4.1/ Stuttgart

4.1.1/ Stuttgart's Internal Contracting scheme at a glance

KEY FIGURES
City surface: 207 km²
Inhabitants: 607,000
Municipal building stock:
1,315 facilities
(each is one building or more)
Total surface area: 2,337,000 m²

Energy Consumption (2013):
Heat: 331,887 MWh
Electricity: 200,406 MWh
Water: 1,644,076 m³
total energy and water cost:
€ 66.9 m in 2013
(€36.5 m in 1995)

REVOLVING FUND
Size of revolving fund (2013):
€ 11.8m (€2.3m in 1995)
Ratio Seed Fund
to annual energy cost: 6%
Number of measures implemented:
more than 340 agreements
Investment covered:
€ few thousand - € 1.2m

Special features of the Internal Contracting in Stuttgart

Stuttgart's Internal Contracting links different independent parts of the city authority to enable quick and flexible investment decisions. Its operational scope is energy improvements within the municipal building stock. The scheme is exclusively operated as an internal process wherein the underlying revolving fund functions as an intermediate buffer for cash flows. The fund is embedded within Stuttgart's regular accounting system as a part of the city's general budget. Every financing aspect (investment, (saved) energy costs, payback) remains under the municipality's control.
Stuttgart' Internal Contracting contains no "automatic mechanism" to increase the fund. The city council increased the fund size steadily from €2.3 m in 1995 up to €11.8 m in 2013. The savings of all implemented measures totalled €1.8 m of energy costs saved in 2013 and €18 m€ in total over the 19 years of operating the Internal Contracting scheme. In this time investments of €15 m were made possible.

4.1.2/ Organisational structure

The idea for Stuttgart's revolving fund arose from the request to have an internal, quick responding financial source for small but urgently needed energy saving investments. This is because the standard procedure to cover financial demands needs to be prepared well in advance. Investments have to be applied for under the 'normal' budget, which is negotiated every two years. Measures which have not been selected for the budget cannot be completed and have to be applied for in the next budget period.

Stuttgart's municipal internal performance contracting scheme, also called "Intracting" is based on the principles of "contracting" but is entirely financed by the municipal budget. Internal stakeholders are the departments for energy, facility management and construction. The **energy department** has overseen energy management since 1977. It is in charge of monitoring the energy use of municipal property, making energy efficiency improvements and promoting the use of renewable energy. Thus, it has a comprehensive overview of energy use in all municipal buildings. In 1995 the city council entrusted the management of Internal Contracting to the energy department, which offers energy services as an internal ESCO. 16 officers, mainly engineers and technicians, work part time for Internal Contracting (one full-time job equivalent). The **facility management department** is responsible for running and maintaining the municipal buildings. It is the client within the Internal Contracting scheme. The **municipal construction department** plans and executes refurbishments or new constructions, when ordered to do so by the facility management department.
The revolving fund is embedded in Stuttgart's regular accounting system as a part of the city's general budget. At the end of the budget period, remaining funds are deemed necessary for the next period and are transferred to the following budget period. Therefore, the fund account is considered to be permanent. Should the city council ever decide to terminate the fund, its budget would return to the city treasury.

Today Internal Contracting is mainly used to steer investment decisions for already scheduled measures towards energy efficiency beyond the current standard. The extra costs are financed through the fund, provided economic efficiency can be verified. Investments, savings and the status of the fund are reported to the city council for each budget period. The operational management costs (including labour costs) of the fund are paid out of the energy department's annual budget.

4.1.3/ Operating the scheme

The scheme is exclusively operated as an internal process. All the capital remains in the city budget's bank account until the invoices of the external service providers (builders, equipment suppliers) or others are paid. The procedure is as follows:

The energy department monitors the energy consumption of the buildings used by the city authority. Data analysis, on-site energy audits and projected constructional measures like general retrofits, extensions or new constructions can trigger an investigation if an energy saving measure can be applied and if Internal Contracting is the financing choice. As soon as an energy saving potential is identified, the energy department prepares an investment plan.

The Internal Contracting scheme provides full, partial and supplementary funding (see also section 3.2.5). Several measures can be bundled in one package, thereby allowing them to be processed as one single measure. The economic calculations draw on cost calculations for the proposed measure made by the construction department. The share of investment which is financed by the revolving fund is based on the technical lifetime of the energy saving measure(s) and its yearly energy cost savings. The calculations exclude energy price increase rates. Thus, energy prices are assumed to be constant. Payback within the technical lifetime of the measure is mandatory. If an energy efficiency measure proves cost-efficient and the facility management department agrees to the investment plan, an agreement is signed to formalise the financing process using Internal Contracting. The agreement typically includes the following clauses:

- Description of the energy efficiency measures to be implemented;
- Evaluation of expected energy and financial savings and of CO_2 emission reductions;
- Investment costs;
- Description of the financing terms and scope of the measures;
- Determination of repayment terms (annual rate and duration);
- Specific clauses;
- Cost-efficiency analysis;
- Description of criteria;
- Payback rate calculations; and
- Obligation of the "client" department to inform the energy department in the event of any modifications.

