Energy Efficient Cities Initiative

GOOD PRACTICES IN CITY ENERGY EFFICIENCY

Campinas, Brazil –Energy Management in the Provision of Water Services

Project title	Energy management in the provision of water services
Sector	Municipal water and sanitation services
Type of project	Energy management
City and country	Campinas (Sao Paolo), Brazil
City population	1,060,000 (2008)
Total project cost	R$1.8 million[1] (~US$1.03 million)
Estimated annual energy savings	1.4 GWh/year[2]
Project status	Project began in 2000 and is ongoing

Project Summary

Between 2000 and 2008, the City of Campinas, in the Brazilian State of Sao Paolo, developed a successful energy management program, increasing tap water connections by 22 percent without additional energy requirements. These new connections, provided through its water and sanitation utility SANASA, primarily serve the urban poor living in peri-urban slums, or *favelas*. They enabled uninterrupted tap water service to reach 98 percent of the population of the city by 2008, compared to 88 percent in 2000.

In 2007, in its Capivari water treatment plant (one of SANASA's two plants), SANASA undertook an estimated R$1.8 million energy efficiency investment in variable speed drives, achieving over 30 percent reduction in electricity consumption at the plant (1.4 GWh/year) and nearly 20 percent reduction in contracted demand. The simple payback period for this investment was less than four years, consistent with typical commercial investment thresholds.

During this same period (2003-2008), the utility carried out a much broader program – involving non-revenue water (NRW) reduction, system optimization and energy efficiency retrofits – to significantly improve their overall energy use. Based on the analysis of SANASA's operations data between 2003 and 2008, the utility achieved an estimated 200,000 kWh of annual electricity savings (in addition to the Capivari plant investment) compared with the base year (2003), equivalent to about R$410,000/year electricity cost savings (about US$230,000/year). More than 25 percent of these savings were the result of a reduction in electricity intensity while the rest can be attributed to a reduction in NRW, enabling the utility to serve more people from the same amount of treated water. These figures are only an estimate because the detailed costs of other direct or indirect energy efficiency activities were either not documented by the utility or implemented as part of other programs.

1. Introduction

The Municipality of Campinas, also known as Campinas County, covers the City of Campinas and its suburbs. It is the center of a relatively prosperous and fast growing metropolitan region in the State

[1] Investment amount only reflects the energy efficiency renovation project at the Capivari water treatment plant. Refer to Box 1 in the main text.
[2] Savings figure only reflects the actual energy savings achieved by the energy efficiency investment at the Capivari plant.

of São Paulo, Brazil. The municipal population is over 98 percent urban and grew from 970,000 in 2000 to 1,060,000 in 2008. The surface area of the municipality is about 790 km^2. The City of Campinas is the richest city in the metropolitan region of Campinas and the 10th richest city in Brazil, with a gross domestic product (GDP) of 27.1 billion reais[3] (2007), about 0.96% of Brazil's total GDP. Currently, one-third of industrial production of the State of São Paulo is concentrated in the city of Campinas. With high tech industries and a metallurgical park, it is considered the capital of Silicon Valley Sterling.

SANASA (*Sociedade de Abastecimento de Água e Saneamento S.A.),* established in 1974 and owned by the municipal government, provides water and sewage collection and treatment services in the Municipality of Campinas. Raw water is provided from two surface water sources. About 95 percent of the treated water is produced at the *Atibaia* plant and the remaining 5 percent at the *Capivari* plant. The topography of the service area is gently undulating. In 2000, the utility served some 205,000 customers with about an 88 percent access rate for treated water. While they had undertaken some measures to reduce NRW, the utility still reported 26.5 percent NRW in 2000. Electricity costs as a percent of the total operation and maintenance (O&M) costs were relatively low, at about 6.4 percent, but were rising. The prevailing water tariff was about R\$1.19/m^3 in 2000 and had been rising steadily.

SANASA was concerned with the rising costs of electricity, which was a key motivation for undertaking the activities associated with energy optimization. Electricity prices increased significantly until 2006 due, in part, to an acute nationwide power crisis. The utility saw the importance of energy efficiency since it could have a potentially large impact on its financial performance and service quality vis-à-vis tariff levels and was concerned about its public image. Also, as water nominal tariffs continued to rise, there was increasing pressure on the utility to reduce operation costs (either through NRW reductions or energy efficiency) in order to help limit the tariff increases.

2. Project Description and Design

This case study examines major activities which (directly or indirectly) contributed to the energy efficiency improvements at SANASA between 2000 and 2008. As it does not represent a specific project or investment program, the case study provides a broader perspective on how a water and sanitation utility can be organized and can mobilize resources to address a range of issues affecting its operational efficiency, and energy efficiency in particular.

