the service provider as a way of shortening, and improving, what would have been a cumbersome procurement process.

Step 3 – The Structure of the Bid: A tender document was prepared during 1999-2000. This instrument took 18 months to prepare, because of complexities in structuring the risk / reward allocation. This has never been done in Brazil, and as a result it not only had to make sense for the parties involved – each of which would have to sustain significant risk – but it also had to make sense for state *and* federal decision-makers.

The critical fact involved the development of a formula through which to score the performance of the contractor. While Sabesp was interested in having the contractor take on certain risk, the management also had to ensure that performance could be measured – and that the additional revenues generated were shared appropriately between the winning bidder and Sabesp. The formula that Sabesp management decided upon was the following:

$$\textit{Profit for the Service Provider} = T \times R \times K \times G$$

Where:

(T) Water and Wastewater revenue for Sabesp minus Sabesp’s overhead variable, that averaged R\$3.19 This is the average net income per cubic meter of water that Sabesp earns. (i.e. Sabesp charged an average of R\$ 3.49 per cubic meter of water, and there was a deduction of R\$0.30 for SG&A expenses from this tariff that was reduced in order to share the savings of the net income of water delivered.)

(R) Meter depreciation (based on a 12 month curved depreciation schedule of 48.80%)⁵

(K) Multiplier that determined the winner. The multiplier was what determined the differential between competing bids. i.e. the winning bid would have the lowest multiplier). The K Factor is a coefficient that, when plugged into the formula, determines the amount that Sabesp is liable to pay for the service. In other words, the K factor determines the revenue to the service provider. The multiplier was the determining factor in the bid awards, as the lowest multiplier would determine the “cheapest” service to Sabesp.

(G) Historic weighted average gain after changing meters. (i.e. average revenue gain during 3 months after changing the meters makes sure that there are no seasonal fluctuations in the gains of a specific meter change date).

This last was the critical variable. Both the contractor and Sabesp needed to precisely measure the actual gain from meter installation – in order for the contractor to be rewarded.

As a part of this process, Sabesp set the following physical requirements – emphasizing a very high degree of control over the infrastructure that would be installed by its contractor:

⁵ The average meter in Sabesp has a useful life of 4 years. The coefficient used by Sabesp, was an average of the depreciation of the meters it had operating during the first year of meter’s operations, where it loses 48.80% of its value.

1. Class of Meters. Sabesp determined that all the meters to be installed were to be a minimum of Class C, for between 3m³/ hour and 1,100m³/ hour, with an electric pulse out-flow.
2. Most Promising Consumers. Within the bidding documents, it was stipulated that out of the 6 million meters that Sabesp operated, that the metropolitan region corresponded to 3.2 million, and that the largest consumers represented 30% of the revenue base, with 32,000 meters. Sabesp maintains a database of its customers, and determined the largest 32,000 (the largest water users in its system) as the target for the exercise, given that these customers with large consumption were also the “lowest hanging fruit”, or the consumers most likely to offer the largest loss reduction potential, based on the sheer volumes of water billed.
3. Out of Bounds Clients. In addition, and importantly, Sabesp established several clients that it did not want to target. These were entities with strong ties to the government. These included schools, colleges and certain government buildings.
4. **Performance. The contract demanded that the winning consortium replace at least 75% of the 32,000 meters, or a total of 24,000 meters.** The winning consortium had the obligation to supply and install the most adequate meter to each case, including revamping of site installations, as required.
5. Term – Total Term and Financial Term. The terms of the contract were for a total of 36 months, where the winning consortium would participate in the gains for the 12-month period after the individual meters were installed, and would be required to guarantee the meters for a period of 3 years after the installation.
6. Payment Scheme -- Payments were made by the final clients (all 30,000 large users) to Sabesp, and Sabesp passed on the payments to Invensys based on the formula, on the clients where Invensys has already changed the meters. The payments were made at the end of every 30 day period, pro-rated for when the clients' meter reading date was.

Finally, profits were also capped for each lot at R\$ 48 million.

Step 4 – The Action: There are four major metering companies in Brazil, and all four companies participated in the bids for two separate lots:

1. Actaris (ex-Schlumberger)
2. Liceu
3. Elster (ex-Nanssem)
4. Invensys

The Winner – Invensys⁶

Invensys metering systems won both lots. The company partnered with a local engineering firm, BBL, to form a consortium for the execution of both contracts. Invensys brought the technical knowledge and expertise, while BBL brought local knowledge and a ‘tropicalization’ mentality.