Once an Internal Contracting agreement has been concluded, the energy department informs the finance department that the revolving fund will be used to support the investment agreed by the facility department. Then, the facility department commissions the

construction department to realise the measure. The construction department contracts with building firms to do the job, oversees their work, collects the invoices and calls the finance department to pay them. This results in an 'internal' debt to the construction department. At the end of the year it will be settled by the facility department since it was the entity that commissioned the construction department. The specific amount of the investment to be settled using the revolving fund is verified by the energy department through the invoices collected by the construction department. Once the facility department announces the completion of the measure, the energy department issues annual invoices to the facility department internally until the investment is paid back to the revolving fund. The amount of the annual payments is determined solely according to the calculated energy cost savings specified in the agreement.

Figure 13 is a simplified visual of the whole Internal Contracting process within the municipal authority of Stuttgart

Since no actual money is transferred from one municipal department to another, the Internal Contracting agreements can be considered as a trade-off of obligations between the departments. The payback time varies depending on the characteristics of each energy measure, its cost and expected resulting energy savings. Initially, projects were only eligible if the payback time did not exceed 75% of the technical lifetime of the measure. This eligibility criterion was abandoned in 2006, thus enabling a greater number of projects to be adopted. Today, payback times vary between 3 and 25 years.

However, if actual savings on energy costs are lower than expected,

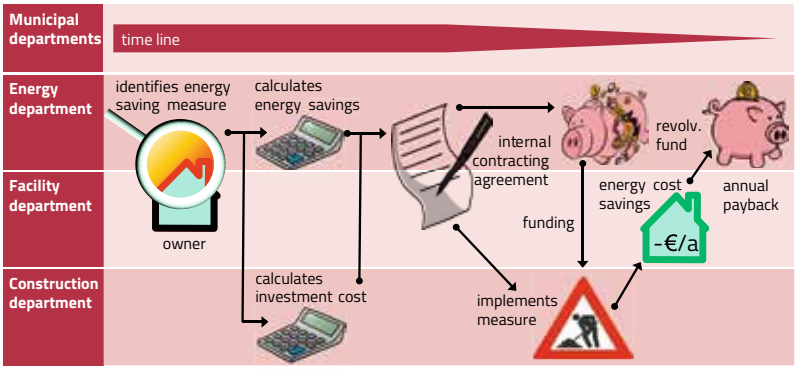

Figure 13: Stuttgart's Internal Contracting process

the payback period is recalculated on the basis of actual data and an amendment to the agreement is prepared by the energy department.

Stuttgart's Internal Contracting scheme may appear to be very bureaucratic, since the Internal Contracting fund functions simply as an intermediate buffer for cash flows. But it has to be considered that the scheme is implemented within an organisation of around 13,000 employees. The Internal Contracting links different independent parts of the authority, thereby enabling quick and flexible investment decisions, which would not be possible without this scheme. Another advantage of Stuttgart's Internal Contracting is that each financing aspect (investment, (saved) energy costs, payback) remains under the municipality's control. Therefore, problems can be solved internally.

4.1.4/ Evolution of the fund

The revolving fund is dedicated to financing energy saving measures quickly and independently of budget periods. In 1995 the city council of Stuttgart allocated 2.3 million Euros as a seed fund to enable Internal Contracting within the city organisation. The Internal Contracting scheme implemented contains no specific rule to increase the fund. Only energy cost savings qualified as interest-free paybacks flow back into the fund to keep its sum total in balance. Nevertheless, since the city council has recognised the positive results of Internal Contracting, the fund size has been increased almost yearly but not uniformly. In 2013 the fund held 11.8 million Euros, which is about 0.5 % of the annual municipal overall budget, or the equivalent to 19% of both the yearly energy and building maintenance costs of the municipality. The savings of all implemented measures totalled 1.8 million Euros of saved energy costs in 2013 (active measures) and 18 million Euros in total (including total savings of expired measures) over the 19 years of operating the Internal Contracting scheme. In this time investments of 15 million Euros were made possible. Figure 14 shows the key financial figures of Internal Contracting in Stuttgart prior to 2013.