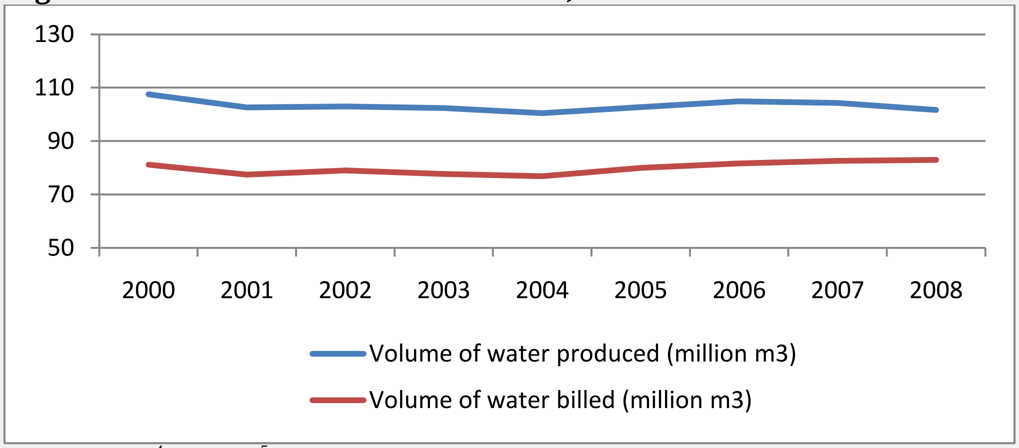
<u>Water production and access</u>. Over the eight year period, SANASA increased the number of treated water connections from 205,000 to 252,000 (2008), much faster than the population growth during the same period (22 versus 9 percent, respectively). The major reason behind this trend was the increased connections to the urban poor in the slum areas, or *favelas*. By 2008, the utility served 98 percent of the municipal population with treated water and 88 percent with sewage collection, with all connections metered. Between 2000 and 2008, the length of the water supply network grew by almost 16 percent while total water production was moderately reduced (Figure 1).

The expansion of the collection and treatment of wastewater has lagged far behind the supply of treated water since SANASA only started to treat wastewater in 2001/2002 (although wastewater collection started earlier). In 2008, only 60 percent of the billed water consumption was collected. At that time, only about 60 percent of the collected wastewater was actually treated but the

[3] In 2008, one Brazilian reais (R\$1) was equivalent to about US\$0.57 (annual average).

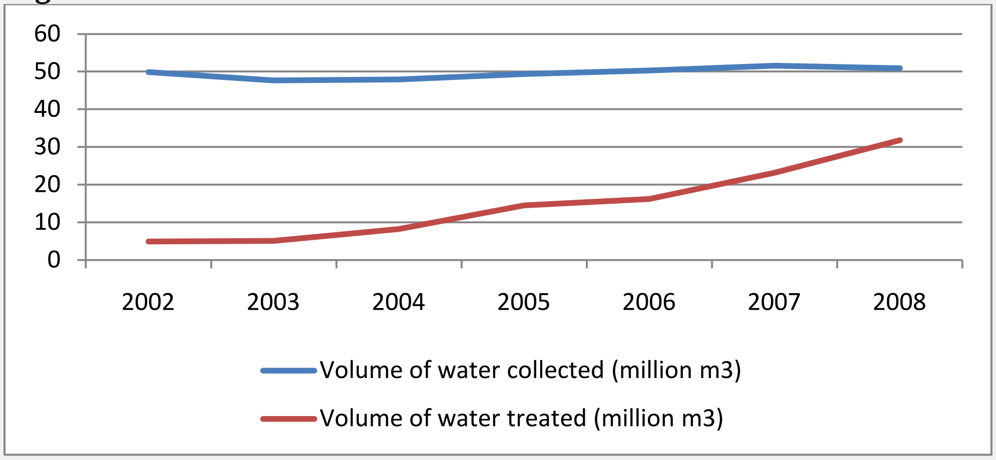
percentage was quickly increasing (Figure 2). Wastewater treatment grew approximately six-fold from 2000 to 2008 and became the main area for new investment.

Figure 1: Water Production of SANASA, 2000-2008



Source: IBNET[4] and SNIS[5]

Figure 2: Water and Wastewater Volumes 2002 - 2008



Source: IBNET and SNIS

Non-revenue water. Compared with similar sized water utilities in the State of Sao Paulo, SANASA stands out with a significantly lower NRW but much higher energy intensity for water production and wastewater collection and treatment (Table 1).

