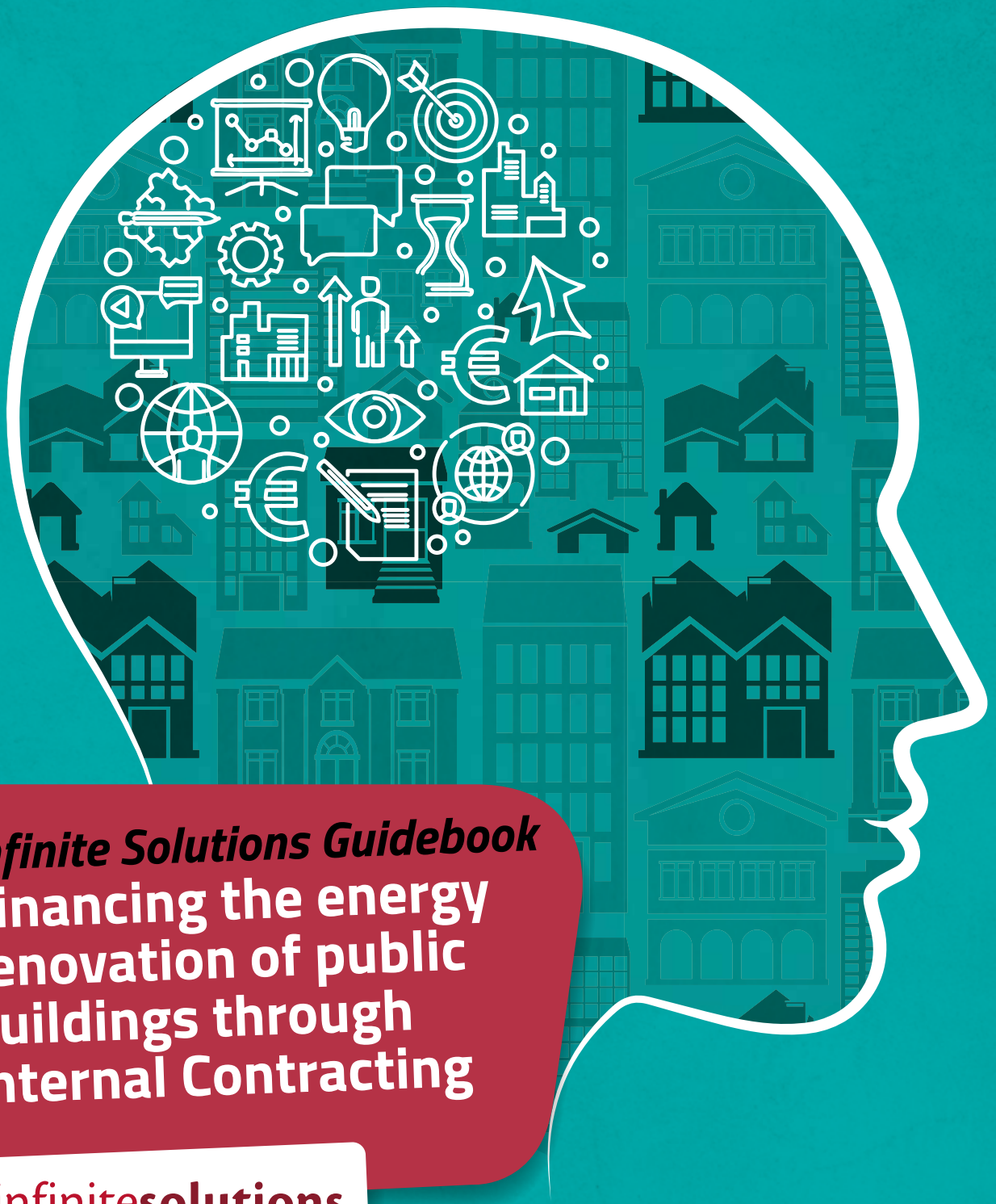

Infinite Solutions Guidebook

Financing the energy renovation of public buildings through Internal Contracting

infinitesolutions
FINANCING ENERGY TRANSITION IN CITIES

Co-funded by the Intelligent Energy Europe Programme of the European Union

This guidebook was developed by Energy Cities as part of the Infinite Solutions Project.

Authors:
Nino Schäfer (Landeshauptstadt Stuttgart)
Peter Schilken (Energy Cities)

Contributors:
Ivan Simic, Boris Kuharic (REA Sjever)
Célia Laranjeira, Carlos Rodrigues, Carla Couceiro (City of Águeda)
Agnese Presotto, Alessandro Mazzeschi (City of Udine)
João Cleto (City of Almada)
Ian Turner, Matthias Kühnbach (Energy Cities)

Graphic Design:
www.TUTTIQUANTI.net

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1/ Introduction

Meeting the European energy and climate policy objectives will require the mobilisation of substantial energy efficiency and renewable energy investments at the local level. Given both the substantial effort necessary to finance the energy transition and restricted municipal budgets, it is clear that these objectives cannot be met through traditional public financing such as grants or direct investment, but by finding a new approach to financing solutions.

One innovative financing scheme has proved to be particularly relevant in enabling investments in energy saving projects for municipalities and public organisations: Setting up an internal energy contracting scheme that includes a revolving fund. However, due to its unconventional approach in terms of public funding accounting, organisational barriers or simply a lack of information, so far few European municipalities have adopted the concept.

In the light of this situation, the European Commission decided to fund the project INFINITE Solutions (INnovative FINancIng for Local SusTainable Energy Solutions) within the scope of its "Intelligent Energy–Europe" programme. INFINITE aims to spread knowledge about Internal Contracting as a financing tool for energy saving measures among European municipalities.

INFINITE Solutions has been coordinated by Energy Cities. Acting as an advising tutor, the city of Stuttgart has contributed its experience of more than two decades in managing/implementing an Internal Contracting scheme. The municipalities of Almada (Portugal), Águeda (Portugal), Koprivnica (Croatia), and Udine (Italy) have taken part as learning authorities with the objective of setting up their own Internal Contracting scheme.

This guidebook is built upon a comprehensive analysis of Stuttgart's Internal Contracting scheme and a detailed questioning of it by the learning authorities within the INFINITE Solutions project. It is intended to offer guidelines to municipalities as well as universities, hospitals or other institutions interested in applying Internal Contracting to improve their energy consumption and efficiency performance.

The approach of this guidebook is developed as follows:

- The concept of contracting – especially Internal Contracting – will be introduced.
- Universal guidance will be offered on how to implement an Internal Contracting scheme and keep it working over the long term.
- The Internal Contracting scheme will be presented in practice. Several cities will describe their individual approaches to Internal Contracting and the various ways they have been able to adapt the scheme.

The mindmap in figure 1 shows the numerous topics that must be considered when learning about Internal Contracting. All these topics are covered within this guidebook.

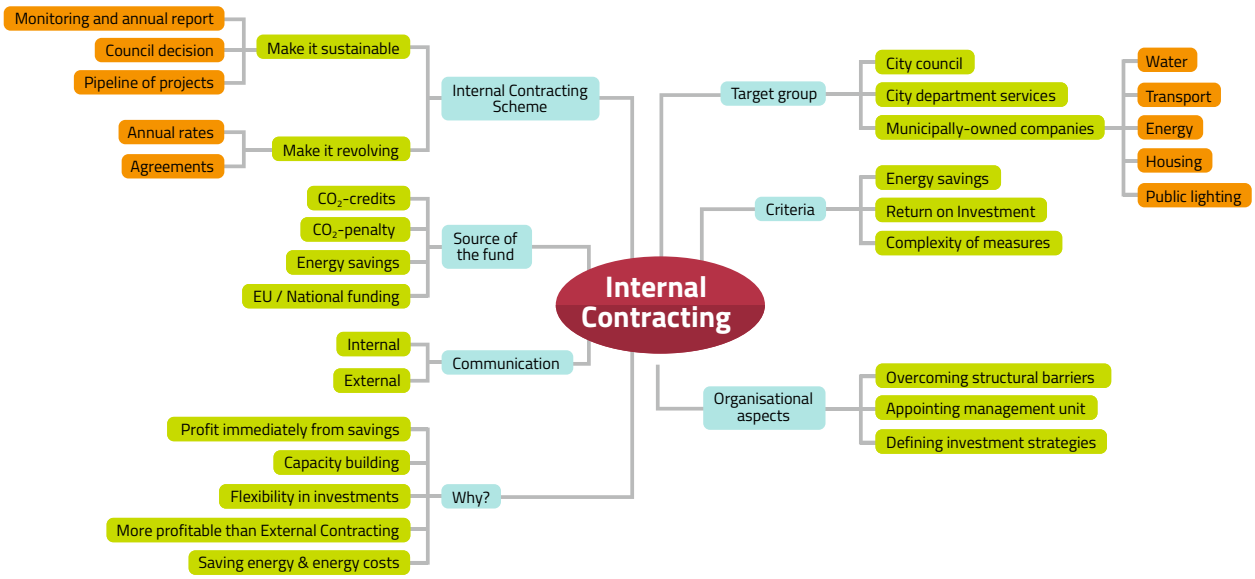

Figure 1: Mindmap showing all the topics relevant to Internal Contracting

2/ Internal Contracting:
Enabling municipalities to design a sustainable and modern infrastructure

This chapter presents briefly internal and external contracting and compares them. It will show under what conditions Internal Contracting has various distinct benefits over external contracting and in which cases this financing scheme can be used beneficially.

2.1/ The concepts of Internal and External Contracting

In brief, contracting is a financing method that enables investments to be made in energy saving measures, by placing the burden of the investment cost on a contractor or contracting fund until it is repaid through the energy costs saved.

In **external contracting**, the municipality commissions a commercial energy service company (ESCO) to carry out energy saving measures for municipal real estate (e.g. a publically-owned school). This external contractor takes over the financing, planning and implementation of selected technical installations to realise the energy savings (e.g. refurbishment of the heating system). It is paid through the resulting energy cost savings over a certain agreed period. During this period the ESCO operates and maintains the installations. The municipality gains control over the installations once the contractor is paid off and the fixed contractual period ends. However, to realise further energy saving measures the external contractor has to be engaged again. Figure 2 shows the interaction of this scheme.

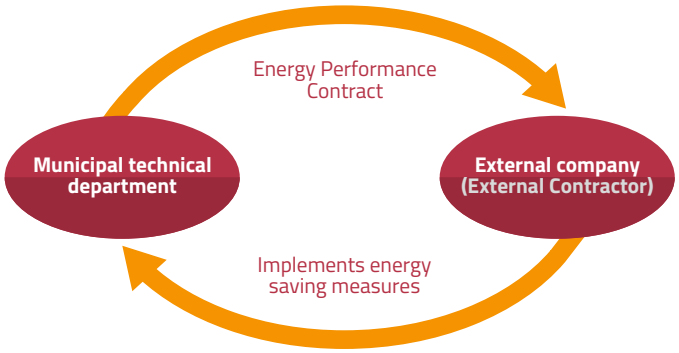

Figure 2: Functionality of external contracting

The idea of **Internal Contracting**, often called **Intracting** (municipal internal performance contracting scheme), is to enable the municipality to finance multiple investments for energy savings without being tied to an external contractor. This requires that a revolving fund be setup.

– A revolving fund is a self-replenishing pool of capital, which only needs to be supplied once. Its name derives from the revolving aspect of its investments and repayments: the central fund is replenished by income from its investments, creating the opportunity to continuously finance new investments from year to year. Its funds are intended to remain available with no fiscal year limitation.

Adapted for the specific purpose of realising energy savings, the revolving fund as a financial buffer is incorporated into a simple cycle of financing energy saving measures and paying back the cost of these investments through reduced energy costs. This is the core of Internal Contracting, which is shown in figure 3:

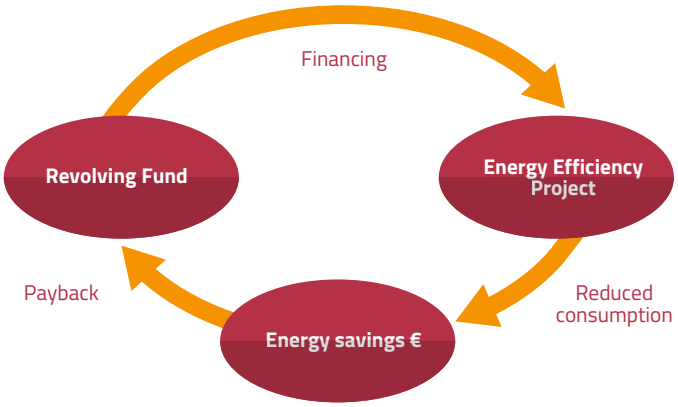

Figure 3: Core functionality of Internal Contracting including a revolving fund

2.2/ Benefits of internal over external contracting

A comparison of the administrative, legal, financial and technical aspects of Internal Contracting to contracting with external partners shows a number of advantages as shown in the table below:

Aspects	Internal Contracting	External contracting
Administrative	Within the limit of the fund's size	No administrative limit from the local authorities perspective
	Fast implementation: measures can be selected, financed and implemented quickly. No need to undertake a public tendering process or get legal advice when drawing up the contract.	Long delay (in particular because of auditing and contract negotiations)
	Reduced need for exact quantification of the energy savings and the monitoring	Risk of litigation related to the quantification and qualification of the realised savings
	All savings realised flow back to the municipality	Savings realised thanks to users behaviour changing are not taken into account
	Part-financing to enhance the energy-related quality of standard retrofits	
	Supplementary financing to trigger investments through combined funding	
Legal		Third party investor (ESCO) takes the risks and guarantees the energy savings
	Simple agreement, possibility of integrating an environmental bonus	Complex contracts to be agreed and signed
		Difficult to evaluate those measures for which no dedicated meter has been installed
		Renegotiation of the contract in case of changes in the building use patterns and times
Financial	No mark-up for business risk and profit or for interest on capital deployed	Additional external costs for the energy audit and planning
	Not subjected to interest rates	Interest rate follows the market
	Financing of small-scale projects (e.g. replacement of pumps, thermostats or control devices) of considerable interest because of their short payback-period	Often a constrained focus on highly profitable measures thus small-scale projects unlikely to be of interest though they might be highly sustainable
Technical	City selects the measures to be implemented	"Cherry picking" risk: selection of most profitable measures, no integrated approach
	Know-how remains in the city departments	Expertise recommended to oversee the actions of the ESCO partner
	Small effort required to monitor projects across their entire life time	

2.3/ Utilisation of Internal Contracting – overcoming structural barriers

Energy efficiency measures that would be profitable are not always implemented by local and regional authorities. Useful and necessary energy-saving investments are prevented by budgetary and administrative constraints like separated budgets aligned with inflexible procedures and strict rules for the staff responsible for implementing the measures. Internal Contracting can help overcome these constraints. It should be seen as a handy tool for staff in charge of energy retrofits and accounting investments or energy costs, as well as for financial controllers. Figure 4 shows these interrelations:

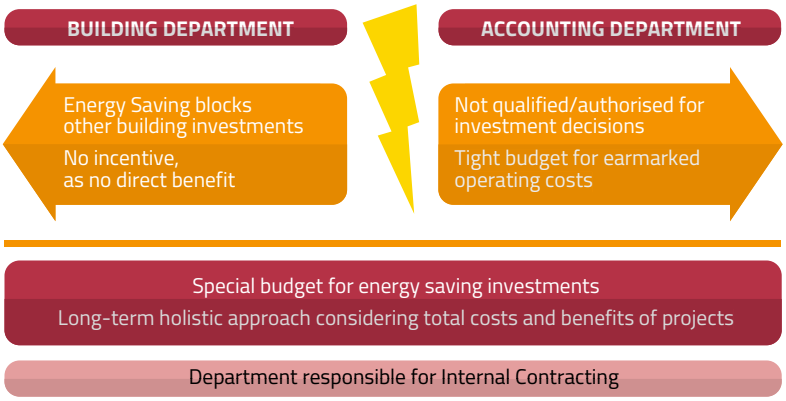

Figure 4: Creating a special budget for energy saving measures avoids a lock-in situation caused by separate budgets

Internal Contracting offers a solution to the following common situations:

a/ No holistic view of costs for energy consumption and investment budgets for improvements.
Very often the funds available for paying the operating costs such as the annual energy purchase and maintenance are strictly separated from the budget for investments. This can result in a lock-in situation within the public authority. On the one hand administrative services have to pay enormous energy bills due to poor condition of public buildings. On the other hand, the departments are not able to re-finance the urgently needed energy-saving measures by paying back the energy costs saved into the investment budget.