⁶ Invensys is a British company; the metering business was sold to a private equity investor on October 22, 2003.

The winning team signed an “Opportunity Contract” with Sabesp in December 2000, for the installation of between 26,000 to 31,000 large Class C meters, targeting the first-tier market- i.e. – the large industrial users in the State of Sao Paulo.

The Invensys BBL consortium won both lots, having offered a K factor of 0.7 and 0.68 for lots 1 and lots 2 respectively. This meant that the consortium offered the lowest multiplier to plug into the formula as explained above. (*Profit for the Service Provider = T x R x K x G*). This means that Invensys was offering the service for the lowest “Profit”.

The contract included full cooperation between Invensys and Sabesp in selecting the potential customers and evaluating the current metering needs. SABESP was responsible for providing consumption records and other pertinent information for the targeted consumers such as their payment history and payment ability (several large-scale consumers had a history of never paying their water bills).

Importantly, BBL – the Brazilian company -- was the services arm for the operation. It began monitoring each of the customers, by placing a data-log during a 7 day period.

After the initial audit phase, an analysis and results document was prepared and the information was assessed jointly by Sabesp and Invensys in order to supply meters. The contract determined that for every new meter that was changed, a study had to be presented and agreed to by Sabesp and Invensys BBL, after conducting a study.

Results

The contract is on-going, with the initial period expiring in December 2003. Sabesp executives estimate that a total of 28,000 meters will have been installed during the course of the contract. The meters, as originally agreed, will become Sabesp property after December. The revenue gains for Sabesp were R\$ 91.8 million – revenues from the targeted consumer base grew 9% over and above what could have been expected.⁷

From Sabesp’s management point of view the results were excellent. The project achieved 85% of the targeted goals – the utility’s returns were 85% of the total originally expected. Given the uncertainties in assessment and projection, and the fact that this was an entirely new modality for Sabesp, this was a more than satisfactory result.

Additionally, of course, Sabesp was able to

- (a) Upgrade its meter base, without a dedicated capex program,
- (b) Re-educate its largest consumers, and capacitate its technical staff, and
- (c) Expose and train staff in the best global practices for metering, as well as for billing and collections.

⁷ Note that original expectations were R\$112 million, based on the preliminary feasibility reports.

In addition, and very important from the stand-point of efficiency, the targeted consumers reduced their water consumption by 18% during the course of the project, as a direct result of water audits, system revamping, and clear and prompt billing.

Sabesp engineers have not been able to fully quantify additional avoided costs -- nonetheless, they stated clearly that there have been savings on operations and maintenance costs including energy costs for pumping stations, chemicals for water treatment and water pipe infrastructure maintenance.

From the private sector point of view, Invensys has stated that the results for the project were very good, despite the fact that revenues for the project reached only 80% of what management had originally expected – total profits were R\$38,400,000 and did not reach the R\$48 million cap.

The bottom line is that the project worked, for all parties. Sabesp increased its revenue by 9% over the service area, generating more than R\$ 90 million – which it could use for debt retirement, operations and maintenance, or new connections. While the supply side was not explicitly targeted in this project, a rough estimate of savings can be translated into the supply side of the equation:

From the profits of this operation, if used solely for coverage extension, the utility would have established 221,084 *new* water connections each year for the three-year period; and if used for operations and maintenance, then these monies would have allowed Sabesp to service 280,152 existing connections. **What is extraordinary is that the whole of Sabesp averaged only 167,969 new connections over the last three years.**

Summary of Lessons Learned

The Sabesp case study highlights several important lessons for policymakers, utility managers, and private vendors.

1. Policymakers

One of the key goals of the government is to make the firm healthy, so that it can provide services to clients without transfers from the state government budget. This project clearly and unequivocally promised to contribute to that mission. The result was that the government – state officials overseeing Sabesp’s budget and performance – fully supported this effort.

So, from the policy point of view there are two stand-out of lessons:

First, the project would not have worked without the government’s commitment to resolving institutional and legal issues critical to long-term performance contracting. This ability to problem-solve was critical in both establishing the form of the contract, and in making sure that it was executed in a timely fashion, in a manner profitable for both parties. Several critical flaws in the legislation were addressed such as the “866 Law”- the prevailing maxim that in Brazil any Public Sector contract over R\$ 5,000, needs to be awarded to the lowest price bidder. Sabesp’s commitments to resolving this through the above-mentioned risk-reward formula, was critical in the successful implementation of the project. Management contracts are subject to the same regulations, and require an in-depth legal and fiscal analysis for implementation.