Cost Recovery. In 2008, SANASA reported revenues of US$170.1 million and net income of US$22.2 million. SANASA's revenue covers at least its O&M costs. The utility's operating cost coverage ratio (OCCR)[6] averaged about 1.2 from 2000 to 2008 (Figure 3), indicating that there were

[4] International Benchmarking Network for Water and Sanitation Utilities (IBNET), World Bank.
[5] Sistema Nacional de Informações sobre Saneamento (SNIS) – National Information System on Water, Sanitation and Solid Waste.
[6] OCCR measures how far operating revenues cover O&M costs. The rule of thumb is that if the OCCP is below 1, the utility would not be able to cover its O&M costs with its revenues. If the OCCR is between 1 and 2, the revenue would be able to cover O&M, partial to full depreciation, and even capital costs as the margin increases. In reality much depends on the actual capital costs and the types of depreciation for instance.

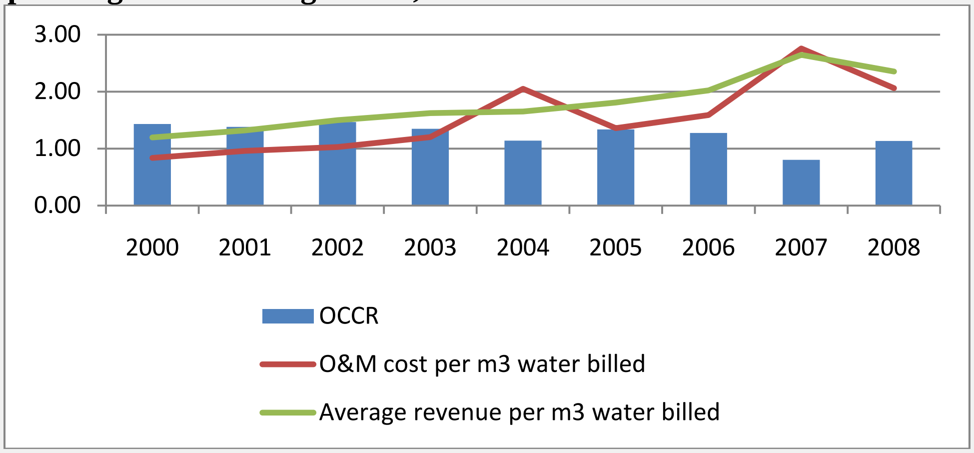
Table 1: SANASA Profile in Numbers, 2008

Indicators (as of 2008)	Unit	SANASA	*Others**
Households with direct water connection	%	98%	99%
Households with sewer connection	%	88%	96%
Total annual water production per capita	Liters/capita/day	270.37	287.27
Total annual water consumption per capita	Liters/capita/day	220.74	185.60
Percentage of total connections metered	%	63%	73%
Non-Revenue Water (NRW)	%	21%	39%
Total annual wastewater collected	million m3/year	50.85	37.77
Wastewater receiving primary treatment	%	63%	70%
Average water tariff	R$/m3	1.95	1.48
Average wastewater tariff	R$/m3	2.97	1.52
Operating cost coverage ratio		1.13	1.16
Electricity use per m^3 water (production volume)	kWh/m3	0.59	0.36
Electricity use per m^3 wastewater (collection volume)	kWh/m3	0.29	NA
Share of electricity costs in total O&M costs	%	6%	7%

Source: IBNET
** Median values calculated across utilities of similar size operating in the State of Sao Paulo*

funds from revenues to cover part of the capital depreciation (replacement investment), but the funds were unlikely to be sufficient to pay for expansion investments. Water tariffs rose steadily, from R$1.19 in 2000 to R$2.35 in 2008. In real terms, however, the increases between 2000 and 2008 were only about 0.3 percent annually.

Figure 3: Average Water and Wastewater Tariffs, O&M costs (in R$/m^3) and Operating Cost Coverage Ratio, 2000-2008



Source: IBNET and SNIS

<u>Energy use</u>. SANASA purchases all of its electricity from the local electric utility, CPFL (*Companhia Paulista de Força e Luz*). It has more than 200 points of consumption which are billed separately. Of all electricity consumption, about 80 percent is for water supply, 17 percent for wastewater, and 3 percent for administrative facilities. About 80 percent of the consumption is from low-voltage connections and 20 percent from medium voltage connections (2.3-25 kV). On average, the cost of low-voltage electricity is much higher than the cost of medium voltage electricity, which carries peak and off-peak prices. The vast difference between peak and off-peak prices, more than 7

to 1 in 2008 for SANASA, provided a major incentive for shifting pumping to off-peak hours, and was facilitated by investments in elevated water storage facilities.

Electricity has been a moderately significant share of annual operating costs of SANASA, falling between 5 and 9 percent (Table 2), compared to the medium value of about 25 percent for all water and sanitation utilities in Brazil in 2008. Energy consumption for wastewater collection and treatment is still less than 30 percent of the supply of treated water, due to the relatively small coverage and the lower energy intensity of wastewater collection and treatment.