Internal Contracting is a holistic scheme that is used to implement procedures that link all aspects of energy management such as maintenance, energy consumption, energy efficiency improvements, new equipment (including its installation) and energy costs.

b/ Limited investment budgets
When technical equipment is operating within a normal maintenance cycle, but innovations show that the technology in place is outdated, then, installing modern technology is more appropriate than maintaining the existing equipment. However, the use of advanced technology usually requires modern onsite supporting infrastructure. Thus, instead of a simple replacement a specific refurbishment is necessary.
If such a situation has not been "foreseen" and a special budget has not been prepared, the financing needed for the refurbishment can overburden the regular budgets, thereby not allowing the most efficient alternative to be selected as regards both profitability and resource savings.

Internal Contracting can be used to finance the additional cost of buying the most suitable technology at the lowest total cost. Moreover, financing through this scheme may increase the number of retrofits. This can help to keep the average age of the installed equipment low and may reduce maintenance costs.

c/ Limited maintenance budget
Often maintenance is optimised in order to minimise the costs of one single maintenance activity or to keep within a yearly budget for technical equipment. This approach often goes hand in hand with cheap, non-durable low-tech equipment, causing high energy demands and frequent replacements, both ultimately resulting in expensive operating costs. Energy efficient, durable technology with a low life-cycle cost would require a higher initial budget.

Internal Contracting offers a way out of this dilemma by financing the additional costs for the optimal solution exclusively during the transition phase.

d/ Limited energy cost budgets.
The repayment of Internal Contracting measures through saved energy costs could be considered in economic terms to be a 'zero sum game'. However, this conclusion is wrong in times of rising energy prices. Indeed, as the energy saving measures lower energy consumption, energy efficiency is increased and the effect of rising

energy prices is lowered. This is crucial if energy cost budgets are predetermined taking into account the previous years' energy bills meaning that any additional costs for non-calculated energy price rises have to be paid for using general budgets, which have been designated for the core activities of a municipality or an administrative unit.

e/ Fixed schedules of budget negotiations.
In most public organisations, budget lines are negotiated within a fixed schedule. Every call for a new budget has to be presented in the form of a well-documented financial request and budget lines are frozen until the following negotiations. Therefore, financial demands which were not considered during the previous budget negotiations have to be placed on hold until the next round. In addition, small investments are often considered not worth fighting for in budget negotiations.

However, with energy saving measures two things have to be kept in mind:
- The faster they are implemented, the more energy and money will be saved
- Very often they come along in a fixed window of opportunity (e.g. integration of energy saving measures the retrofitting programme of a larger system)

In these cases, Internal Contracting can respond quickly to the financial demand and can ensure that these energy saving measures will be considered.

f/ Conflicts of interest
Energy efficiency measures are widely acknowledged as a tool to reduce energy consumption and CO_2 emissions. But in a complex municipal organisation every unit has its designated tasks and will always and rightfully spend its budget in order to fulfil them. Often energy saving is nobody's main responsibility. Thus, when it comes down to a final budget decision, there is no specific support for energy efficiency measures, even though the technical knowledge and awareness of the profitability of sustainable technology exist, as well as the desire to combat climate change. However, priorities are set elsewhere (e.g. childcare facilities). Consequently, only a particular department explicitly dedicated to improving energy efficiency, backed by a distinct, powerful mandate (e.g. the city council) is capable of discussing energy efficiency measures with responsible decision makers and influence investment decisions in favour of environmental sustainability, without having to address a conflict of interest.

Internal Contracting helps such a department to overcome barriers within a local authority and to demonstrate that energy efficiency measures can pay off. Moreover, Internal Contracting with its revolving fund can be the single recipient for all financial contributions if the city council has the political objectives of improving energy efficiency and the use of renewable energy, as well as combatting climate change. Both the unit managing the Internal Contracting and councillors can highlight the purpose of the fund and its activities in (political) discussions. Over time, the city council will become familiar with "its" Internal Contracting and confident in the efficiency and effectiveness of the donations it receives. As a consequence, the revolving fund is likely to receive further funding without requiring too much effort to convince the city council of its benefits.

Finally, Internal Contracting can stimulate the municipal staff to change their behaviour and can strengthen a culture of cross-linked and integrated thinking with respect to all economic, energy-saving and environmental protection aspects.

2.4/ Strengths of Internal Contracting in a nutshell

Internal vs. external contracting:
- Faster implementation of projects
- No profit mark-up
- No cherry-picking
- Supplementary or Part-financing possible
- Facilitated monitoring

Tackling structural barriers:
- Overcoming administrative constraints
- Overcoming fixed budgets
- Avoiding conflicts of interest

Strategic aspects:
- Internal Contracting linked to a revolving fund enables multiple investments for energy savings
- The revolving fund can concentrate all monetary allocations for improvements of energy efficiency, the use of renewable energy and combatting climate change
- Internal Contracting strengthens cross-linked and integrated thinking for holistic views on all aspects of energy use – investments in energy and cost savings

3/ Implementing and managing Internal Contracting with a revolving fund

The previous chapters explained the principle of Internal Contracting. They gave an idea on how this scheme could be applied and its benefits. This chapter goes further into Internal Contracting and deals with aspects linked to setting up, initialisation and operational management of the scheme. The chapter is structured around the organisational, financial and technical aspects.

3.1/ Organisational aspects

3.1.1/ Initial momentum

Even with all the advantages described in Chapter 2, an Internal Contracting scheme can be undermined even before it gets off the ground if the decision-makers have concerns about some of the following aspects:

- It implies a significant change in business-as-usual procedures
- It requires the involvement of several different units within the institution
- Not all the decision-makers or relevant staff are familiar with energy management issues and/or investment evaluation and/or financial procedures

In order to implement Internal Contracting successfully, political support is essential. Convincing executive directors to apply the concept of Internal Contracting to their organisation may require an internal communication campaign. Such a campaign should include the following components:

- Providing information on energy management, related financial issues and potentials for energy saving investments
- Raising awareness of and interest in Internal Contracting
- Identifying staff interested in innovative financing approaches– the more high-ranking, the better.

It may take some time to gather momentum for Internal Contracting to be set up. Its advantages may have to be brought forward many times, when discussing related issues such as building renovation, energy costs or financial constraints for investments. Concrete examples may facilitate the discussion:

- **Identify uncontroversial investments which have resulted in energy efficiency improvements (e.g. replacing damaged windows).**
- **Illustrate how Internal Contracting could work on these easy to grasp examples.**
- **Outline how Internal Contracting can enable further investments in (advanced) energy savings or the use of renewable energy.**

3.1.2/ Combining competencies and initial decisions

To develop a contracting scheme that is different from the one that generally already exists, organisational tasks have to be linked as shown below (see figure 5). Depending on the size of the organisation, these tasks could be linked to individual persons within one working unit or to several units, each in charge of one task. Thus different people, who not only have different working experiences, but also different working skills, have to come together to understand the contracting idea and to adapt it to their internal procedures.

- **Do not underestimate the effort required for the joint learning process and for people to become familiar with the cross-linked, transversal approach of Internal Contracting.**

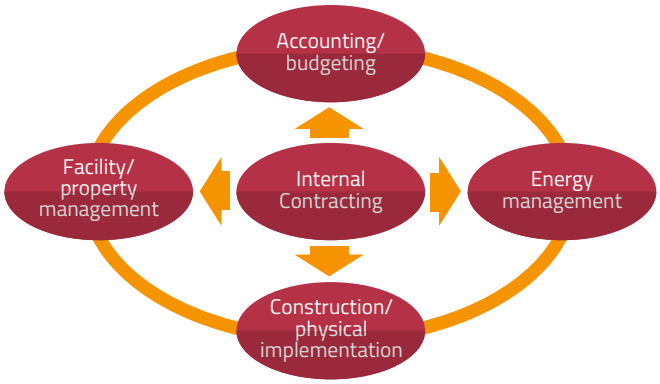

Figure 5: Tasks of an organisation needing to be connected to set up Internal Contracting.

This Internal Contracting development core team has to specify how the scheme can adapt to the organisational, legal and financial framework of the organisation.

- **Not dealing with one of the organisational, legal or financial aspects of Internal Contracting may cause the entire adaption and implementation process to fail.**

If there is a lack of legal, financial or energy experts in-house, external expertise has to be incorporated. Besides the general information in chapter 3, this guidebook provides in chapter 4 a set of case studies describing how other municipalities have implemented the Internal Contracting concept.

Once a clear scheme has been developed, describing its operation, the revolving fund's scope and the investment strategy, a council decision has to be prepared to get approval for the scheme and its integration in the organisation's structure and to launch Internal Contracting. Appendix 1 shows an example sourced from the initial decision of the city council of Stuttgart to kick off Internal Contracting. Further internal working procedures have to be developed. Appendix 2 shows an example of an agreement used by the city of Stuttgart, which breaks down the collaboration by the various Internal Contracting stakeholders into individual projects financed through the revolving fund.

- **The core-team in charge of preparing Internal Contracting can form the nucleus of an "in-house contracting competence centre".**

3.1.3/ The scheme within the organisation

As part of the first steps for Internal Contracting, an internal unit has to be appointed, taking the role of the ESCO, that is, assessing the energy consumption of the organisation and investigating saving potentials.

- **At the very least, a basic energy management unit is needed to identify viable energy saving measures to be financed through Internal Contracting.**

The introduction of Internal Contracting may strengthen the unit in charge of energy management. In order to implement the scheme, this unit needs to be upgraded to a fully **in-house competence centre** for Internal Contracting. It has to manage cooperation between the different independent departments taking part in the contracting scheme within the same organisation, while dealing with all kinds of technical, financial and accounting issues. The competence centre also functions as a contact and reference point for the staff involved.

To fulfil its new Internal Contracting task, the competence centre needs to be provided with a sufficient initial revolving fund, which is essential to run the Internal Contracting scheme sustainably.

In figure 6, illustrating the scheme, the Energy department has the role of the in-house competence centre. It has access to the energy saving (revolving) fund. Due to its energy management abilities, the Energy department proposes cost-efficient energy saving projects to its "client", a technical department or municipally-owned company. These measures are financed through the "Energy savings revolving fund". Cost savings made by the client (by saving energy as soon as the proposed measure is implemented) over the following years are used to repay the capital invested to the Energy department. As soon as an energy saving project is accepted by the client and planned by the Energy department, it receives financing from the revolving fund. Implementation of the project immediately leads to reduced energy consumption and, therefore, declining energy costs, resulting in a smaller energy bill for the respective department. These savings are gradually paid back to the revolving fund.

After a starting period, in which initial funding is necessary, new projects are exclusively financed by yearly paybacks, enabling the municipality to realise an infinite number of energy saving projects. Naturally, the course of the financial flows is somewhat theoretical, as individual projects have individual payback periods and both savings and investments are likely to vary over time. If specific accounting of the revolving fund is embedded within the general accounting procedures of the organisation, fund management costs (including labour costs) are low. An existing energy management unit should have the capacity to calculate energy saving measures. However, implementing the technical measures will take the most effort and should be coordinated with the construction department.

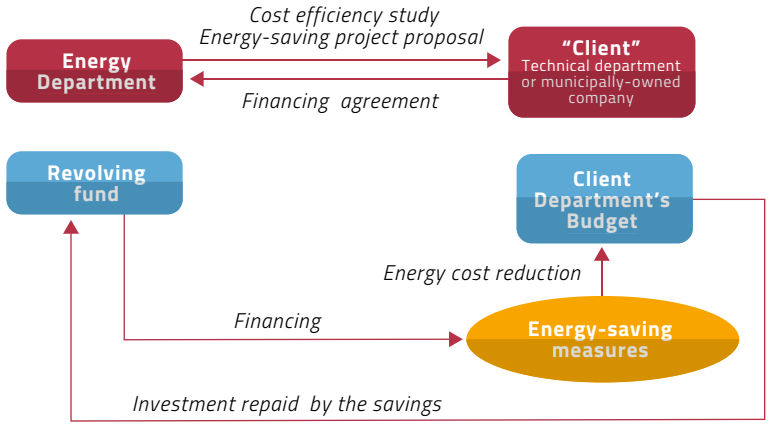

Figure 6: Internal Contracting financing scheme

3.2/ Financial aspects

As shown in chapter 2, Internal Contracting serves many purposes. If correctly applied, it can be an effective financing tool. However, the performance of the scheme is tied to certain limitations of the revolving fund, which have to be kept in mind, before requesting financial support for investments under the scheme. This section provides information about the financial background of the Internal Contracting scheme and strategies on how to deal with it.

3.2.1/ Distinct purpose and use of the fund

When setting up an Internal Contracting scheme the budgets for maintenance, new developments and the additional one for Internal Contracting have to be clearly distinguished from one another. Since Internal Contracting operates with much smaller budgets than construction or maintenance, financial overburdening of the Internal Contracting fund must be avoided.

- **An Internal Contracting fund must be used solely for financing energy cost saving measures.**

If energy improvement is the sole reason for a retrofit, then energy cost saving measures can be entirely financed through Internal Contracting. Any additional renovation work has to be financed through conventional construction or maintenance budgets. However preparatory work may be necessary to implement the energy saving measures, e.g. strengthening the structure of a roof to support the weight of a photovoltaic installation. Thus, the cost of this work has to be included as part of the energy saving measure. Often this preparatory work is preponderant in deciding whether an energy saving measure is viable or not and whether it should be given the go-ahead.