Figure 14 shows that the yearly investment in energy savings (red columns) fluctuates. Since the budget for the revolving fund (violet solid line) was increased, significantly higher annual investments have become financeable. Total investments (solid red line) and savings (solid light

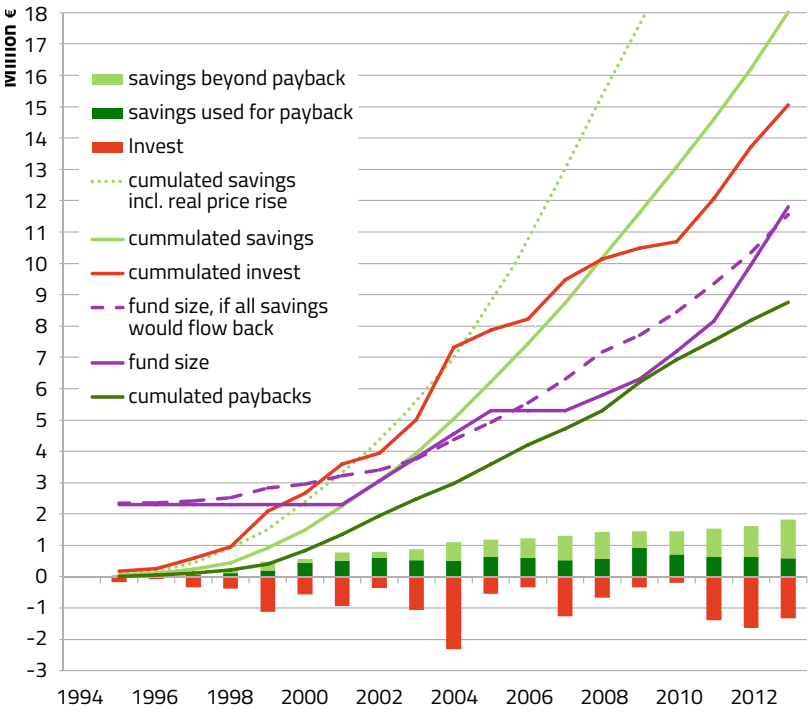

Figure 14: Development of Internal Contracting key figures in Stuttgart

green line) have developed clearly above the budget line. This has been possible through the reinvestment of paybacks. Thus the fund is seen to be "revolving". However, to want to know how many "revolutions" the fund has already achieved, i.e. how many times the value of the fund has been invested and paid back, is pointless in the case of Stuttgart, since the total paybacks (solid dark green line) only "touched" the budget line at a value of 6.3 million Euros in 2009 once, but never exceeded it, due to budget increases (see also section 3.2.2, and compare with Figure 7). In short, due to the success of Internal Contracting the size of the fund has increased fivefold over its 19 years in operation. The solid financial situation of the municipality of Stuttgart could have supported this development, but it can be shown that the budget of the revolving fund would have been able to follow the same development solely if all savings had been paid into the fund (dashed violet line). Since 2009 the total savings have been higher than the investments. It can be stated that every investment – before and afterwards – is already financed by past savings.
Also savings are even higher in retrospect, if past energy price rises are included in the calculation (light green dotted line). This is an additional benefit for the general municipal budget.

The internal performance contracting scheme introduced in 1995 made combined savings of:

	2013 contribution	Total amount 1995-2013
District heating	5,608 MWh	87,000 MWh
Natural gas including replacement by - firing wood chips or pellets, - solar heat	19,371 MWh 10,000 MWh 1,000 MWh	233,000 MWh 78,000 MWh 12,000 MWh
Electricity including replacement by - photovoltaic	5,308 MWh 317 MWh	40,000 MWh 615 MWh
Water	40,000 m^3	517,000 m^3
CO_2	9,452 tons	108,000 tons
Energy costs saved	€1.8m	€18m

4.1.5/ Management of the fund

There are three different parts to the fund: invested, earmarked, and free capital. The invested capital is the part of the fund used to finance energy saving measures implemented in previous years and yet to be paid back. The earmarked capital is that already assigned to energy cost saving measures which are being prepared for implementation. Free capital is capital that can be contracted for new measures. Figure 15 shows the development of these different types of capital in Stuttgart's revolving fund.