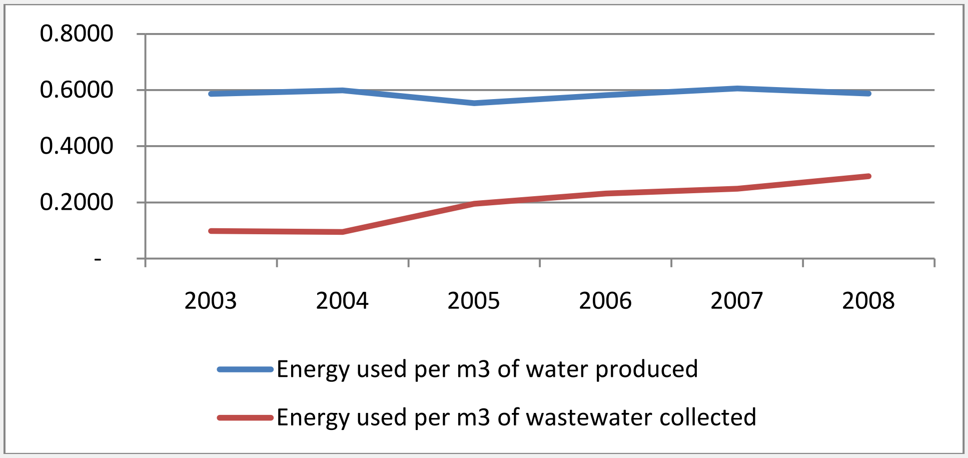
Table 2: Energy Use and Costs of SANASA, 2000-2008

Year	Share of electricity cost in total O&M Costs	Total electricity costs in R$	Total annual electricity consumption for water supply (MWh)	Total annual electricity consumption for sanitation (MWh)	Average electricity cost R$/kWh
2000	6.4%	6,952,536	NA	NA	NA
2001	6.3%	7,519,222	NA	NA	NA
2002	7.4%	9,578,490	NA	NA	NA
2003	7.5%	11,274,995	60,016	4,690	0.174
2004	5.3%	13,139,028	60,144	4,560	0.203
2005	9.2%	15,990,005	56,852	9,681	0.240
2006	8.7%	18,194,638	60,975	11,637	0.251
2007	5.3%	19,428,760	63,209	12,828	0.256
2008	6.2%	17,144,124	59,890	14,935	0.229

Source: IBNET and SNIS

Energy intensity in water production has remained relatively constant over time despite the steady decline of energy intensity measured in water actually billed. The increase in energy intensity in sanitation (collection and treatment) reflects the continued increase in the share of treated wastewater (Figure 4).

Figure 4: Energy Intensity of Water Supply and Wastewater Collection and Treatment in kWh/m^3 Produced or Collected



Source: IBNET and SNIS

Core energy efficiency improvement efforts. SANASA did not have a specific corporate energy management program that could systematically seek out and address energy efficiency issues. Likewise, it did not set a deliberate target to suppress energy consumption of water supply. Rather, energy management, including specific energy efficiency improvements, was approached as a part of operational management to improve the overall operational efficiency and to enhance financial performance. SANASA pursued a number of activities which improved energy efficiency improvement and promoted energy cost reduction of the utilities. These activities included: (i) reduction of NRW, through leakage control and management as well as other measures; (ii) optimization of network operation, such as changing the tariff schedule by switching to night shifts and using reservoirs; and (iii) specific energy efficiency improvement measures, such as replacing energy inefficient equipment. Each of these is elaborated below.

NRW reduction. SANASA had a long standing program to control NRW and was able to reduce NRW further during this period. In 1994, SANASA received a loan from the World Bank which included resources for NRW reduction, then 38 percent compared to the national average of 40 percent. These early efforts reduced NRW to 26.5 percent in 2000. After a six-year period of little change, measures to reduce water losses were intensified, resulting in a decrease of from 25.8 percent in 2006 to 20.8 percent in 2008.

Large energy savings have been an important co-benefit of this NRW program. For example, a network pressure control project completed in 2003 for Leste and Barreiro supply sectors reduced the pumping electricity use of the sites by 30 percent. The project implemented automation and the use of variable frequency drives in pumps in order to reduce pressure to the minimum required by the system. The results included a reduction of water losses, a reduction of energy use by 360 MWh/year (from 0.176 to 0.121 kWh/m^3), and a reduction in power demand from 270 kW to 220 kW.