3.2.2/ Annual investment & fund size

The idea of the revolving fund assumes that yearly investments of energy cost saving measures can be financed with a fund of limited monetary value, which has to be set up only at the start of the scheme. New investments are financed by energy cost savings gained and paid back by previously implemented measures. Hence throughout the years an infinite number of energy saving measures can be financed and implemented without increasing the fund size.

However, the fund cannot cope with investments of any size. For sure, the cost of a single investment has to be lower than the fund's value. In fact, the total annual investment is limited to only a share of the fund's value, since the fund is intended to pay for investments made in different years with paybacks also extending over several years. To operate, the revolving fund constantly requires that investment cost and payback times of the financed measures are appropriate to the fund. The relation is expressed in the following formula:

total annual investments ≤ funds value * 2/(payback time of investment+1)

Longer payback times not only prolong the refinancing of the investment, and hence of the fund, but lower the investment which is annually financeable. Increased investment costs can completely halt this business model. To ensure the revolving fund is not overloaded in the first years of Internal Contracting – which would cause suspension of investments – as a rule of thumb one can state:

- **The monetary value of the revolving fund should be at least 3 times as much as the investments planned for the first year when starting the Internal Contracting scheme, thus enabling investments with 5-year payback time.**

Figure 7 displays the ideal development of the financial parameters of a contracting scheme with a fixed fund size and constant annual investments of one third of the revolving fund's value with equal payback extending over five years.

After the initial set-up period covering the first five years, the contracting scheme becomes stable. Hence from the sixth year onwards new measures will be financed entirely by savings generated by previous measures Total

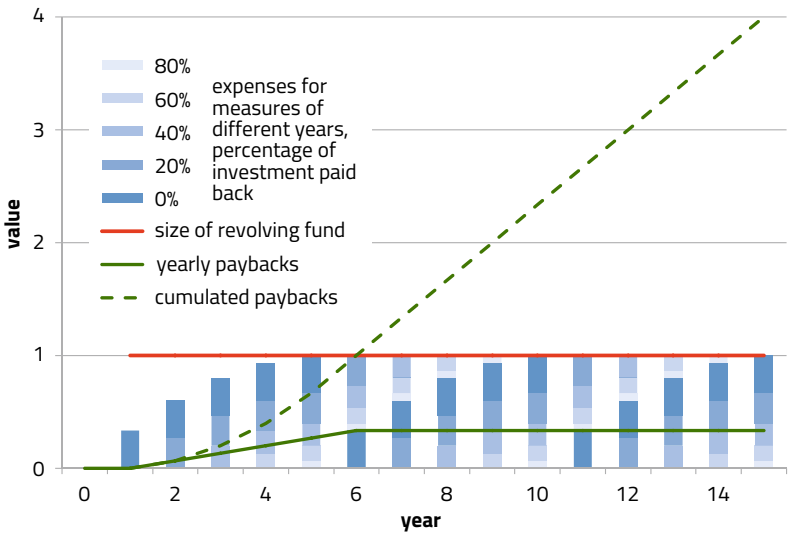

Figure 7: operating a contracting scheme with a fixed fund size

paybacks then increase every three years by a value equal to the fund. Thus the initial deposit in the fund pays "itself" back. This means that the so called "revolving fund" does one "revolution" in six years and two "revolutions" in nine years. Figure 7 also shows that:

- **The full total of the fund does not have to be provided at the beginning of the Contracting scheme. The fund's value can be increased with time and decreasing demand until annual investments and paybacks reach an equilibrium.**

Regarding the example of Figure 7, this means that the initial budget for the fund has to serve the investments of the first year. Subsequent financial demands in the following first five years decrease yearly by 20% until the revolving fund recovers its pre-designated volume and is able to run independently without further financial injections from the sixth year onwards. But one aspect has to be kept in mind:

- **With a limited fund size, the Contracting scheme can run perpetually, financing an infinite number of measures, provided the financial parameters of the measures taken in the ensuing years are compatible with the fund size.**

3.2.3/ Closed market: the fruit tree

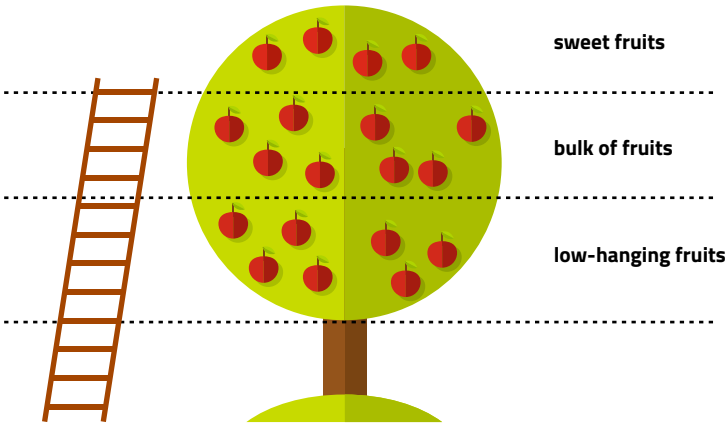

Figure 8: Picture of the fruit tree

The general opinion that contracting schemes can run perpetually is a challenge especially for Internal Contracting, since these models target a limited "market" e. g. the building stock of a municipality. These constraints can be expressed in the picture of the fruit tree.

Standing in front of, lets' say, an apple tree ready to harvest it, it is obvious that the crop is finite and not uniform; it is rather a mixture of apples of different quality which is dependent on the maturing conditions. When harvesting the apples, they can be categorised according to the height of the tree and the level at which they were picked: The low hanging apples can be picked easily without extra tools, but they might not ripen during summertime because of the shade provided by overhanging branches and leaves. To collect apples from the upper levels a ladder is needed. The tree is largest in the middle and this is where the bulk of fruit is to be found. At this height a lot of apples can be harvested from one step of the ladder. These plentiful apples offer the best ratio between quantity, harvesting effort and sweetness. The apples on the top level of the tree are the sweetest, because they have received most sunlight. To pick these sweet apples some courage and a long ladder are needed. Hence, the effort and risk needed to harvest sweet fruit are significantly higher than collecting lower hanging fruit.

Regarding Internal Contracting, the tree symbolises a closed market in which the contracting scheme will operate. The apples represent the potential energy saving measures. Their number is limited, especially in terms of economically-profitable projects. The different apple categories represent the different characteristics of the measures in terms of their financial parameters and their sustainable impact. Low hanging apples represent measures

with a low investment and short payback time. They are cheap and easy to implement, but usually have a minor impact in terms of energy (cost) savings. Plentiful apples represent a bunch of measures with similar financial parameters. Therefore, they can be efficiently handled with similar accounting routines. But to exploit this resource of energy cost saving measures, higher investments than for low hanging fruit are needed.
Sweet apples are measures which have a great impact in terms of environmental sustainability or energy cost savings over the technical lifetime of these measures. In general, their implementation requires not only high investments, but maybe also special political decisions and different accounting, organisational or management procedures. Higher energy prices are fertilizer for the tree, since new measures henceforth become profitable. The auxiliary ladder, to harvest the fruit, is the contracting budget. This means that energy saving measures can only be financed if the budget can cope with their investment costs.
The size of the contracting fund and the investments necessary to realise energy cost savings out of the different categories have to be determined in each organisation individually. Influencing variables are, among others, the size and energy conditions of the operational market of the contracting scheme and the financial resources of the organisation.
It is reasonable to

- **Start Internal Contracting with a budget fund suitable to target the low hanging fruit.**

However, a budget line that is too restrictive could lead to a situation where no further measures can be contracted, because the revolving fund does not have the capacity for higher investments. To avoid this,

- **A mechanism to increase the volume of a fund should be integrated into the Internal Contracting scheme.**

In the medium term the budget size should grow to become sufficient to cover investments of measures which represent the bulk of fruit. Nevertheless, the picture of the fruit tree implies that (Internal) Contracting has a certain lifetime. Raising energy prices may prolong the duration of that lifetime.

3.2.4/ Internal accounting of a revolving fund

A "healthy" Internal Contracting scheme depends on both the capability to steadily finance new investments but also to 'confiscate' long-lasting paybacks for refinancing. The following obstacles linked to public authorities' internal organisational and accounting rules are commonly encountered:

- The opening of an independent working bank account alongside the organisation's official one for independent, transparent transactions is in general forbidden.
- The sole main budget is highly segmented into virtual limited sub-budgets.
- Sub-budgets remainders at the end of a budget period have to be reclaimed for the following period.
- Budget allowances are usually provided for one budget period and are intended to meet present financial demands – not to refinance past investments.
- The organisation's working units are restricted to addressing their financial demands via their own dedicated sub-budget only.
- Investments (e.g. in energy savings) and running expenses (e.g. energy bills) have to be accounted for separately.
- (Energy) cost reductions are not recorded in the accounts as 'income'.

These obstacles are contrary to the cross-linking, transversal and sustainable prescient approach of Internal Contracting. In these cases, the internal revolving fund has to be emulated by linking the administrative rules in place in such a way as to induce and steer the financial flows:

a/ The internal revolving fund needs an initial budget allowance.
b/ The internal account of the fund needs permanent approval.
c/ The fund managing unit (in general the energy department) has to be given authority to allocate financial obligations to other units in order to claim paybacks as income to the fund. This can be achieved through internal agreements based on an initial council decision (see Appendix 1-2).
d/ The Internal Contracting clients need approval to claim not only their (energy) costs for the following budget period, but also the monetary value of the energy cost reductions – with the objective of transferring the agreed amount to the Internal Contracting revolving fund.

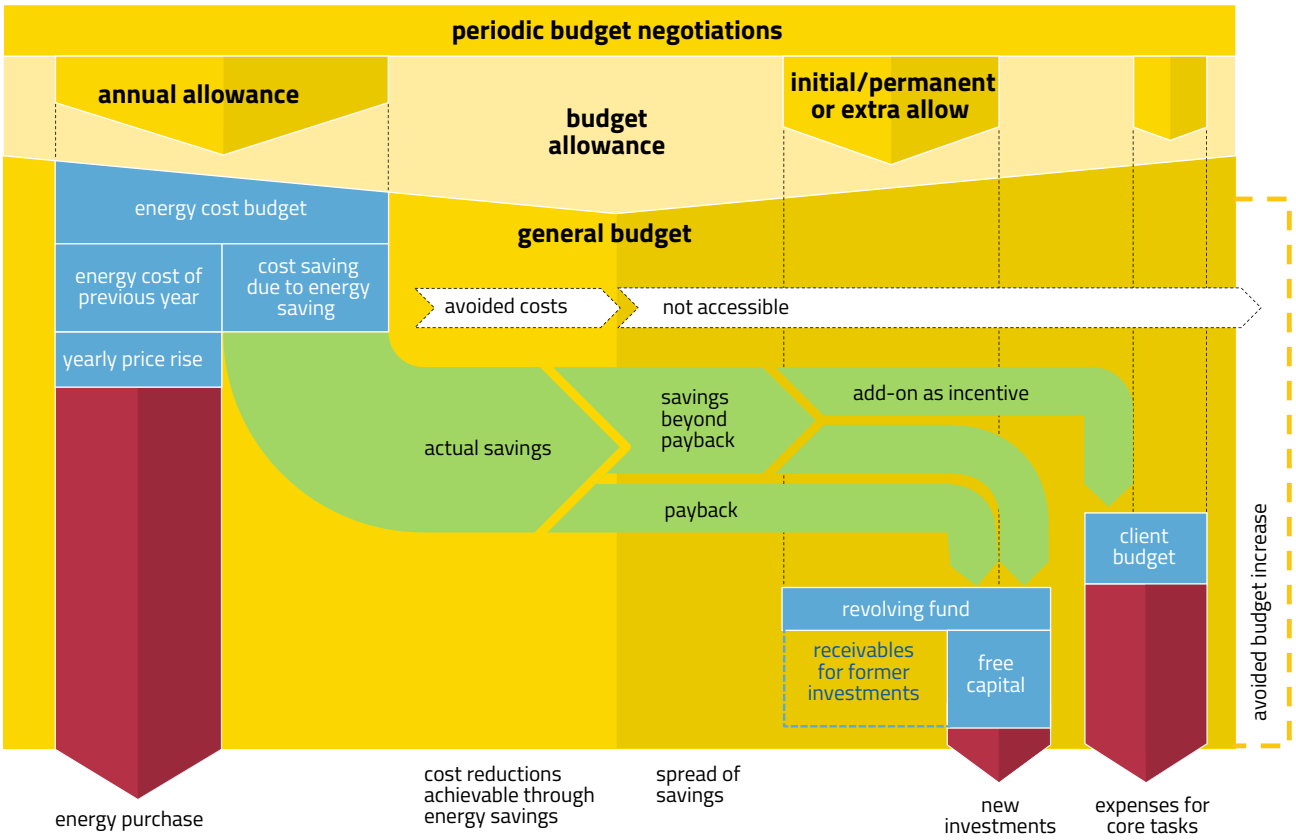

Figure 9: connections between sub-budgets relevant to Internal Contracting

Figure 9 shows the connections in the general budget.

The sub-budgets (blue) within the general budget (yellow) result from the periodic budget negotiations. The value of actual cost savings made is considered within the present allowances of the energy cost budget (green outgoing arrow), although the present spending for energy purchases (left red arrow) has already decreased due to past energy saving investments. The savings are now transformable as income for other purposes (green arrows) – mainly to serve as payback to the fund. If the cost savings over the lifetime of an energy saving measure are higher than the required payback for its investment, the additional savings can be used for other purposes. Such an opportunity should be used to increase the contracting fund or to acknowledge the collaboration of the unit where the agreed energy saving measure has been implemented (client) by giving an incentive for free use. However,

- **The financial demand on the feeding budget (i.e. the energy cost budget) cannot be reduced until contracting investments are paid back and other purposes have been served.**

Moreover, energy improvements generate "avoided future costs" (white horizontal arrow), since energy savings are not subject to energy price rises. However, transforming these avoided future costs into present financial resources may be impossible since avoided future costs are rarely subject to budget negotiations. Such an attempt would also increase the overall financial demand on the general budget. Thus, avoided costs can only be used as an argument to promote the benefits of an Internal Contracting model.

Similar to the future costs, the returns of the revolving fund on former investments are not considered within the present general budget. An Internal Contracting scheme has to keep track of an investment for more than just one budget period.

- **Internal Contracting is a scheme to holistically link the past, present and future.**

Hence, to operate a revolving fund, not only an initial budget, but also the ability to record costs savings as paybacks on former investments, are essential. Whether energy costs are accounted for centrally or decentrally within individual units of the organisation is of no importance. After the start-up phase, the revolving fund can be operated entirely on on-going paybacks. If further savings are available, the fund can be even increased. Furthermore, even if inaccessible, the avoided costs can be used as an argument to promote the benefits of an Internal Contracting model when discussing its development in reviews.