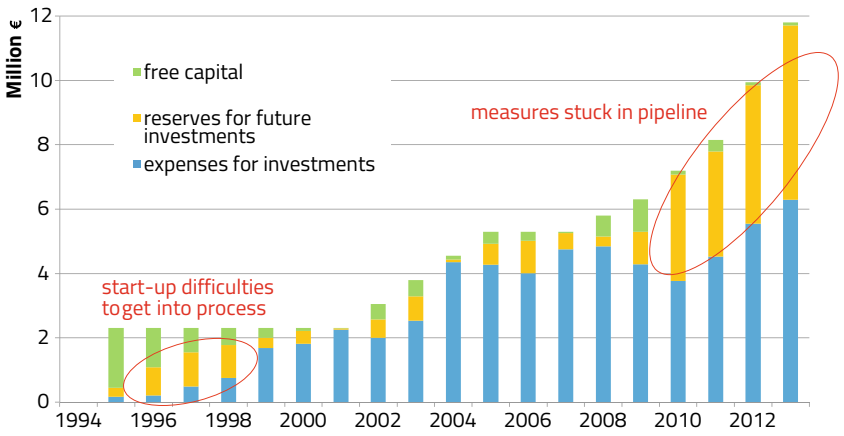

Figure 15: Development within the revolving fund of invested, contracted and free capital

In the first 4 years of the fund's operation, investments increased slowly due to internal reluctance to use this new financing tool. Staff in the facility and financial departments had to be convinced and trained to work with Internal Contracting. By the second year more than one third of the revolving fund had been earmarked for future investments. In the third year this share increased, taking up half of the revolving fund, before decreasing in the following years, since Internal Contracting was progressing. In the fifth and sixth years there was a healthy ratio between all three capital types. In the sixth year almost no free capital was left in the fund, but new measures could be still contracted, since significant paybacks were flowing back into the fund (compare with Figure 14). By 2001 the fund seemed to be performing optimally. But in fact, almost all the capital was invested (see also section 3.2.2, compare with Figure 7), and the fund was overstressed. No capital was earmarked for investment in the following year. Thus an increase in the budget allocated to the fund was needed in 2002. The fund increased until 2005, enabling measures to be contracted at higher costs and longer durations and more measures with higher annual investment costs to be financed (compare with Figure 14 and Figure 16). Between 2005 and 2008, the fund operated stably. But beginning in 2009 the fund appeared to have become imbalanced: investment declined until 2010, although the budget was increased. By 2013 half of the revolving fund was earmarked for upcoming measures.

The development of the revolving fund in recent years has to be seen in the light of a huge backlog in school building renovation work which accumulated due to expenditure cuts in previous years. Starting in2009 the city council approved a huge school renovation programme. The Internal Contracting fund was increased at the same time to accompany the standard renovation work with advanced energy retrofits. However, the construction department has now focused on urgent renovations due to a shortage of manpower. New measures can no longer be implemented easily due to the extra work load of regularly planned maintenance or refurbishments. For this reason, a lot of investments ready to be financed by the revolving fund have been put on hold.

When the budget period terminates, only the earmarked and the unbound capital has to be assigned to the following budget period, since the invested capital is not counted in the internal budget account of the revolving fund. Thus, if most of the revolving fund is invested, only a small amount of capital has to be shifted to the next budget period in terms of conventional accounting practice. Thus, only a little effort is required to justify why the capital is still needed. But at the same time most of the revolving fund's value is shifted automatically to the next budget period, since it has been agreed that it will flow back to the budget in following years as paybacks. To prevent any failure of this approach, Stuttgart's formal internal agreements for each particular measure, based on an initial council decision (see examples in Appendix 2), secure the future paybacks.

4.1.6/ Measures financed through Internal Contracting

The measures financed include:
- Insulation work;
- installation of wood-fired heating systems;
- Installation of CHP systems;
- Lighting renovation;
- Regulating device renewal; and
- Facilities using renewable energy.

Individual project costs of the energy saving measures vary from a few thousand Euros to over 1 million Euros. Payback is between 6 and 7 years on average, up to 15 years for larger projects (worth 1 million Euros and more).

Figure 16 plots the investment costs of all financed measures versus their payback times. Within the diagram different areas of certain measures can be located. Further bubbles illustrate the benefit of energy cost savings. The bubble size represents the value of all savings over the technical life time of the individual measure.