Network optimization. Automated operational data collection was initiated in 2000. The full software for online automation and control, however, was not implemented until 2006. The supervisory control and data acquisition (SCADA) system now in operation informs water data (flow, pressure, etc.). These data are recorded continuously. Monitoring and reporting of energy data remain unsophisticated and is only available from two sources: (i) electric utility meters on a monthly basis according to the invoice received, and (ii) portable meters, which are used in specific situations without a regular schedule.

The electricity rationing imposed in 2001 to cope with the severe national power shortages triggered the initial efforts by SANASA to improve water supply energy efficiency. Such early efforts included both conservation actions and operational optimization. For example, the utility completed the Jambeiro storage tank and distribution centers in March and April of 2002, which enabled the use of the system pressure to direct supply of the elevated storage tanks. The total energy savings of the two sub-projects were 334 MWh/year.

Other optimization efforts included: (i) investments in capacitors to increase the power factor (i.e., reduce reactive energy) in 18 facilities during 2007[7]; (ii) operational changes using automation and control to shift pumping off-peak with subsequent renegotiation of contracts with the electric power utility, two in 2007 and at least two in 2008; and (iii) renegotiation of contracts

[7] This was to avoid fines which were being incurred for a power factor below 0.92

with the power utility to shift from the "Blue" tariff schedule to the "Green" tariff schedule in 17 facilities in 2007, one in 2008.[8]

Energy efficiency measures. Distinct programs to improve energy efficiency were also initiated, gradually building upon the monitoring and control systems used for water loss management operations. Since 2007, the main energy efficiency measures have been:

- A significant investment in energy efficiency was made at the Capivari water catchment and treatment plant (Box 1). The investment of R$1.8 million was made with resources provided by the local power utility CPFL under the EEP program mandated by ANEEL - the power sector regulator.[9]
- The Maintenance Department planned to invest R$600,000 in 2010 to replace standard motors with high efficiency motors and R$90,000 for electricity meters for energy management. The investment in meters represents an important deepening of energy monitoring capability.

Box 1. The Capivari Water Treatment Plant Energy Efficiency Project

In October 2007, SANASA commissioned an investment of R$1.8 million in the Capivari Water Treatment Plant. This involved the installation of variable frequency drives in three 100 HP pumps for raw water and three 400 HP pumps for treated water which reduced energy consumption by 33% and contracted demand by 19%, as shown in the table below. This translated into a cost reduction of R$27,570 per month. In June 2008, the electricity contract of the plant was renegotiated. The contracted demand was reduced from 825 kW to 670 kW and there was a shift from the Blue to Green tariff. This renegotiation led to a further R$19,200 per month of energy savings. According to SANASA, the savings achieved by this project amount to 1.4 GWh/year, whereas the financial gains were at least R$560,000, indicating a simple payback period of less than 4 years.

Energy (kWh) Savings of Capivari Water Treatment Plant Project

		Monthly average in each period				
		Total R$	kWh-Peak	kWh-Off Peak	kWh Total	% kWh on Peak
Before project	Oct 2006-Set 2007	107,555	44,844	308,855	353,699	12.7%
Before new contract	Oct 2007-May 2008	79,985	23,069	214,613	237,682	9.7%
After new contract	Jun 2008-May 2009	60,784	21,162	215,751	236,913	8.9%

Source: SANASA

Rationale for efficiency improvements. The increasing cost of electricity has been the key motivation for undertaking the activities associated energy optimization. Electricity prices increased significantly until 2006. Since then, nominal electricity prices have only increased by about 2 percent. The utility values activities, which have a large impact on its financial performances and

[8] There are two variants of the medium voltage tariff: the Blue tariff and the Green tariff. In both of these tariff schedules peak power is far more expensive than off-peak power. The **Blue tariff** has two capacity prices - peak and off-peak and four energy prices distinguished by season (dry and humid). It is the dominant choice for flat users, load profile typical of processes industries. On the other hand, the **Green tariff** has a single capacity charge and the same energy price structure of the Blue tariff. The Green tariff is designed as an alternative to users with an intermediate load or variable load at peak hours. If a consumer can get its load factor low enough it has an incentive to shift to the Green tariff which, unlike the Blue tariff, does not apply specific demand charge for the peak usage.

[9] The mandatory energy efficiency program (EEP) for power distribution utilities overseen by the power sector regulator ANEEL. Under the EEP electric distribution utilities must spend 0.5% of their gross revenue on energy efficiency projects with consumers. A few have been performed with water utilities, including this one at SANASA.

service quality vis-à-vis tariff levels, and is concerned about its public image (Table 3). As water nominal tariffs have doubled since 2000, there is more pressure on the utility to reduce operation costs (either through NRW reductions or energy efficiency) to keep the tariff increases limited.