Figure 10 illustrates the cash flow of the internal revolving fund for one example project with a payback time of 8 years and a project lifetime of 15 years. The payback time depends on the policy defined on how savings will be returned to the fund. If the savings are returned to the revolving fund in full, then the payback time will be 8 years. After that time, the financial department usually claims the savings and will reduce the client's budget accordingly. However, savings can also be returned to the revolving fund beyond the payback time, until the end of the project lifetime. In this period, savings can be split between the beneficiary and the revolving fund or the total savings can be transferred to the revolving fund.

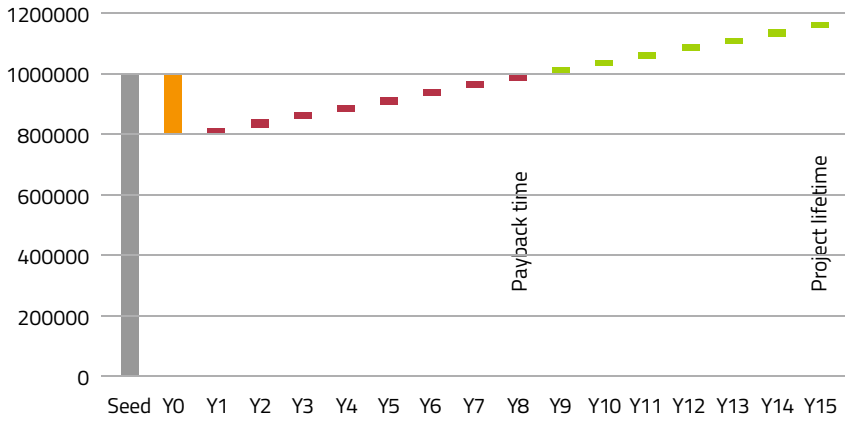

Figure 10: revolving fund cash flow for a single measure

Figure 11 shows the cash flow for the client of the Internal Contracting system. The client will see the energy costs decrease after the investment. Usually, savings are not only achieved for energy costs but also for operating and running costs (depicted as cost savings). The client will transfer the rest of the savings to the revolving fund. The duration of the savings transfer will depend on the agreement (or defined policy as stated above) between the revolving fund and the client. In this (somewhat ideal) case, the client will achieve the full potential of its savings after the payback time. Until Year 8, the major part of the savings will be transferred to the revolving fund and after that and until the end of the project lifetime, the client will reap the benefits of its investment.

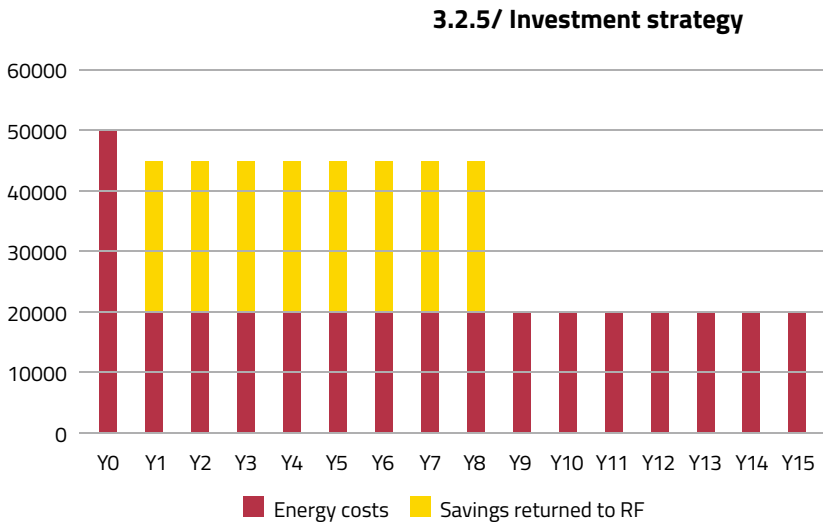

Figure 11 : cash flow for Internal Contracting client

In order to use the fund as efficiently as possible, it is recommended that the following criteria are taken into consideration:

- **short payback time** (e.g. 5 years), allowing a quick reinvestment (turnover) of the fund.
- **limited investment cost per single measure or portion of the cost**, covered by the fund, to increase the quantity of measures bankable by the fund. This is only possible if the remaining financial demand is covered by other means (e.g. a regular construction budget).
- **restricted ratio of payback and lifetime of the measure**, ensuring the financial success of the projects and the fund as a whole, e.g. payback should happen within three quarters of the operational lifetime of the energy saving measure.

Such rules can significantly limit the scope of action of the Internal Contracting scheme. However, when contracting proves successful and the fund size is not the limiting factor, such restrictions can be relaxed, thus enabling a greater number of projects to be financed. In this case, the payback time could be aligned with the technical lifetime.

When considering financing a particular energy saving measure through Internal Contracting, it is recommended that one or more of the following strategies are adopted:

- **Partial financing – Combining the measure with renovation or maintenance work:**
  If energy saving measures are coupled with forthcoming renovation work, often most of the preparatory work can be carried out alongside the normal renovation work, so that only the share of the cost of the energy saving measure has to be financed through the contracting budget. Moreover, costs equal to the initially intended standard measure can be met by the regular construction or maintenance budget. Thus, the revolving fund will cover only the extra cost needed for going beyond the legal requirements or for additional installations (e.g. burner replacement, CHP instead of standard boiler, cost differential of a CHP unit versus a boiler).
- **Partial financing, but all energy cost savings are recorded:**
  If an energy efficiency measure is an additional benefit of energy improvements in a renovation process, whose main purpose is a complete overhaul, energy savings are just a welcome side effect of a measure put in place anyway. Nevertheless, all energy cost savings of the renovation – compared to the conditions before – can be recorded for repayment. For example: replacing old single-glazed windows with new triple-glazed windows (double glazing is legally required, whereas triple glazing is an extra with an additional energy and comfort improvement).
- **Supplementary financing:**
  The revolving fund can also finance the remaining cost of energy saving measures which have received specific funding for other reasons (e.g. a grant for ecological criteria). In this case, the savings made by the whole measure are incorporated in order to determine the profitability of the part financed through Internal Contracting. This functions even if use of the other funding (grant) excludes an additional (external) subsidy, since, from a legal point of view, the Internal Contracting funding is still self-funding for the organisation, municipality or public authority.
- **Linking projects:**
  If the energy saving measure is not eligible to the revolving fund, but is simultaneously projected with a profitable measure and both measures are thematically linked in content or objectives, then bundling both measures should be considered. This means listing both investments under one identity, ensuring that the savings generated by the economic measure can pay back the investments of both measures. In most cases this is only possible if the "uneconomic measure" has significantly lower investment costs than the "economic measure".
- **Entire financing**:
  If financing and implementation of the energy saving measures cannot be combined with other processes (e.g. a photovoltaic installation on top of a new building), the revolving fund has to finance the total investment cost of the measure – including the preparatory work.

- **To keep the financial load on the revolving fund low and payback times short, all accessible sorts of co-financing should be considered to finance the investments.**

3.2.6/ Energy pricing

Taking **energy price increases** into account while calculating the profitability of a project seems to be reasonable, since energy prices usually tend to increase. However, price rises cannot be predicted with absolute certainty. Indeed, drops in energy prices occasionally occur. Therefore, assuming that energy price rises will boost the estimated economic outcome of a proposed project increases the risk of financial failure for the authority. Furthermore, a project that has performed better than expected, perhaps due to a rise in energy prices, is a better promotion for the contracting scheme than discovering that the payback period of a project has to be prolonged, because actual savings on energy costs are lower than expected.

- **Stay on the safe side, do not speculate on rising prices**

3.3/ Technical aspects

Prior to signing an Internal Contracting agreement, it is imperative that a thorough analysis of the potential for energy savings and cost-efficiency has been carried out.

3.3.1/ Identifying appropriate measures

Contracting success can be quickly achieved by focusing on easily realisable measures with low investments and short payback times. Usually these are measures which can be combined with normal renovation or general maintenance work. Thus, in the run-up to regular construction or maintenance processes it is recommended to investigate whether additional energy saving measures can be applied. Therefore:

- **Consult potential customers in charge of planning new construction, renovation, retrofits or maintenance about your scheme. Ask about what is on their schedule. Try to steer their investment decisions towards energy efficiency beyond the current standard by offering additional Internal Contracting funding**

Before the measure being considered is investigated in detail, a check needs to be made that the energy saving measure will not be the subject of, or affected by, a more significant retrofit or new construction, which could replace the whole installation before the investment of the measure is paid back.

To examine the profitability of a project, its economic parameters have to be determined. These are the investment cost and the resulting expected financial savings calculated by multiplying the energy savings and the cost per energy unit. The investment divided by the annual energy cost savings will equal the payback time. Another parameter is the operational lifetime of a measure, which depends on the durability of its technical parts.

If the calculated payback time is less than the operational life of the energy saving measure, then it is economically viable. If the payback time exceeds the operational life of the measure, it should not be considered further. Only projects with feasible investment costs and payback times are suitable for funding via Internal Contracting (see also section 3.2.2).

3.3.2/ Monitoring energy savings

Comparing energy bills of previous years before and after the implementation of energy saving measures might provide a first clue about a system's performance. It appears to be a straightforward process and a good option. Also this simple approach is transparent for (political) decision makers. But caution is needed: in such a scheme, paybacks for investments - financed via the Internal Contracting fund - might only be claimable if energy savings can be proven through actual cost reductions on energy bills. However, this takes no account of the fact that energy bills are the outcome of various financial and energy-related influences. For instance, an unforeseen higher usage of the monitored facility or increasing energy prices would obscure any costs savings achieved. Hence, a proper evaluation of the real performance of energy improvements requires a more precise approach.

- **Tracking the effect of measures means taking into account more than just a comparison of the figures on the bill: Monitoring energy savings entails comparing expected energy demands, which were determined before the energy retrofits, with actual energy consumption as soon as the improvements are operational.**

By doing so, the actual value of the efficiency measures becomes more visible. However, to evaluate the effects of an investment the following aspects need to be kept in mind.

- **Balancing precise metering of savings and the costs of metering devices**

Monitoring energy savings requires metering energy consumption. Local energy improvements should be measured within a close technical context, since overall energy consumption is the sum of many other additional influences (e.g. weather conditions) whose volatility may obscure savings. However, it is impossible to meter each energy-consuming element individually. In some cases, it has to be calculated using different available parameters (e.g. flow rate or temperature) and connected physical qualities (e.g. density, thermal conductivity and heat storage capacity).
From a financial perspective, overall metering of energy consumption seems sufficient, since energy meters themselves do not save any energy, but it should be noted that the cost of special meters to monitor energy savings have to be included in the energy retrofit investment. Therefore non-essential meters reduce the profitability of energy improvements. Consequently, investments in special meters often come under close scrutiny with a danger of being the subject of investment cost cuts.

- **An altered energy consumption pattern following a change in facility usage**

Expected demand is linked to the use of the monitored facility. Where energy

retrofits play a smaller role in bigger refurbishments, the use of the target facility may be reorganised causing a more energy-intensive use of it (e.g. more public visitors due to increased attractiveness of the facility) and consequently an increase in energy consumption – although the energy saving measure is operating properly. In such a case, the performance of the energy saving measure cannot be monitored without taking into account the change in usage. A proper evaluation might result in an unexpectedly higher specific energy efficiency (e.g. heat demand per visitor in a public pool).

Hence, the required type and number of meters to monitor energy savings has to be determined for each project individually. If a project ends up with energy performance that is significantly different than expected, an evaluation needs to be made of whether the particular energy consumer behaviour has changed, for instance due to a different use of the facility.

3.4/ Implementing and managing an internal revolving fund in a nutshell

Prerequisites for the introduction of Internal Contracting

- Ability to assess energy consumption and to investigate saving measures and potentials
- Initial funding needed to start investing in energy saving projects and create returns

Purpose of a revolving fund:

- Avoiding annual budgeting discussions
- Earmarking financial resources for energy saving purposes

Operational aspects and investment criteria:

- When selecting initial energy saving measures, focus on short payback periods and ensure that low hanging fruit is targeted first
- To avoid misuse of the revolving fund, it is important to ensure that it is not used for other purposes than saving energy costs
- Consult potential client departments on their project pipeline. Identify energy saving measures which could be added.
- The payback time of the measure must be shorter than the lifetime of its technical parts
- Investment and pay back flows have to be appropriate to the size of the revolving fund: If projects with a 5-year payback time are targeted, the budget allowance for the revolving fund should be at least 3 times larger than total annual expenses
- Lower expenses and shorten payback time by including other funding opportunities
- Stay on the safe side by calculating economic efficiency without energy price rises
- Payback-rates of Internal Contracting investments should not be rigidly linked to monetary cost savings on energy bills, but rather determined using a holistic assessment of all energy-related factors
- The more successful a fund is, the faster the low-hanging fruit is targeted. Consequently, the revolving fund should be continuously extended.

4/ Internal Contracting in practice – Case studies

The concept of contracting was first adapted and internally implemented by the City of Stuttgart as a financing tool. Here Internal Contracting proved highly successful at reducing energy and water costs, which prompted other cities and institutions to adopt this financing model.

Internal Contracting has been copied several times under different names, but it is not yet an extensively used instrument for financing public building renovation. Currently, the non-exhaustive list of authorities operating Internal Contracting schemes includes: Lörrach, Frankfurt, Bonn, the Federal State of Baden-Württemberg, Cork County, Litoměřice, and recently Infinite Solutions partners, the cities of Águeda, Almada, Koprivnica and Udine. Each organisation has adapted the idea of Internal Contracting including a revolving fund to its own context. These special features are highlighted in the following case studies presenting the individual Internal Contracting solutions of several public authorities, mainly municipalities.