Second, the state at the end of the day must backstop the contract. In this, Sabesp is something of a special case – because of the company’s financial strength they provided a de fact guarantee. Invensys stated, however, that a guarantee would make it easier for the company to establish such contracts across smaller municipalities, and less solvent state utilities.

There are a number of **risks** faced by policymakers, many of which have to do more with image than with substance – these come under the rubric of the risk of ‘trying something new:’

- Results – much is promised, but if it does not deliver then how will policymakers handle the dual problems of dashed expectations, and very public criticism?
- Transparency – given that they were trying something new and risky, how do they protect themselves from corruption charges – both from below, and from above? Would there be a role here for the IDB, on the guarantee side?

2. Utility Operators

For the utility there were a series of lessons learned:

First, the utility was able to clearly access know-how from the supplier/contractor. Sabesp engineers and management stated that there were significant benefits to working with Invensys over a

long contract period. The contract period spanned 36 months, which gave continuity to service, and an ability to leverage know-how and measure results jointly. There were benefits to both vendor and utility in this **intense mutual collaborating**.

Second, the study and consumer audit process was jointly conducted, and was not paid for up-front by Sabesp. One of the principal barriers to entry to cost saving / risk projects is obtaining capital to finance the diagnostic phase. The initial costs for prospecting, fieldwork, statistical evaluation and feasibility studies, is estimated at 2% of the total number of meters installed for any municipal project.

Third, policy makers is the necessity to create a more uniform risk-reward formula for utilities, The contract successfully structured a manner in which the private vendor would finance equipment over 12 months. The initiative did not involve commercial bank or state and federal approval processes, and was therefore faster to implement.

Fourth, management systems were improved. The integration of public and private teams allowed the utility to improve its internal process through integration of AMR and services that Sabesp would have otherwise had to create through entirely separate bids.

Among the major challenges to implementing such performance contracts, Sabesp has stated that variable tariffs⁸ across the clients it services makes it difficult to assign a standard return model to all cities.

The **risks** faced by the utility management team included:

- How to structure and score a risk/reward formula in such a way as to ensure measurable return?
- How to move a new model through an approval process in a timely fashion, so that it does not become too costly in terms of management time and energy, and so that it does not risk losing the private sector's interest?

3. Private Vendors

According to Invensys' experience, risk contracts require highly pro-active business development efforts by vendors. Politically, Brazil has a long road to hoe before water sector policy-makers and utility managers can readily create incentives for structured and long-term investment vehicles. Business need not wait for a uniform, national, regulatory framework – and, in fact, can do quite well financially as long as their partner is a serious well-managed company.

Aside from pro-active business development, a service arm must be created, and an integrated sales approach developed, bringing together technology, service and finance. The service arm should be locally based, owned and operated.

The **risks** for the private sector are, then, clear:

⁸ Municipal potable water tariff rates may vary anywhere from R\$0.50 to R\$1.50 per cubic meter, depending on the political model of each city.

- How to enter into a contract with a public entity when the ‘rules of the game’ for such entities are not established?
- Is it worthwhile forming a unit to perform on such a contract, including giving away significant knowledge, when there is no guarantee of a return?

Relevance for other Countries; Conditions Required

The case study is highly relevant for municipal water systems throughout Latin America. There are more than 500 systems with populations of 50,000 people and above. The conditions exist in all of these systems – and they exist in the context of pipes and energy as well – for performance contracting based on *partnerships* between the public sector and private sector, and the *performance* of both parties.

The following are requirements:

1. **Policy Decisions** – The decision to go ahead with a performance contract must be made at all relevant levels of government, and a concurrent commitment must be made to erase all roadblocks to successful development and execution.
2. **Efficient Management** – Utility management must make a decision to work efficiently, openly and professionally with the private sector bidders, so that all preparations are done as rapidly as possible.
3. **Efficiency Requirement** – The basic conditions must exist for success, and this is a combination of basic commercial inefficiency (or, in the case of pipes, physical inefficiency) and relative professional competence.
4. **Public/Private Coordination** – in the case of Sabesp public/private coordination was critical both in conceptualization and in execution. Both parties made a decision to be ‘winners,’ and both concerned themselves with the other’s fate; in addition, both melded first-class teams of professionals to work for success during the 30-month exercise.
5. **A Guarantee Mechanism** – Most utilities will not have the creditworthiness of Sabesp, this is the single area in which they are a special case, and as a result some kind of guarantee for (a) payment, and (b) for performance will be required of the public contracting party – this is particularly true of smaller municipalities.
6. **A Standard Contract** – The Sabesp contract took 18 months to develop – this should be a one-time cost for Latin America, rather than a recurring cost, and so a Standard Contract should be developed for all qualifying municipalities in Latin America.
7. **Analytic Maturity** – It is fundamental that all partners have a clear understanding of the clients and the optimal targets, and that this understanding is shared as to details and depth.⁹

⁹ Items #7 and #8 have significant costs associated with them – the one in terms of lawyers and lawyer fees, and the second in terms of a lengthy diagnostic assessment. But these are not issues that can be solved with funds – rather they must be solved with a capacity commitment *within* the contracting utility.