Table 3: Key Drivers for Implementing Energy Management and Associated Measures

Possible drivers ranked on a scale from 1 to 5 (5 most important)

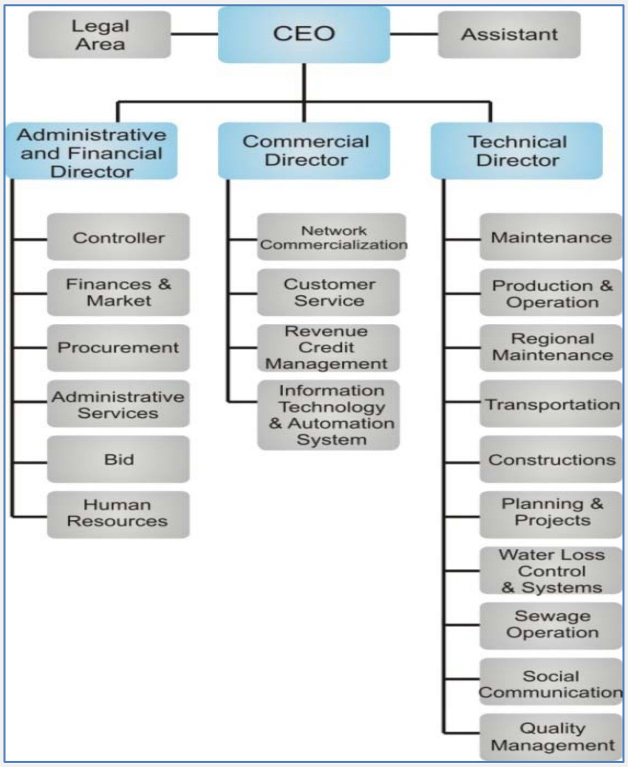
Possible Driver	Importance Then (2003)	Importance now
1. High cost of energy as a share of operational costs	2	4
2. Increasing energy costs (electricity tariff increasing faster than inflation)	4	3
3. Reducing technical water losses lowers energy use	1	5
4. Reduced operational impact allows lower water tariff and lower non-payment	2	2
5. Reduced operational costs allow increase of investment to expand services	1	5
6. Reduced operational costs improve the utility's financial performance	1	5
7. Environmental concern, as it projects a positive image of the utility to its clients	1	5

The sector regulatory environment ensures that the utility can retain the benefits from any reduction in operational costs. This provides the utility with an incentive to undertake energy and other operation efficiency programs since the gains will yield increased resources for replacement or expansion investment and improved financial performance.

Energy management organization. SANASA does not have a formally constituted energy efficiency team. Energy issues are addressed on a day-to-day basis by different departments of the company, such as management of water losses, management of information and automation, and management of maintenance (see Figure 5). These departments, however, collaborate on a task force, particularly during the implementation of specific projects. Monitoring of monthly energy use is centered in the maintenance department. The purchase of new and more energy efficient equipment to replace older equipment is usually placed in the budget of the maintenance department. There is a department that focuses specifically on reducing NRW.

Top management receives a monthly operational report. Although the data are generally about water losses, these reports can influence decisions and modify existing plans. For example, in one water loss project, the branch lines were substituted, following analysis and report on this topic.

Figure 5. SANASA Organization Diagram



Source: SANASA

Most work related to NRW and energy efficiency is done in-house, though some is outsourced. Since SANASA is a public company, it is subject to public procurement rules (Law 8666). This makes obtaining the best value for goods and services difficult. Life cycle costing is still not feasible in public bids. The government accounting monitors regard almost any minimum technical standard as an unwarranted restraint on competition.

3. Cost, Financing, Benefits, and Effects

Information regarding the share of investment from SANASA's internal cash flow and other external sources was not available. Therefore, this case study relied on the figures for the Capivari project as a proxy to analyze the cost-effectiveness of energy efficiency investments in SANASA.

Because the utility is only able to cover its operating costs and part of its depreciation costs, it has limited funds to initiate all the necessary upgrades. As a result, it has invested far more of its funds in water loss reduction than in energy efficiency. The utility has limited capacity to borrow and, in general, its primary source of credit is *Caixa Econômica Federal*, a government-owned financial institution. Both energy efficiency and water loss reduction projects were financed by a combination of internal cash flow and external resources (loans and grants):

- The Capivari project was financed by *CPFL* (the local electric utility) under the mandatory public benefit wire charge overseen by the power regulator, ANEEL (*Agência Nacional de Energia Elétrica*);
- Water meters were financed by *Banco Nacional de Desenvolvimento Economico e Social* (BNDES, a government-owned development bank) and using its own funds;
- Some pipeline replacement was financed by the Inter-America Development Bank (IADB); and
- Other measures have been financed by *Caixa Econômica Federal* and BNDES, though a NRW loss program was funded from an earlier World Bank loan[10].