Key figures	Stuttgart	Udine	Àgueda	Koprivnica	Almada
N° of inhabitants	607,000	99,000	47,800	30,854	169,700
N° of public buildings	1 315	250	45	45	357
Total surface area of the public buildings	2,337,000 m²	174,000 m²	50,042 m²	51,500 m²	130,000 m²
The public building sector's carbon impact	57,700 t (in 2014)	6,500 t	not available	not available	"around 18,000 t (around 4% of total emissions)»
When was the financing scheme set up?	1995	2015	2016	2015	"2016 (not revolving fund: 2009)»
Financial parameters					
Total energy and water costs	€ 66.9m (in 2013)	€ 4.3 m (energy)	€ 0.938 m(energy)	€ 0.9 m(energy)	€ 4.5 m(energy)
Size of revolving fund at start	€ 2.3m	€ 32,000	€ 300,000	€ 20,000	€ 500,000
Size of revolving fund by end 2016	€ 20.8 m (in 2015)	€ 32,000	€ 300,000	€ 84,000	€ 500,000
Ratio Seed Fund to annual energy cost at start	6%	1%	32%	10%	10%
External contribution to the fund? (if yes by whom and how much)	No	No	No	No	No
Business Model					
Who administers the Internal Contracting?	Energy department	Municipal Agency for Environmental Policies	Division of Environment and Sustainable Development	Operational team (Regional Energy Agency North director + 2 city representatives)	Energy department
Eligible measures	Already scheduled energy efficiency measures with cost benefits	energy efficiency measures cost benefits + 4 preconditions priority = SEAP measures	SEAP measures + 5 criteria	cost benefits + degree of urgency + financial opportunities	cost benefits
Investment range	few thousands € - €1.2m	€ 1,600 - € 24,000	€ 5,800 - € 145,000	€ 19,000 - € 45,000	€ 900 - € 250,000
Maturity - pay back period	between 3 and 25 years average 6-7 years	average : 48 months	4.23 and 7.35 years	6, 10 and 17 years	average : 2.9 years (3.9 years with previous fund)
Interest rate	0%	0%	0%	0%	0%
Consideration of energy prize changings	No	No	No	No	No
Profit sharing	No	No	No	No	Yes
Internal Contracting - eligibility criteria & conditions					
Entire financing of the measures	Yes	Yes	Yes	Yes	Yes
Part financing	Yes	No	No	Yes	Yes
Supplementary financing	Yes	No	No	Yes	Yes
Environmental bonus	No	No	No	No	No
Client departments					
Client departments	Municipal facility management department	Any municipal unit/department	Any municipal department	Any municipal department	Any municipal department
Results (by the end of 2016)	(by the end of 2015)	(jan 2015 - dec 2016)			
Part of the initial fund spent	several times already	all	all	all	all
Number of measures implemented	More than 340 agreements	8	2	3	3 (65 with previous fund)
Total investment	€ 20.8 m	€ 32,000 (€ 139,000 when adding pilot actions)	€ 150,836 + VAT (23%)	€ 84,000	€ 57,000 (around € 1.5m with previous fund)
Energy Cost savings	€ 22m (€ 31.7 m when taking into account energy prices' evolution)	€ 7,700 (taking into account constant energy prices and pilot actions)	€ 43,972	Not possible to measure yet	€ 20,000 (€ 1.2m with previous fund)
Cumulated Heat energy savings	264,000 MWh	47,700 kWh/year	502 MWh	Not possible to measure yet	71 MWh/year (3,285 MWh/year with previous fund)
Cumulated Electricity savings	56,000 MWh			Not possible to measure yet	
Cumulated Water savings (m³)	612,000 m³	(no water saving actions up till now)	(no water saving actions up till now)	(no water saving actions up till now)	(no water saving actions up till now)
Cumulated CO_2 reduction	132,000 t	22.6 t (taking pilot actions into account)	243 t	Not possible to measure yet	25 t (994 t with previous fund)
Specific features					
Specific features	Fully internal process	> Internal process > Some of the cost-benefit analysis are from external experts > Economic benefits feed the fund and are not shared with "client" municipal unit	No legal status	Managed by the regional energy agency	> changed in 2016 into a revolving fund >»Client» department gets shares of cost savings

Figure 12: Case studies overview table

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,

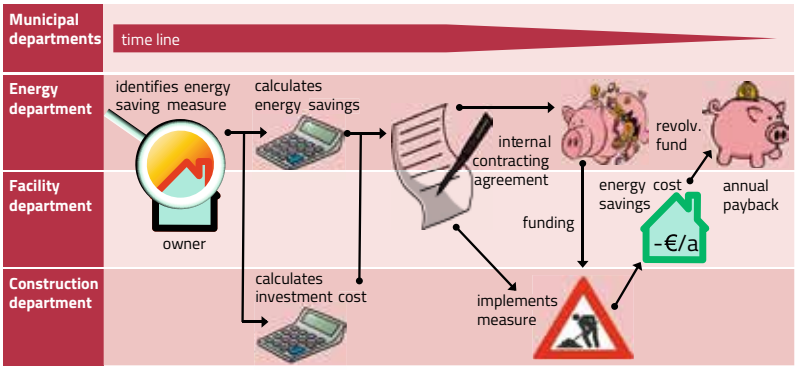

Figure 13: Stuttgart's Internal Contracting process

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

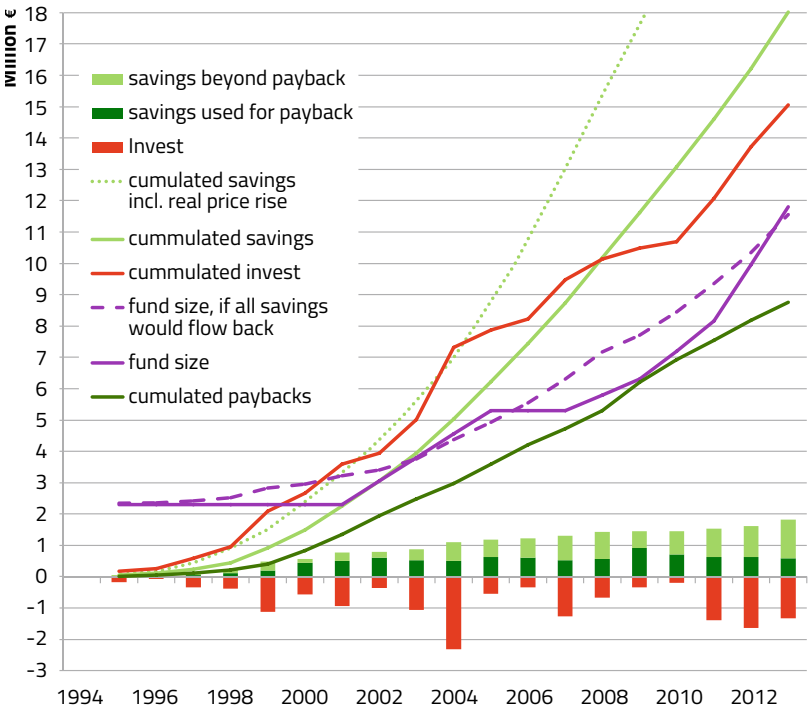

Figure 14: Development of Internal Contracting key figures in Stuttgart

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.

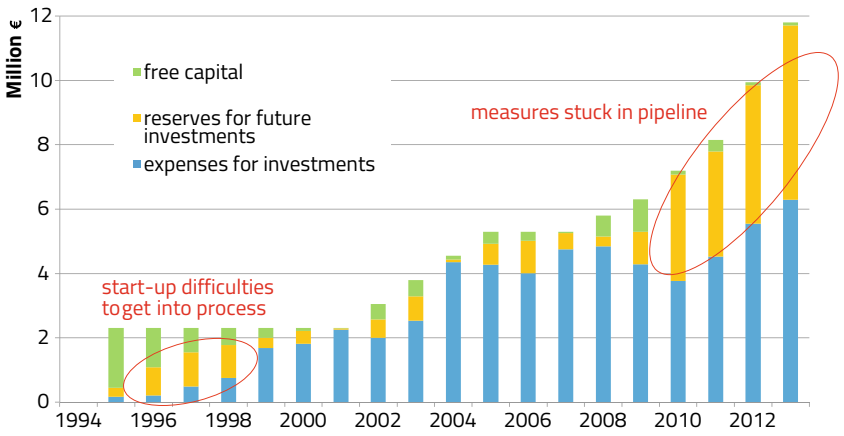

Figure 15: Development within the revolving fund of invested, contracted and free capital

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.

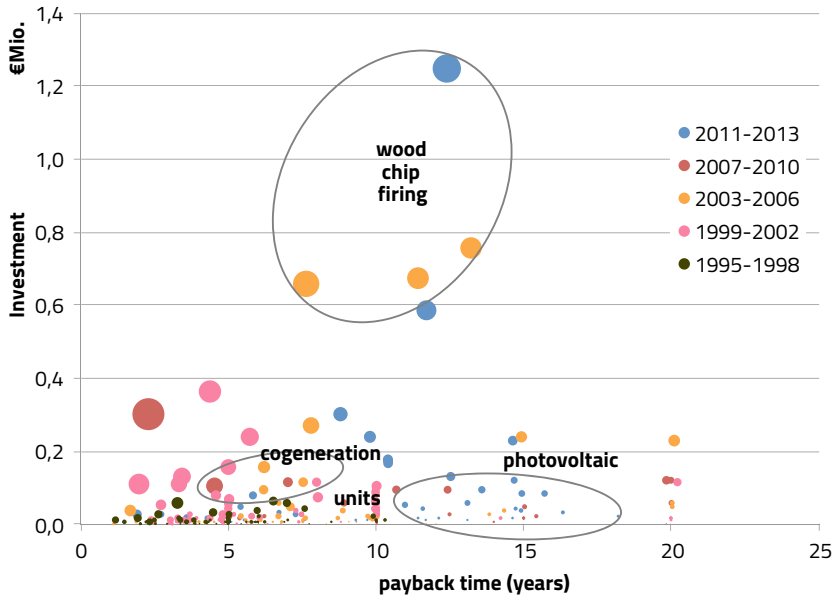

Figure 16: Financed measures in Stuttgart – Key parameters

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

Jürgen Görres - Office manager

Landeshauptstadt Stuttgart
Amt für Umweltschutz
Gaisburgstraße 4
70182 Stuttgart
Germany

Juergen.Goerres@stuttgart.de
www.stuttgart.de/umwelt

4.2/ Udine

4.2.1/ Udine's Internal Contracting scheme at a glance

KEY FIGURES
City surface: 56.8 km²
Inhabitants: 99,000
Municipal building stock:
250 facilities
Total surface area: 174,000 m²

Energy Consumption (2015):
Heat: 15,200 MWh
Electricity: 11,800 MWh
Water: 590,000 m³
total energy cost: € 4.3 m

REVOLVING FUND
Size of revolving fund: € 32,000
Ratio Seed Fund to annual energy cost: 1%
Number of measures implemented: 8
Investment covered:
€ 1,600 – € 24,000

Special features of Internal Contracting in Udine

Financing retrofit measures through the fund is not the only result of the city council decision. **New know-how, expertise and skills** have been developed both by Udine's municipal staff and other Italian local authorities the Agency is cooperating with. Moreover, new information about the energy consumption of the municipal buildings, equipment and facilities allows for better use of them.
The biggest challenge in Udine was raising the initial fund, due to the very tight budgetary situation of the municipality. Finally, it was possible to create the fund with income from the EEC's investment on the National Energy Market. Aware of the small size of the fund, the city is aiming to increase its amount. Council decision No. 272/2016 identifies the following sources

- financial savings resulting from lower energy bills and maintenance costs (€11,000.00 for 2016);
- incomes from the Energy Efficiency Credits investment on the energy market (€30,000.00 for 2016-2021);
- the entire amount of the investment money allocated to the annual City Budget for implementation of Udine's SEAP measures.

4.2.2/ Organisational structure

Udine, considerably smaller than Stuttgart, represents a 'typical' small to medium sized EU city. The fund was set up at the end of 2015. In Udine the initial fund size was €32,000. This sum was the city's budget income from the EEC's investment on the National Energy Market for the 2007-2014 period.

In Udine a new council by-law has very recently been passed. It states that the revolving fund will be the financial tool through which the authority will finance any SEAP measure. So the fund has changed its name from "Climate Fund" to "SEAP Fund".

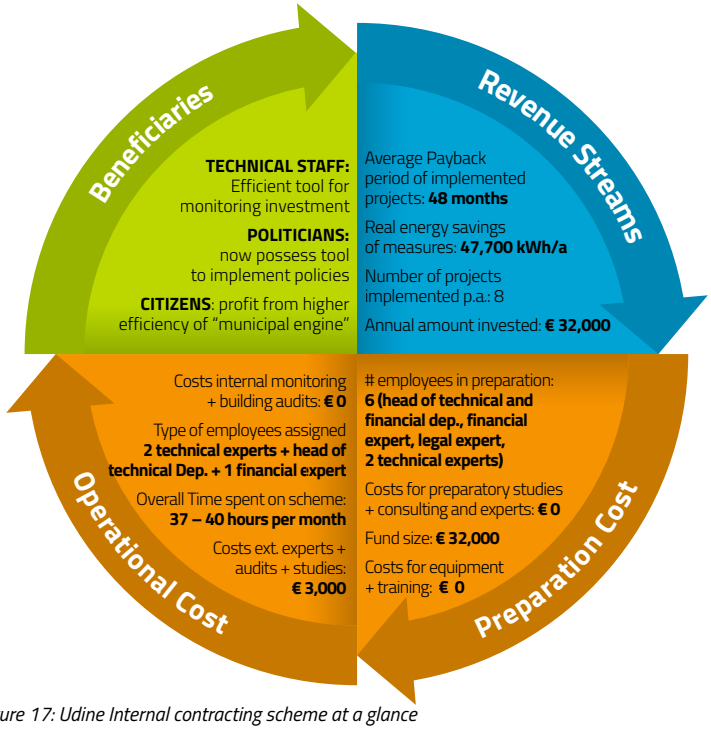

Figure 17: Udine Internal contracting scheme at a glance

4.2.3/ Management of the fund

In Udine technical management of the fund was assigned to the **Municipal Agency for Environmental Policies** that has the role of an Energy Service Company (ESCO). All municipal units and departments are invited to propose energy efficiency measures to be financed by the fund. The proposals are evaluated subject to a **cost-benefit analysis**, mandatory criteria and the amount available in the fund. The Agency implements the measures and calculates the financial savings achieved which are redirected back into the Fund. The City Authority decided to start the Fund with energy savings generated by four **pilot measures** implemented in 2015.

To set up the fund, a "core management team" comprising the head of the technical department, two technical experts, one financial expert, one political representative and two other external technical advisors was created and is still active today. However, the day-to-day business is now managed by the two technical experts.

The diagram below illustrates the business model and organisational functionality chosen for the Udine SEAP fund:

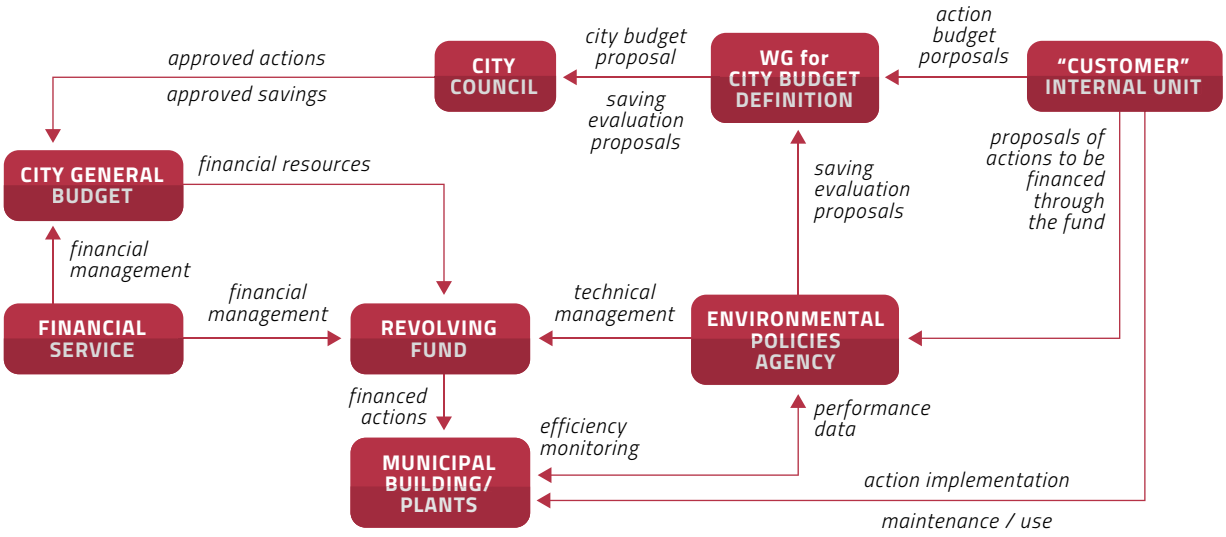

Figure 18: Business model and organisational functionality

Investment Criteria:
The City Council by-law No.289/2015 states that any measure financed through the fund has to fulfil four preconditions.