Appendix I: Complementary Case Study - Porto Ferreira Cost Sharing Contract with Eneterpa / SCS

In the case of Porto Ferreira, CG/LA highlights that the principal differential was an up-front diagnostic phase that was paid for by the municipality during 4 months; after which a risk formula was constructed.

The project was signed the second semester of 2002, and 60% of the work has been executed already. Initial results point to an increase in micro-metered water volumes of 30% and 29% in revenue. The city council has further stated that additional benefits to the project have been avoided costs, similar to Sabesp's case of pumping costs, chemical treatment and water pipe infrastructure maintenance.

The shared savings pay out was based on the following pre-agreed to pricing formula:

The payments are administered based on the total of meter readings for the municipality, following the verification of successful commercial water loss reductions along the life of the municipal contract. A simple "Risk-Reward" formula based 100% on calculated risks to avoid unnecessary shared-savings disputes was prepared. The formula was:

$$\mathbf{R = K \times GE \times T \times Fr}$$

Where:

- **R** = Monthly Reward
- **K** = Commercial Factor
- **GE** = Real gain by measured volume
- **T** = Average Tariff
- **Fr** = Reduction Factor

Monthly Reward (R):

The Monthly Reward "R" is determined directly from the effective gains in measured volume of all connections established during the project, limited by minimum and maximum gains and profits. Minimum gains are based on supplier penalties determined by the level of project's success whereas maximum gains are based on adequate risk margins with success and productivity indices.

The Monthly Reward is all-inclusive following the operational payments: labor charges; supply of meters, accessories, equipment, tools and other products; transportation, set-up and termination of equipment teams; local administration; direct and indirect expenses; and any other expenses incurred in the water measurement optimization process.

SCS has a defined reward formula to even correct measurement mistakes in particular months, with payment adjustments to be made in the valid readings for the subsequent month. The monthly reward is a sum of all the meters involved in the project for a specific month as expressed by the formula below:

$$R_m = \sum R_{\alpha} \leq \text{xxxxxx m}^3/\text{month}$$

Where:

- **R_m** = Monthly Reward owed in a specific month
- **R_α** = Individual Reward of each meter involved in the project
- **xxxxxx m³/month** = Maximum sum of effective gains in measured volume for reward purposes

Commercial Factor (K):

The Commercial Factor “K” is a critical coefficient that is pre-established to determine remuneration for reaching effective measurement gains of a particular meter. In order to qualify for the public bid, the “K” coefficient cannot exceed 1,0000 and must remain competitive to market rates maintaining above 70% of the lesser of the following values:

- The arithmetic average of the “K” values proposed in other competing proposals, above 50% of the maximum value allowed (where the “K” maximum is of 1,0000), or the “K” coefficient itself when only one proposal fits the criteria; or
- The maximum coefficient value established by the municipality (where the “K” maximum is of 1,0000).

Note: The “K” factor is the key determinant to the project’s approval, which according to the bidding process, proposals will be classified based on ascending order of the “K” coefficient, where the project with the lowest “K” factor will be chosen.

Real Gain by Measured Volume (GE):

The effective gain of measured water supply is calculated in cubic meters applicable to all connections that are part of the project.

The equation to calculate the effective gain (GE) is:

$$GE = MR - MO$$

Where:

- **GE** = Effective Gain
- **MR** = Quarterly-Moving Average Monthly Consumption based on Real Consumption for reference month (m).
- **MO** = Quarterly-Moving Weighted Average Monthly Consumption based on Original Database for reference month (m).

The effective gain (GE) will only be considered when the equation $GE = f(MR - MO)$ is positive, where MR is greater than MO, calculated with one significant decimal place (one tenth of a cubic meter). In order to understand how the GE formula works, it is important to understand the SPC “Reference Month” and “Consumption” criteria:

Reference Month

Monthly references help define the beginning of the measurement cycle of each meter. The validity of these reference dates begins and are evaluated as follows:

- The first month following the meter exchange date is considered the first reference month (m), and already counts as contributing to the effective measurement gains in the formula.
- The consumption and other relative values during the reference month will be processed and evaluated in the following month (m+1). Once the measurement validity is confirmed and approved, the 30-day term invoice is issued in that same month.