Cost-effectiveness. By far the largest energy cost savings resulted from reducing water losses and renegotiating contracts – especially shifting from the Blue to the Green tariff. In the case of the Capivari project, the tariff shift represented 40 percent of the overall benefit. In the view of SANASA, the potential for further cost savings from shifting contracts to the Green schedule has now been exhausted.

There were insufficient data and information to allow a robust analysis of the costs and benefits of all activities in NRW reduction and energy efficiency improvement during the 2000-2008 period. Judging by the type of projects undertaken by SANASA based on broader international experiences of similar activities, the benefits are likely to be significantly larger than the costs. By SANASA's own account, the energy efficiency and NRW projects undertaken to date were reported to have had simple payback periods of four years or less since they are subject to commercial investment thresholds.

Impacts on energy consumption. One approach to the evaluation of the impact of NRW and energy efficiency activities on energy consumption (i.e. avoided energy consumption derived from a baseline which did not materialize because of the implementation of the activities) is to analyze their impact on the energy intensity coefficients of the utility for water supply and wastewater treatment. A first rapid analysis is to determine what happened since 2003, the first year that energy consumption data are available, making a before and after analysis assuming that the trends of 2003 would have continued.

[10] SANASA also manages three Brazilian Government's Growth Acceleration Plan (called PAC) projects, but these are for expansion of the system – especially to expand wastewater treatment.

Because of decreases in NRW, less water production is necessary. Remarkably, SANASA, which is still expanding its water supply and wastewater services, saw a decline in NRW allowing it to expand water supply without increasing water production or energy consumption. Another effect is the decline in actual energy intensity as measured by energy consumption per cubic meter of water produced or wastewater treated. Energy intensity declined by 3 percent over the period between 2003 and 2008.

Obviously, this consumption effect can be translated into energy consumption saved. As illustrated in Table 4, the overall energy savings have been substantial, with annual savings of about 1.6 GWh. Assuming the current nominal energy tariffs, these savings translate to average annual savings of about R$410,000 – reducing the energy cost share from 7.5 percent of O&M costs in 2003 to 6.4 percent in 2008. For SANASA, the actual benefit could be even larger assuming that the water saved through the NRW loss reduction can actually be sold to consumers. In this case, the benefits from NRW reduction can be compared to the average tariff that SANASA can charge to its customers. For this analysis, however, only the energy cost savings were accounted.

Table 4: Energy Savings, 2003-2008

Year	Energy Savings (MWh)			Energy Cost Savings (R$)		
	Decline in NRW	Decline in Energy Intensity	Total	Decline in NRW	Decline in Energy Intensity	Total
2003	0	0	0	0	0	0
2004	-2,951	460	-2,491	-599,227	93,414	-505,814
2005	-950	2,462	1,512	-228,280	591,637	363,357
2006	3,003	-1,222	1,781	752,382	-306,108	446,274
2007	4,235	-1,492	2,743	1,082,107	-381,195	700,912
2008	2,593	1,956	4,549	594,040	448,192	1,042,232
Total Savings	5,929	2,164	8,094	1,601,021	445,939	2,046,961
Annual Savings	1,186	433	1,619	320,204	89,188	409,392

Source: World Bank staff estimates based on data from IBNET and SNIS

4. Project Innovation

What SANASA had achieved between 2000 and 2008 was noteworthy: increasing the connection of tap water service by 22 percent and raising the served population ratio from 88 to 98 percent (most of the new connections being low-income households), while actually reducing water production by 6 percent. As a result, energy consumption for water production and distribution has remained flat during this period, indicating significantly improved efficiency measured by the level of water service provided.

This achievement, while largely attributable to the continuous NRW control efforts, was made possible by a well-run utility management which was committed to improving and maintaining operational efficiency in order to achieve the dual objectives of being financially sound and providing affordable water and wastewater services. Such a combination of good corporate governance, underlying commercial operation principles, and due social obligations is the driving force for sustained improvement of operational efficiency, of which energy efficiency is an integral part.

5. Lessons Learned

The most important lesson learned from SANASA's experience is that sustained energy efficiency efforts have to be underpinned by a constant desire to improve and maintain business performance, which is primarily driven by the commercial interest of the utility and influenced by their social obligations. Such drivers combined with good corporate governance have been instrumental in SANASA's success. In addition, the following specific takeaways were noted:

1. NRW and energy efficiency of water service delivery is so intimately related that NRW reduction is likely the most important and cost-effective energy efficiency strategy of any water utility with significant NRW problems (for example, with a NRW ratio higher than 30%). Recognizing this linkage and better integrating the synergistic aspects of both could help water and sanitation utilities better package and sequence their operational efficiency improvements.
2. It is important that the utility management supports such a comprehensive approach to improving operational efficiency, as well as develops an organizational structure that ensures relevant data and information are collected, analyzed and passed through the management hierarchy and actions taken when decisions are made.
3. Energy price increases can provide an important incentive for water utilities to embark on an energy (cost) management program, as was the case for SANASA. In environments with low electricity costs, energy efficiency programs will be less likely to take off and be sustained. Yet, when energy price increases become more manageable this incentive shows its limits, especially for inducing energy efficiency investments which have a relatively long payback period (for example, longer than 5 years) but still financially attractive if longer term finance can be obtained.
4. Wastewater collection and treatment are increasingly important and becoming a larger part of the business. This changes the energy structure of a utility and increases the overall energy consumption and cost of the utility, raising the importance of improving energy management.
5. With political pressure about the levels of water and wastewater tariffs, utilities need to reduce the operational costs in order to minimize tariff adjustments, and hence efficiency improvements become an important, if not critical, option.
6. The establishment of an automatic operational monitoring and data collection system is critical to improving operational management. The SCADA system, which was acquired by SANASA in 2006, has become more prevalent in water and sanitation utilities around the world. The development of a regular energy data collection and reporting system is a precondition for any corporate energy management program. SANASA's energy management effort started by analyzing the electricity bills of its 200 plus connection points. To strengthen its energy monitoring capacity, SANASA also invested in its own electricity meters (in addition to the ones installed by the power utility).
7. It is likely that availability of external financing will encourage more utility investments in improving energy efficiency, since in general water and sanitation utilities are operating under relatively tight budget constraints. More innovative financing options, such as off-balance sheet mechanisms, may be even more attractive to such utilities.

As a publicly owned, financially independent, and commercially operated water and sanitation utility, SANASA has strived to expand and improve water and sanitation services while controlling operation costs. Attention to energy cost control and selective investments in energy efficiency improvements have been an important part of that corporate effort and have made significant contributions to enhancing services and improving financial performance.

Going forward and building on its past success, SANASA could benefit from a more systematic approach to energy management, with improved energy performance monitoring and evaluation and more explicit energy accountabilities assigned to operational and maintenance teams. This will help the utility continuously identify and assess energy efficiency opportunities and levels of improvements.

6. Financial Sustainability, Transferability, and Scalability

The activities which helped SANASA deliver water services with increased energy efficiency were commercially driven. They are primarily for enhancing and maintaining the utility's financial performance in response to the changing operating environment of the utility, be it rising electricity prices or limiting room for increasing water tariff. SANASA is in the process of entering into a concession contract with the City of Campinas. This is likely to further strengthen the commercial orientation of the utility's operation, in principle a good thing for energy efficiency, provided that there are clear incentives for improving operation efficiency built into the concession contract.

SANASA's experience is generally transferable to other Brazil water and sanitation utilities because they operate in the same regulatory environment. But the quality of corporate governance may differ significantly and will have a major impact on the outcome. In two other Brazilian utilities studied by the World Bank's Energy Sector Management Assistance Program (ESMAP), SANEATINS of the State of Tocantins and Águas do Imperador of the City of Petrópolis in the State of Rio de Janeiro, similar results have been achieved. For example, between 2003 and 2008, SANEATINS increased its water production by 18 percent, tap water connections by 30 percent, while electricity use of water supply only increased by 12 percent.

References

This case study was primarily based on information gathered during a visit to SANASA in April 2010. Most time series data were obtained from the database of IBNET and SNIS.

ANNEX: CITY AND PROJECT PROFILE

CITY PROFILE

1. Name of the City	**Campinas**
2. Area	**790 km^2**
3. Population	**1,060,000 (2008)**
4. Population Growth Rate	**1.1% per year from 2000 to 2008**
5. GDP of the City	**R$27.1 billion (2007)**
6. GDP Growth Rate	**NA**
7. GDP per Capita	**R$25,600 (2007)**

PROJECT PROFILE

1. Project Title	**Energy management in the provision of water services**
2. Sector	**Municipal water and sanitation**
3. Project Type	**Energy management**
4. Total Project Capital Cost	**R$2.1 million (~US$1.2 million)**
5. Energy/Cost Savings	**1.6 GWh/year/R$410,000**
6. Internal Rate of Return	**18%**
7. Project Start Date	**2003**
8. Project End Date	**2008**
9. % of Project Completed	**On-going process**

Project contacts:

Lina Adani Cabral, Manager of the Water Loss Reduction Initiatives
Hermes R. Oliveira, Maintenance Manager for Energy Efficiency Initiatives
SANASA – Campinas
Avenida da Saudade, 500 Ponte Preta
Campinas – SP – Brazil
Tel: +55-19-3735-5000
http://www.sanasa.com.br/