N.	Precondition	value
1	Reduction of CO_2 emissions (for retrofit measure only)	> 10%
2	Return On Investment (ROI)	< 10 years
3	Intervention lifetime / ROI	> 1
4	Energy saving (for retrofit measure only)	> 10%

As to the score assigned to each measure applied, this is calculated based on the following five criteria.

N.	Criteria	Maximum score
1	Measure covered by the SEAP action pipeline (y/n)	10 points
2	Reduction of CO_2 emissions (for retrofit measure only)	25 points
3	Return On Investment (ROI)	20 points
4	Intervention lifetime / ROI	10 points
5	Energy saving (for retrofit measure only)	35 points

4.2.4/ Measures financed through Internal Contracting

In Udine the economic savings are linked to the implementation of four pilot measures already financed in previous years through the City budget:

1/ Lighting plant renewal at "Parco della Rimembranza" - completed in 2015
2/ Lighting plant renewal at "viale Palmanova" overpass - completed in 2015
3/ New windows frames at "Forte" infant school - completed in 2015
4/ Roof insulation at "Fruch" primary school – completed in 2016

4.2.5/ Monitoring and evaluating the impact

In order to monitor the fund activity and evaluate performances, an annual document based on a cost-benefit analysis of each individual investment will be produced. The document will report the energy consumption performance measured during the months (12 if possible) following implementation of the investment. If consumption is higher than forecast, specific measures will be taken to ascertain the reasons for the discrepancy and restore proper operation. The measures may be technical (directly on the equipment) or "educational", focused on users' behaviour.

More information

Agnese Presotto
Office manager

u.o. Agenzia Politiche Ambientali
via Stringher 14
33100 Udine
Italy

agnese.presotto@comune.udine.it
www.comune.udine.it

4.3/ Águeda Fund

4.3.1/ Águeda's Internal Contracting scheme at a glance

KEY FIGURES
Municipality surface: 335.27 km²
Inhabitants: 47,800
Municipal building stock:
45 facilities
Total surface area: 50,042 m²

Energy Consumption (2015):
Natural Gas: 1,940 MWh
Electricity: 1,886 MWh
Water: 61,197 m³
total energy costs: € 0.938m

REVOLVING FUND
Size of revolving fund:
€ 300,000
Ratio Seed Fund to annual energy cost: 32%
Number of measures implemented: 2
Investment covered:
€ 5,800 – € 145,000

Special features of Internal Contracting in Águeda

The FEWE has no legal status and is formed by the transfer to a specific heading in the municipal budget, established for this purpose, of an initial amount of funding created by the Municipality, as well as extra financing necessary to attain the objectives. After the formal decision by the Mayor, the proposal is forwarded for implementation to the Division of Environment and Sustainability. The Fund is 100% financed by the municipal budget, with €300,000 as a seed, and by the water and energy savings.

4.3.2/ Management of the fund

Águeda is considerably smaller than Stuttgart representing a 'typical' small EU city. It is important to note that half of the cities in the EU have a relatively small urban centre of between 50,000 and 100,000 inhabitants.

Águeda City Council approved the Finance Scheme on the 15th of March of 2016. The revolving fund for energy and water efficiency (FEWE) was provided with an initial amount of €**300,000** from the municipal budget, and integrated into the 2015/2016 City Plan and Budget.

The fund is managed by a core team, composed of technicians specialising in different fields (from different operational and technical divisions), and has political supervision. In Águeda, the fund can only be used for the following situations:

a/ Eligible investments for the promotion of energy and water efficiency;
b/ Maintenance and preservation of such investments.

All municipal departments may present proposals to be included as an eligible investment in energy and water efficiency, and should provide all the necessary elements for the analysis of the proposals, in particular:

- Initial Investment (€);
- Energy Consumption Reduction (kWh);
- Expected CO_2 Emission Reductions (tCO_2);
- Estimated Payback (years);
- Maintenance Value (€ / year).

The applications must be forwarded to the Division of Environment and Sustainability (hereafter DV-AS) for information.

Investment Criteria:

The project proposals are evaluated accordingly:
1/ The project has to be part of the SEAP (Sustainable Energy Action Plan).
2/ Deeper evaluation based on specific criteria (weighting factor/score):
   - Payback (35%);
   - Energy savings (30%);
   - CO_2-emission reduction (15%);
   - Contribution to the CoM (Covenant of Mayors) or Mayors Adapt objectives (10%);
   - Innovation (10%).

Based upon the criteria each project is scored. Implementation of the project depends on its score and on the available funds. After the formal decision by the mayor, the proposal is forwarded to the corresponding Division.

The diagram below shows the use of the fund, which is described in Article 4 of the Internal Regulation of the Fund for Energy and Water Efficiency (FEWE):

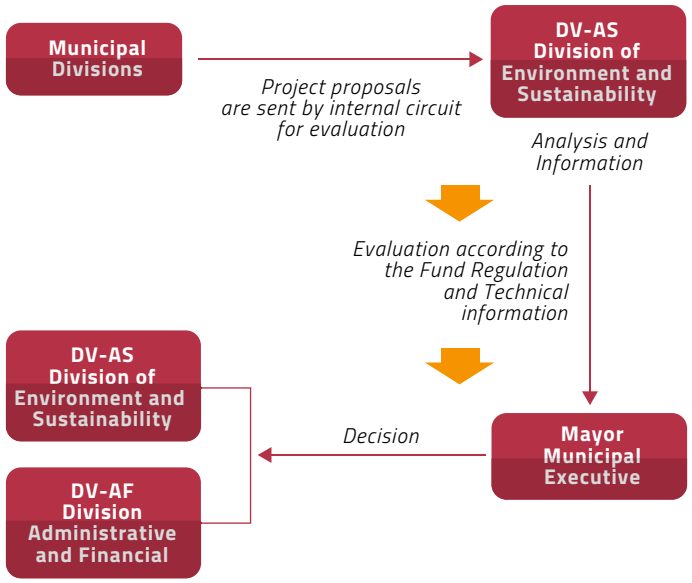

Figure 19: Diagram illustrating Article 4 of the FEWE Internal Regulation

4.3.3/ Measures financed through Internal Contracting

In Águeda prior to each measure first stage audits and local studies are carried out on energy and water efficiency measures for buildings.

The first Project financed by the fund was the **Wattguard System** installed in the Municipal Stadium. This system reduces the electricity consumed by the lamps and the range of the variation in current and voltage without changing the frequency, thus increasing light intensity by between 40% and 70%.

- Investment: €5,789 + VAT (23%)
- Energy savings: 9,660 kWh/a
- CO_2-emission reduction: 4t/a
- Payback: 4.23 years.

Figure 20: The Wattguard

Figure 21: Municipal Stadium in Águeda

The second project financed by the fund was the installation of photovoltaic panels, to be implemented in eleven municipality buildings: Municipal Library, 8 Schools, Municipal Stadium and Águeda Business Incubator.

- Investment: € 145,047 + VAT (23%)
- Energy savings: 209,900 kWh/a
- CO_2-emission reduction: 75,500 t/a
- Payback: 7.35 years.

Figure 22: Two different buildings with UPAC installed
top: Municipal Stadium, bottom: Fernando Caldeira school

The electric power production units called "Self-Consumption Production Units" (UPAC – Unidade de Produção para Auto Consumo) will reduce electricity costs associated with the operation of the selected buildings.

4.3.4/ Monitoring and evaluating the impact

Figure 23: Águeda Energy and Water Fund in figures

In Águeda all the municipal facilities will have smart meters to monitor and evaluate the impact of the implemented projects. A platform has also been created: the FEWE Platform (http://fee-agueda.irradiare.com), via which they can control the energy consumption reduction, CO_2 emission reductions, savings and the remaining value of the FEWE in all buildings.
If any measure does not work as expected, it will be investigated to find the reason why, and solutions will be found to improve the performance.

More information

Célia Laranjeira
Project manager

Municipality of Águeda
Division of Environment and Sustainable Development
Praça do Município
3754-500 Águeda
Portugal
Tel: +351 234 610 070

celia.laranjeira@cm-agueda.pt
dv-as@cm-agueda.pt
http://fee-agueda.irradiare.com

4.4/ Koprivnica Fund

4.4.1/ Koprivnica's Internal Contracting scheme at a glance

KEY FIGURES
City surface: 91 km²
Inhabitants: 30,854
Municipal building stock:
45 facilities
Total surface area: 51,500 m²

Energy Consumption (2015):
Heat: 6,700 MWh
Electricity: 4,100 MWh
Water: 59,000 m³
total energy cost: €0.9m

REVOLVING FUND
Size of revolving fund: €84,000
Ratio Seed Fund to annual energy cost: 10%
Number of measures implemented: 3
Investment covered: €19,000 – €45,000

Special features of the Internal Contracting in Koprivnica

Koprivnica is different from the other cities mentioned in this report: there were no "low-hanging fruit" investments, which means that the revolving fund had to be larger, and replenishing it takes longer:

- **In this case, the use of external co-financing sources is needed**

Koprivnica's fund is managed by the regional energy agency. This may lead to the creation of a larger regional fund covering projects for many municipalities.

Moreover, the creation of Koprivnica fund has inspired other public institutions, such as General County Hospital "Dr. Tomislav Bardek" Koprivnica with its €500,000 fund.

4.4.2/ Management of the fund

Like Águeda, the City of Koprivnica is a 'typical' small EU city. The initial fund size was €20,000. During its first year of operation the fund grew to €84,000 as the city assigned more money for two new projects in 2016.
In Koprivnica the team included representatives of the city and the Northern Regional Energy Agency. The appointed representatives were responsible for contributing to the establishment of the Fund using their competences in the field in which they operate. Specific skills required to set up the Fund were related to the area of public finance, the relevant legislative framework, local government administration and technical areas related to assets and energy. Today the fund is managed by an operational team that consists of three members whose decisions are made based on a majority vote. The members are the:

- Managing director of the REAN Agency
- Head of the administrative department of finance, the promotion of entrepreneurship and utility management
- Head of the administrative department of social services and European affairs

Based on two analyses carried out during the set-up period, the Agency prepared an initial short and long term plan for the fund. In the future, all planning, including annual and multi-year plans as well as decision-making will be made by the Operational team that has an obligation to meet at least once every three months.

The annual plan will be defined before the adoption of the budget for the coming year and it will contain a list of all the projects (with at least the anticipated investment cost) that will or could potentially be implemented in the coming year. The criteria for the nomination of projects into the annual plan are as follows:

- The cost-efficiency of the project
- The degree of urgency of the project
- Financial opportunities
  - Financial savings from previous projects
  - City budget
  - Availability of external sources of (co)financing

In addition to the annual plan, the Operational team will be creating a multi-year plan that will cover a 3-5-year period and all potential projects that could be implemented during that period. Both plans may evolve.

The project documentation development process will be improved as a cost-optimal analysis will be integrated in all future project planning and designs while decisions for the nomination of projects will be supported based on the following:

- Total investment in Croatian Kuna (HRK, national currency)
- Calculation of energy savings
- Period of return on investment (based on current prices)
- Annual savings in HRK and kWh
- Annual maintenance
- The duration of the investment/ project

4.4.3/ Measures financed through Internal Contracting

The first project in **Koprivnica** that was financed through the Fund was retrofitting the lighting system of the A.N. Gostovinski primary school.

- Old situation – fluorescent and filament lighting; initially installed in 1990
- New situation
  - LED technology
  - Sensors

The investment cost €20,000.

Figure 24: New lighting system (LED) at A.N. Gostovinski primary school

The second investment of the Fund was the installation of a new HVAC system at Koprivnica open university.

- Old situation – 170 kW gas heating boiler initially installed in 1973, no air conditioning
- New situation – 49 kW condensing boiler, 41 kW air/air heat pump, new ventilation chambers, heat recovery

The investment included thermal insulation of the ceiling planned as a subsequent measure as this measure triggers additional energy savings at a very low cost.
The investment cost €45,000.

Figure 25: New air-conditioning chamber at Open university

Figure 26: Retrofitted heating system at the library

The third investment was retrofitting the heating system at the "Fran Galovic" library and "Velebit" movie theatre.

- Old situation: two low-efficiency and oversized natural gas boilers installed in 1997
- New situation
  - One condensing boiler
  - Improved insulation of thermal fluid supply system
  - New distribution pumps

The investment cost €19,00.

4.4.4/ Monitoring and evaluating the impact

In Koprivnica the financial savings generated by the energy projects implemented will be calculated by the Agency based on the technical project documentation developed for each individual project. For evaluation purposes the Agency will prepare a revolving project report for each individual investment and these reports will be used by the Operational team for planning and by the administrative departments of the city for defining their budget. Changes in the cost of energy will not affect the replenishing process since the payback of each project covers the entire life time of the investment.

More information

Boris Kuharic
Project manager

Regional Energy Agency North
Miroslava Krleze 81
HR-48000 Koprivnica
Croatia

boris.kuharic@rea-sjever.hr
www.rea-sjever.hr

4.5/ Almada's Climate Fund

4.5.1/ Almada's Internal Contracting scheme at a glance

KEY FIGURES
City surface: 76 km²
Inhabitants: 169,700
Municipal building stock:
357 facilities
Total surface area: 130,000 m²

Energy Consumption (2015):
Electricity: 26,000 MWh
total energy cost: €4.5m

REVOLVING FUND
Size of revolving fund: €500,000
Ratio Seed Fund to annual energy cost: 10%
Number of measures implemented: 3 (65 with previous fund)
Investment covered: €58,000

Special features of the Internal Contracting in Almada

In 2009 the "Almada Less Carbon Climate Fund" was setup. It aimed to reduce Almada's carbon footprint by financing energy efficiency and renewable energy investments. After the first seven years of successful operation, and leveraging over € 1.5m of investment for energy efficiency and renewable energy, in 2016 it became a revolving fund.
The most important innovation of the fund is the 'shared benefits' approach which encompasses different sharing schemes linking the fund and the "client department" based on the characteristics of the project. This ensures that the fund is replenished and gives extra motivation for different departments to invest in energy efficiency projects. It is also important to ensure monitoring of the measure since a non-compliance procedure is included, and the client departments can lose the shared benefit or even have a penalty imposed on their budget if they fail to operate the system correctly.