Consumption

To obtain greater regularity, whenever technically possible, a quarterly weighted average measurement of each connection was structured using thrice the weight for the reference month (m); twice the weight for the prior month (m – 1); and the actual weight for two months prior to the reference month (m – 2), as shown by the following formula:

$$M = [3 \times \text{Consumption (m)} + 2 \times \text{Consumption (m-1)} + \text{Consumption (m-2)}] / 6$$

The SPC has identified the following special case formulas for monthly consumption calculations in situations which:

(a) There is an absence in meter readings for a particular reference month (m):

$$\text{Consumption (m)} = [\text{meter readings (m+1)} - \text{meter readings (m-1)}] / 2 = \text{Consumption (m+1)}$$

(b) There is an absence in meter readings for the reference month (m) and the subsequent month (m+1):

$$\text{Consumption (m)} = [\text{meter readings (m+2)} - \text{meter readings (m-1)}] / 2 = \text{Consumption (m+1)} = \text{Consumption (m+2)}$$

The above formulas may be used to show a cyclical consumption behavior as well, where average monthly consumptions, MO, are calculated using the same reference month and monthly consumptions for that year. i.e. MO for “month 1” uses as a calculation base: reference months 1, 11 and 12. MO for “month 2” uses as a calculation base: reference months 1, 2 and 12.

Consumption monitoring for the first substituted hydrometer reading for the reference month (m), the average MR is the same as the consumption in the reference month (m). The second reading with reference month (m + 1), is weighted twice for the consumption of the reference month (m+1) and only once for the consumption of the previous reference (m), to obtain MR.

In the event of a serious supply problem (i.e. water shortage) that influences in the relative consumption of the reference month (m) of one or more connections, this month (m) maybe excluded from the monthly reward calculations, eliminating the meter substitution time. In this case, average **MR** calculations will be the same as the consumption of reference month (m+1) following similar cyclical consumption monitoring procedures stated above.

Within the analyzed annual period, a 12-weighted moving average will be calculated based on quarters (to obtain an average for the reference month) for each connection from the original database according to the previously stated methodology. These weighted average measurements will involve all consumers that are part of the project for that particular month, represented by **MO**.

Quarterly weighted moving averages will be calculated for each connection for which a meter as installed / substituted during the life the project. These quarterly weighted moving averages will refer to months with real consumption, represented by **MR**.

Note:

Effective gain numbers will be revised whenever one of the following situations occur:

- Connection suppressions and cuts
- Water supply through own resources
- Detection of irregular connections
- Effective alterations of activity (either higher or lower), especially in the case of large consumers
- Not consider periods in which there are serious problems in the supply (water shortages, maintenance, etc.)

In the event of connection suppressions and cuts, the municipality may maintain the active installed meters following the timely correction formula below:

$$VA = VTR \times (1 + i) - \Sigma VP$$

Where:

- **VA** = Updated Financial Value
- **VTR** = Reference Table Value = R\$XXXX
- **i** = Pro-rated variation of IGPM between the starting month of meter installation until the occurrence month of the connection suppression or cut.
- **ΣVP** = Sum of values effectively billed and effective gains of measured volume.

Note: The reference table prices were obtained through a price research of class “B” hydrometers (3m³/h x ¾ diameter), trestle parts, 2 x anti-fraud seals and manual labor for meter installations and trestle fitting.

Average Tariff (T):

The Average Tariff (T) in the project, corresponds to the range of all connections that are part of the project expressed in REAIS/m³. The calculation takes into account the volume of potable water supplied and wastewater collected according to the existing municipal tariffs

Reduction Factor (Fr):

The Reduction Factor refers to the actual municipal gains in the life of the contract.

Appendix II: Bibliography

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Curitiba Water Loss Reduction Study – US Trade & Development Agency. (Produced by Black & Veatch)

Strategic Market Review; Water and Wastewater in Latin America, 1999-2003. CG/LA Infrastructure

Itron Case Studies: City of Houston: http://www.itron.com/article_97.html

SCS Water Billing and Collection Performance Contracting Project – Confidential Business Plan

Note: Most of the research was conducted through private interviews with Sabesp, with private off-takers and with other utilities.