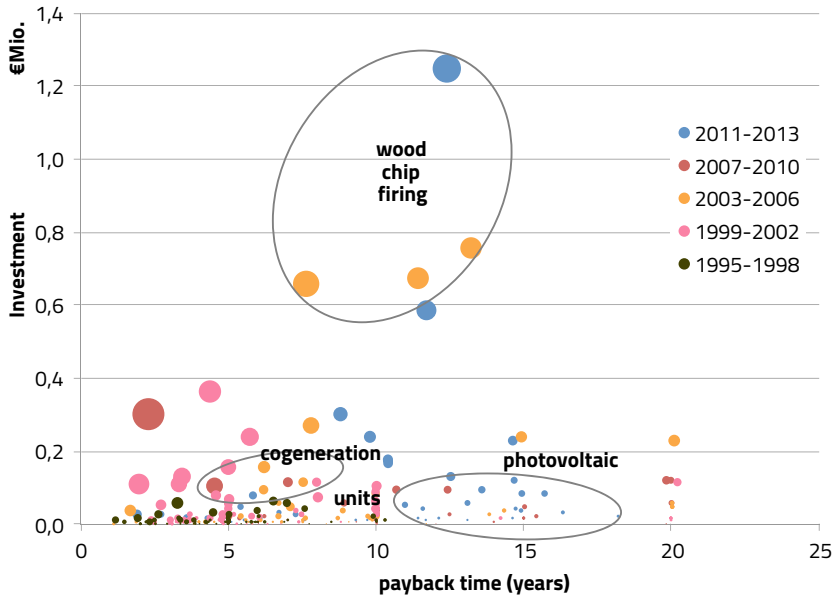

Figure 16: Financed measures in Stuttgart – Key parameters

On analysing the bubbles location, size and period, a drift can be observed. In the first few years of contracting, only measures with a low investment cost and short payback time - "low hanging fruit" - were financed through the revolving fund. In the following years more expensive measures and longer paybacks were also selected. This development is directly linked to the increase in the size of Stuttgart's fund and its increased capacity to finance and carry out measures that are less profitable. The expansion of the financial parameters corresponds with the growth in the gained or upcoming overall savings of the measures during their technical life time.

4.1.7/ Monitoring and evaluating the impact

The municipality's energy department continuously evaluates the impact of the implemented measures.
This begins with checking that the technical equipment has been correctly installed; including verifying if all the previously planned energy meters are in place, connected to the data locker and working properly. This first check is followed by the monitoring phase.
If there are indicators showing that the installations do not perform in the predicted way, the situation will be investigated to seek options to improve the performance.
In respect of the challenges of monitoring energy savings (see section 3.3.2) an energy metering procedure is determined individually for each measure prior to its implementation. This can include adding sub-meters to the main meter of the particular property, or, launching a temporary but intense metering campaign with special meters. Criteria that are considered include the technical nature of the measure, its environment within the overall installations and their use by the building user.

Examples:

a/ Insulation of building envelopes
Insulating the outer walls of buildings is technically speaking a simple but effective energy saving measure. However, these energy savings cannot be metered in a close technical context. Therefore, if the insulation is correctly installed, it is assumed that the predicted savings occur.
If the main meter of the building does not indicate the previously calculated savings, it is likely that the savings are being obscured by other influences (e.g. climate fluctuations or change in user behaviour). In such a case, it is advisable to investigate whether the use of the building or the weather is different from what was assumed when calculating the savings.

b/ Reduction of (hot) water
Water consumption is measured by water meters. If the saving measure affects only a share (e.g. showers) or a small part of high total consumption (e.g. public pools), a sub-meter is installed.
If hot water is the objective of the saving measure, the energy savings are calculated on the physical heat capacity of water, the temperature increase and efficiency data of the boiler, thereby avoiding cost-intensive installations of additional energy meters.

c/ Cogeneration units
Combined heat and power plants operate with a constant ratio of fuel input and heat and power output. Thus only one form of energy has to be metered to determine the other. Usually the most convenient method is metering of the power output, especially if the allocation of grants is linked to this parameter, therefore requiring exact metering.

d/ Wood chip boilers
Wood chip boilers are usually installed next to conventional heating systems to replace fossil fuels. The common 'level' to compare the different heating systems and to meter their impact is the output of heat. Therefore, wood chip boilers are equipped with a heat meter on the output side. The required or used input of wood chips can be calculated using the efficiency data of the boiler and the calorific value of the wood. However, the calorific value of the wood depends on its water content. It should be checked regularly.

e/ Heat recovery from ventilation
The implementation of heat recovery in ventilation systems should be considered with caution since capital, maintenance and auxiliary power costs often equal the saved heating cost. This situation prevents investment in special meters to monitor the savings permanently. In this case, a temporary but intense monitoring campaign is recommended after implementation by using auxiliary meters from the maintenance toolbox. However, it is difficult to determine the heat recovery, since it cannot be metered directly. Many parameters have to be incorporated: air exchange rate; exhaust air temperature; pressure drop; electrical efficiency; and operating hours. It is often the case that not all data are known and therefore have to be assumed based on one's own operational experience or approved technical norms. This is especially true when calculating the outcome of the measure prior to its implementation. Sometimes this provides differing results, depending on whether the calculation was based on assumptions or on readings collected during the metering campaign.

More information

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