4.5.2/ Almada's Climate Fund (r)evolved

Almada's Local Strategy for Climate Change contains a number of measures targeted at reducing the energy consumption of buildings and the transport sector. To support these measures, the "Almada Less Carbon Climate fund" was created in 2009 and it is supported by a specific budget line for energy efficiency and renewable energy investments dependent on an evaluation of the CO_2 emissions from the municipal activities from the previous year (not a compensating mechanism but linking and making the connection between emissions, energy and investment). It supports local energy efficiency investments, serving as a benchmarking instrument for the measures of other key players in the mitigation of GHG emissions, from both the public and private sectors.

After seven years of successful operation, the fund is now being redesigned and upgraded to become a revolving fund. This means that the cost savings resulting from implemented energy efficiency measures will be returned directly to the Fund, ensuring leverage of the fund and boosting further investments in a clean energy transition. This new development is summarised in the image below:

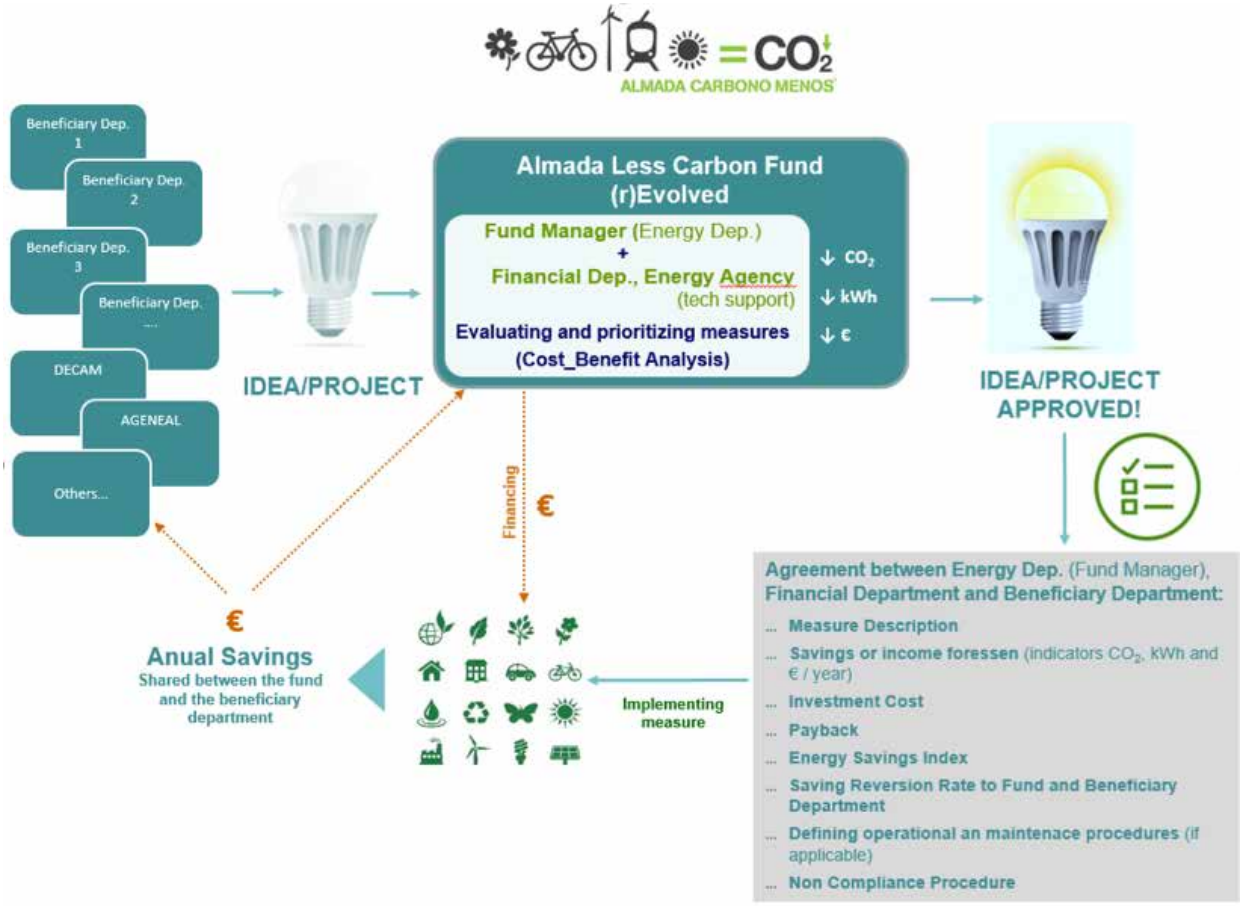

Figure 27: Almada Less Carbon Fund's business model

The most important innovation of the fund is the 'shared benefits' approach which assumes different sharing schemes between the fund and the "client department" based on the characteristics of the project. The main assumptions and objectives are to ensure the sustainability and a leverage effect of the fund, automatically prioritising the most cost-efficient projects, and to directly benefit the "beneficiary department". This will be done by increasing the budget of the "client department" on year+1 investment and increasing the fund in a shared proportion in line with the savings. The need to directly benefit the "client department" comes from the fact that the energy bills are paid for by the financial department and not directly by the "client department's" budget. Conversely, the financial department will see its budget decreased in the same proportion as the savings.
For a project with a very high return on investment the proportion of savings to the fund and client department will be 50/50 until the end of the project lifetime. This ensures that the fund is reimbursed and gets extra funds if the payback time is small and the project lifetime is longer.

The basic idea of the scheme is to maintain the initial structure to ensure continuity of the existing mechanism and financial flows, whilst including a revolving procedure. In order to build upon the work already developed and also to minimise risks from projects where energy savings do not generate large amounts of savings in monetary terms, a hybrid solution has been developed. This solution uses the existing mechanism but mimics the inflow to the fund of energy savings and an outflow to "client departments" based on the result of the projects. Everything is based on the same dedicated budget line for the fund which is used exclusively for energy efficiency and renewable energy investments.

4.5.3/ Core Team

The core team of Almada's Climate Fund functions within a four layered framework:

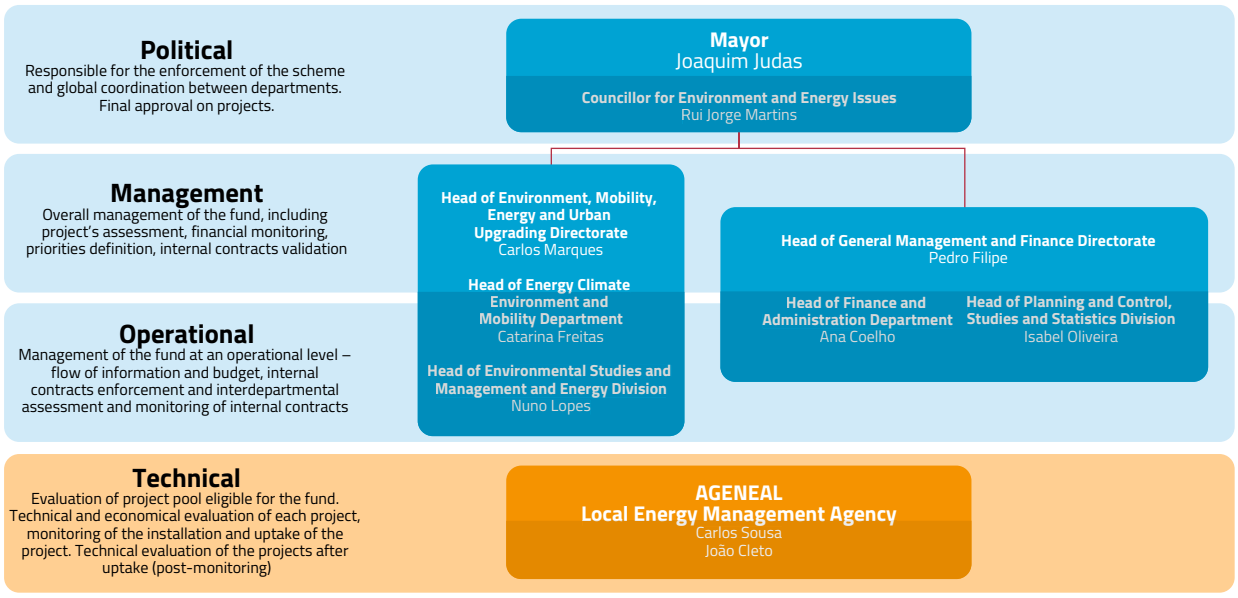

Figure 28: Core team of Almada's Climate Fund

4.5.4/ Legal Organisation and fund characteristics

Operation of the revolving fund will be based on the following pillars:

- Internal procedure which includes an analysis of energy bills, energy audits, an agreement on implementation of measures, investment and annual monitoring.
- Internal performance agreement which includes an energy savings index, the benefits sharing scheme, the duration of the financial flows and the definition of the non- compliance procedure. The agreement is signed between the fund managers and the client department (any department of the municipality).
- **"Shared benefits approach"** Energy cost savings are monitored and centralised by the financial department which pays the beneficiary department.

The standardised internal procedure is made via a five-step approach according to the following information flow:

- **Step 0**: Energy Bill/Energy Audit > Proposal of measures and cost benefit analysis – CO_2, kWh, € (Energy Agency + Energy Department +Financial Department) – check partial or total funding. The "Client Department" can suggest measures.
- **Step 1**: Agreement on the implementation of measures > Energy Department +Financial Department and "client department"
- **Step 2**: Agreement signature > includes definition of measures, expected savings, Payback Period, Energy Savings Index, Benefits Sharing Scheme, penalties for non-compliance
- **Step 3**: Investment made by climate fund
- **Step 4**: Monitoring of measure and annual evaluation

The internal contract is agreed upon with all the departments and has the following structure:

- **Measure**: Definition of measure, expected savings (kWh, €, CO_2), payback time, lifetime -
- **Energy Savings Index**: Based on lifetime/payback time ratio, which should be bigger than 1 (evaluate exceptions for ancillary benefits, pilot projects, opportunities)
- **Benefits Sharing Scheme**: Percentage of savings going to fund (X) and to client department (Y). The greater the energy savings index the higher the percentage to the client department.
- **Financial Flows**: Budget for year+1 increased by X to the fund, Y to client department and –(X+Y)=Z to the financial department.
- **Duration of finance flows**: Lifetime of measure – ensure refunding and leveraging of the fund
- **Non-compliance procedure**: Requirements for operation defined. If "client department" does not operate correctly no compensation for year of faulty procedure. If faulty procedure persists, a penalty will apply to the following year's budget (-X).

To calculate the above parameters one should take into account that the following:

- Forecast energy savings and/or revenues from the measure (€/year) - **PT**
- Investment Cost (€): **I**
- Payback time (years): **[PRS = I/P]**
- Energy savings index: **[FEE = lifetime of the measure/PRS]**
- % of savings paid to the fund: **[TRF = 1/FEE]** - The percentage of savings paid into the Fund is in inverse proportion to the energy savings index. The lower the index, the greater the % paid into the Fund, limited to a maximum of 95% and a minimum value of 50%;
- % of savings paid to the beneficiary department: **[TRB = 1 - TRF]**

The financial flows affecting the departments' budgets in the years following the implementation of the measure are calculated as follows:

- **Financial Department Budget**: - PT PT are the forecast energy savings and/or revenues from the measure. The financial department will not have to pay this part of the energy bill, so the budget can be reduced.
- **Client Department Budget**: + PB (preferable on budget line dedicated to investment) PB is the savings in € paid to the beneficiary department budget and equals PT x TRB
- **Energy Department (Fund Manager)**: + PF PF are the savings in € paid to the beneficiary department budget and equal PT x TRF Note: PT = PB + PF

These values will be repeated until the end of the number of years of useful life of the investment: the greater the number of years of useful life of the investment and the lower the payback time, the greater the potential repayment and leverage of the Fund.

This procedure may seem complicated, but looking at the specific example of Exterior LED lighting on the Modern Art Museum (implemented in 2016) makes quite clear how all the flows work:

Data for the measure

Beneficiary	Investment (I)	Savings (PT)	Lifetime (v.u.)	Payback (PRS)	Energy Savings index (FEE)	% savings to the fund (TRF)
Cultural Department	€11,000	€6,360	10,0	1.7	5.8	50%

Annual Financial flows (from 2017 over project lifetime)

Year	To the fund (PF)	To the Culture Department (PB)	From the Financial Department (-PT)
2017	€3,178.29	€ 3,178.29	€- 6,356.57

4.5.5/ Measures in the pipeline for testing in 2016/2017

In 2016, a set of three measures were selected as frontrunners for a test of the revolving fund scheme in Almada:

Contemporary Arts Museum - Casa da Cerca – Exterior LED Lighting

Energy Savings	48,270 kWh/year	☺☺☺
Savings	6,275.14 €/year	☺☺☺
Avoided Emissions	18,825 kg CO_{2eq}/year	☺☺☺
Investment	€ 12,364.59	☺
ROI	2.0 years	☺☺

Several municipal facilities – power factor correction

Energy Savings	248,333 kVArh/year	☺
Savings	13,316.00 €/year	☺☺☺
Avoided Emissions	N/A	
Investment	€ 19,370.00	☺
ROI	1.5 years	☺☺☺

Parque da Paz - Solar Photovoltaics and Solar Hot Water

Energy Savings + Production	23,366 kWh/year	☺☺
Savings	2,747.15 €/year	☺☺
Avoided Emissions	6,243 kg CO_{2eq}/year	☺
Investment	€ 26,165.00	☺
ROI	9.5 years	☺

Figure 29: Solar thermal installations in Parque da Paz

The amount of money available each year still means that other measures can be included after the test phase. Some of them have already been quantified, studied and will be implemented. They include:

- Public Lighting: Expanding the point to point remote control system, flow reduction with remote control at branch level (groups of light points instead of point to point), flow reduction with multilevel electronic ballasts and LED lighting replacement
- Innovation, energy efficiency and renewable energies in public buildings, schools and social housing stock
- Electric vehicles for the municipal fleet
- Photovoltaic projects of a significant scale, mini-production or photovoltaic energy production centre
- Efficient lighting in historical monuments.

More information

João Cleto, Project manager

AGENEAL,
Local Energy Management Agency of Almada
Rua Bernardo Francisco da Costa, 44
2800-029 Almada / Portugal

joao.cleto@ageneal.pt
www.ageneal.pt

Catarina Freitas
Head of Energy, Climate, Environment and Mobility Department

Municipality of Almada
R. Bernardo Francisco da Costa, 42
2800-029 Almada / Portugal

almada21@cma.m-almada.pt
www.m-almada.pt

5/ Conclusions

- **Cities and regions are key actors in the global fight against climate change**.

International commitments such as those resulting from COP 21 (2015, Paris) and the European energy and climate long-term objectives will only be achieved if measures are taken at the local level, which means an increasing number of European cities and regions voluntarily committing to achieving these goals.

Budgetary constraints, including the internal financial organisation of many authorities, have often blocked useful and necessary energy-saving investments, an obstacle local authorities' technical services have rarely been able to overcome despite the proposed energy-efficiency measures being economically viable. The economic and environmental crisis is forcing local authorities to find new ways to act and take responsibility for their energy and water use.

Energy and water-saving measures in municipal buildings can be financed in many different ways. There are a great number of possibilities and each has its positive and negative aspects that have to be considered in view of the specificities of each local authority. The implementation of energy-saving measures often fails because of lack of funding or because other financing options cannot be tested, even though it is apparent that reduced energy costs generate financial resources which could be used to finance other investments. The challenge is therefore to adopt a project financing model that is both economically viable in the short term and capable of generating energy savings. The authors of this guidebook recommend the concept of Internal Contracting.

- **Internal Contracting offers several advantages compared to external energy performance contracting**

In comparison with contracting with external partners, Internal Contracting has a number of advantages at administrative, legal, financial and technical levels. Internal Contracting
- avoids the effort associated with organising a tendering process for external contractors. Thus, measures can be implemented rapidly.
- can be used to finance small-scale projects unlikely to be of interest to energy service companies (Ie.g. heating regulation systems - a measure costing 2,500 euros).
- is compatible with a holistic investment strategy, aiming to finance the economically most sustainable measures for the municipality – not the most profitable ones for the external contractor.
- enables the municipality to keep its freedom of choice in relation to equipment and building use, with no need to consult an external partner. Low risk of disputes arising from the quantification or characterisation of energy savings or from the estimation of savings not recorded by dedicated meters (e.g. a change in building use does not require renegotiating the agreement).
- strengthens internal expertise and competences – instead of depending on the know-how of an external contractor.

By rethinking energy and finance issues holistically, the public authority will acquire better knowledge of its energy needs and necessary investments in energy retrofits. This first-hand know-how will enable the public authority to develop and pursue an individual investment strategy, independent of the profit objective of an external contractor. The public authority will thus become a true energy player, able to assume its function as a role model for society to progress towards energy transition.

- **Internal Contracting has proven its reliability and robustness**

The concept was first introduced in Stuttgart in 1995, and Stuttgart is still by far the most advanced and experienced city in Internal Contracting. It was originally designed to finance small to medium-scale energy efficiency measures. The scheme then evolved to finance larger-scale measures with longer paybacks. Internal Contracting can be a useful tool to finance the measures of a **holistic strategy for energy retrofits of public authorities building stock**. The concept has been copied several times under different names, but Internal Contracting is still not an extensively used instrument for financing public building renovation. It is mainly used in Germany.

- **The Internal Contracting scheme is also a model for other public authorities**

Collaboration with the Caisse des Depôts and the Federal State of Baden-Württemberg has shown that the Internal Contracting scheme is not only a financing tool for local authorities but also for other public bodies like universities, hospitals or museums. Such bodies often manage more buildings than small local authorities. Quite often their potential for energy saving measures with short payback times is also high due to the fact that energy costs have not been a priority or the saving potential was not visible because energy management was not yet well implemented. For this reason, two French universities became associated partners of the INFINITE Solutions project. The French bank Caisse des Depôts has also set up a support programme to help public authorities implement Internal Contracting. Several public authorities in France have shown interest in the programme and in applying the scheme.

- **Internal Contracting needs specific adaptations to the local context**

Infinite Solutions has brought together municipalities of various sizes: Stuttgart as a major city with a highly structured large organisation as well as Udine, Almada, Águeda and Koprivnica as intermediate or small cities with a respectively lean structure. Since Internal Contracting is simply meant to establish entrepreneurial mindsets in terms of energy retrofits within public authorities, "size" is no criterion in deciding whether public authorities should apply this concept. However, the concept of Internal Contracting needs to be adapted to the individual local context.

For intermediate cities, like Udine and Almada, with populations of 100,000 and over it is relatively "simple" to transpose the "Stuttgart model" as the structure of the authority and the possibilities to work with related city companies and associations are quite similar. The main problem is, in these times of lasting economic crisis in Southern Europe, to convince the city council of the benefits of the scheme and in particular to allocate the initial budget for the revolving fund.

In small cities with populations of fewer than 50,000 as it is the case for Águeda and Koprivnica (via REA Sjever as a partner in the INFINITE project), the situation is different. The authority is much smaller, several services/departments are managed by the same staff and under the mayor's direct authority, so the business model needs to be setup differently; the agreement to be signed between the different city departments also has to be different as the whole procedure is managed by one single service (in Águeda) or an external expert (REA Sjever). Long-term robustness is also more difficult to guarantee as there will be only a limited number of measures with a short pay-back time.

- **Internal Contracting requires a suitable environment**

To be used by regional and local authorities and other public players (e.g. universities, military) Internal Contracting requires an internal unit in charge of energy management, equipped appropriately to monitor energy consumption and with qualified staff, able to monitor energy use. This unit needs to be commissioned to investigate energy saving potentials and to suggest investments for energy efficiency improvements as well as to supervise their implementation.

- **Internal Contracting requires a minimum initial budget**

In order to introduce the scheme successfully a minimum budget is needed. This guidebook proposes two ways to determine the appropriate initial amount.

In Section 3.2.2 the required budget was expressed as a function of the cost of annually planned investments in energy saving measures. Thus, this approach is built upon the ability to realise measures. Some knowledge of the figures and experience with the procedures of the facility involved is needed to calculate a specific monetary value for the initial budget with this "bottom-up"-method. Nevertheless, it can be a useful tool (e.g. for an energy manager) to justify the amount needed for an initial budget when requesting it.

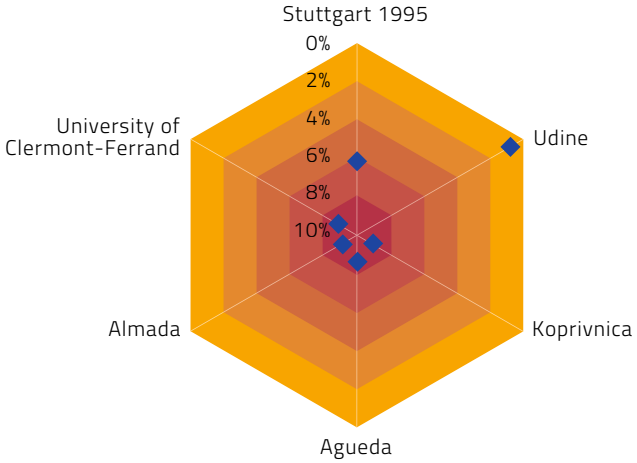

Figure 30: Initial fund to annual energy costs ratio

Regarding the purpose of an Internal Contracting scheme, namely saving energy costs, it is reasonable to set the initial budget for the revolving fund in relation to the annual energy costs of the local authorities' building stock. Figure 30 shows this ratio for partners and associated partners of the Infinite Solutions project (see also key figures of the case studies in Chapter 4).
The values for the initial budgets, shown in Figure 30, result in 1-10 % of the annual energy costs of the local authorities. Stuttgart has proved that a value of 6 % is a good foundation for a long-lasting Internal Contracting operation. Therefore, the authors of this guidebook recommend setting the monetary value of the initial budget for the revolving fund at no lower than 5 % of the annual energy costs of the local authorities' building stock.
If the fund size is too small the whole fund is at risk either of being spent in the first year – no capital would remain for investment in the following years, since paybacks are likely to be low – or of being ineffective with a non-determinable impact on energy consumption. Thus, the long-term success of Internal Contracting would not be demonstrable (e.g. to the city council).

Proposal: public funding for Internal Contracting schemes

Previous EU funded projects (e.g. PICO) focusing on setting up revolving funds failed - either the fund was never set up or it was reintegrated into the ordinary city budget after a short while. As to the cause of these failures, the authors of this guidebook suspect mutually reinforcing difficulties in allocating a significant initial budget and sustainably implementing the transversal concept of Internal Contracting in traditional public authorities with cameralistic accounting and strict action rule, associated with highly segmented organisational structures and staff tasked with fulfilling one-dimensional duties only. If not lastingly removed, these barriers may well undermine operating a formally correctly implemented Internal Contracting scheme.

The authors of this guidebook are convinced that external subsidies would not only solve the challenge of financing the initial budget for the revolving fund, but would also help overcome internal resentments, leaving the way free to implement, operate and "live" Internal Contracting within the public authority. We therefore propose a public funding programme for the implementation of Internal Contracting schemes which includes the requirement to prove the existence of a conducive and viable environment for the scheme within the organisation.

The programme should finance the initial budget for the revolving fund providing about 5 % of the annual energy cost of the individual organisation applying for the programme (for small municipalities an absolute minimum amount is worth considering). The subsidy should only be given, if the applicant:

- operates an effective internal energy management system
- has sufficient numbers of skilled staff to operate the scheme and to implement the measures
- ensures that the paybacks determined will flow back to the revolving fund
- assures that the lifetime of the scheme will not depend on traditional budget periods
- presents a plan to administer the revolving fund sustainably, e.g. by delivering a schedule of investments and paybacks for the initial years of its operation

The French bank Caisse des Depôts has set up a support programme for implementing Internal Contracting in public authorities, which follows these recommendations.

6/ Appendices

6.1/ Council resolution

Example:

Intention

a/ A permanent budget with a total volume of 3 million Euros is provided for special measures to reduce energy consumption and save energy costs in municipal buildings.

b/ The budget is provided in accordance with the actual demand. The initial budget is 1 million Euros.

c/ The budget is controlled by the energy management department.

Inducement

Since the budgets for investments and energy costs are managed separately, the income derived from the energy cost saving measures does not return to the budget which has financed the investments. As a result, economic measures for saving energy often cannot be realised - or only with a delay, because the necessary capital cannot be provided in time.

There is a need for a financial scheme, which allows a quick realisation of economic measures aimed at saving energy and energy costs. It is recommended that a special budget be set up to finance these measures and to collect the resulting savings until the budget is refinanced. The advantage of this internal financing scheme compared to external financial sources is that interest and additional costs for risks and profits can be dispensed with. Only the actual investment costs have to be taken into account.

The following working model is proposed to realise and refinance investments in energy saving measures: The energy management department submits a measure for saving energy in municipal facilities. It calculates the recoverable reduction of energy costs. The construction office plans the implementation of the investment and calculates its costs. The measure gets realised if the calculated energy cost savings can pay off the proposed investment within its technical lifetime. In this case the energy management department uses the budget, which is proposed by this resolution, to finance the measure. Measures which do not exclusively save energy and reduce energy costs (e.g. insulation) get partially financed. To refinance the budget for energy savings the energy management department sets up an arrangement with the municipal unit which will benefit from the expected energy cost savings (see Appendix 2). After implementing the measure by the construction office, the energy costs saved every year return to the energy management department until the investment is paid off. The model is illustrated in Figure 1.

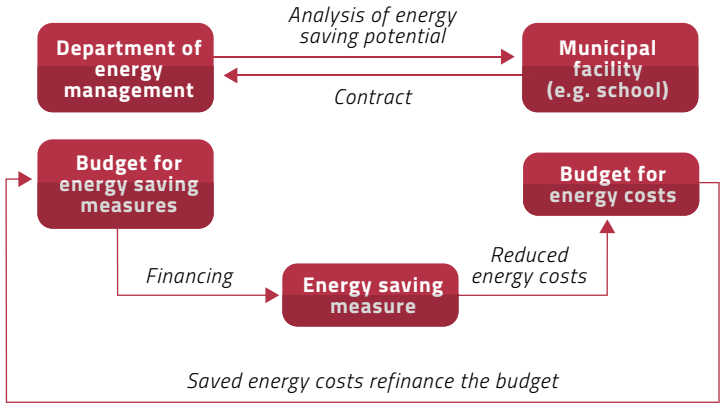

Fig 1: Working model to quickly finance and refinance energy cost saving measures

This financing scheme includes the budget responsibility and the cost-awareness of the municipal units involved. The energy management department initiates and coordinates the energy saving measures and controls the budget for the energy saving measures autonomously.

Financial outcome

The intention of this resolution is to provide the energy management department with a budget of 3 million Euros for energy savings in line with actual demand.

The energy management department proposes energy saving measures which require 900,000 Euros in one year and a payback period of 5 years (see Appendix 1). Another 100,000 Euros are needed for unforeseeable minor short-term measures. Assuming investment and payback time for energy saving measures remain at the same level Table 1 shows financial demand, cash return and the budget of the proposed financial scheme for the first 6 years after implementation. In year 1, the first measures are implemented. The payback starts in year 2. In year 6 there will be 6 million Euros invested in energy savings and no further subsidy from the city's general budget is necessary to run the financial scheme and to invest 1 million Euros in energy saving measures every year.

To realise the predicted energy savings and the payback flow it is important to carefully analyse the energy savings potential and investment costs before starting to implement a measure. Every individual case has to be investigated separately. This is the requirement to run the proposed financial scheme sustainably since the budget is limited to 3 million Euros.

If the payback time is significantly shorter than the technical lifetime of the measure, the subsequent energy costs savings remain as free resources in the budget of the municipal unit which was affected by the measure. This can be an incentive for the municipal units to participate in this energy and energy costs saving model. This financial advantage can be given in advance by reducing paybacks – to a sum that is lower than the yearly savings (e.g. 80%). However, this extends the payback period.

YEAR	FINANCIAL DEMAND	BUDGET	INVESTMENT	PAYBACK IN YEAR					
				1	2	3	4	5	6
	€	€	€	€	€	€	€	€	€
1	1,000,000	1,000,000	1,000,000	-	200,000	200,000	200,000	200,000	200,000
2	800,000	1,000,000	1,000,000		-	200,000	200,000	200,000	200,000
3	600,000	1,800,000	1,000,000			-	200,000	200,000	200,000
4	400,000	2,400,000	1,000,000				-	200,000	200,000
5	200,000	2,800,000	1,000,000					-	200,000
6	-	3,000,000	1,000,000						-
total	3,000,000	3,000,000	6,000,000	-	200,000	400,000	600,000	800,000	1,000,000

Tab 1: key figures of the financial scheme

6.2/ Agreement model

Agreement

No.

between the following parties:

the Energy department
and
the "client" department, namely
regarding
the provision of financial resources
for energy saving measures

1/ Preamble

The Energy department has been endowed with a municipal budget line to finance energy saving measures in municipal buildings. The objective is to achieve rapid implementation of these measures.

2/ Location and description of the measures

Location:
Description:

3/ Funding

Total cost of the energy measure: € including VAT
(as determined by the Buildings department)
Full or partial funding of % is necessary.
Release of funding from the Energy department of € is therefore required.
The funding requirement is justified by the appended calculations.
The "client" department is responsible for checking whether funding is required.
This funding can only be granted in financial year .
As a general rule, funding cannot be carried over to the next financial year.
The financial resources to implement the measure shall be transferred from the "energy saving measures in municipal buildings" project's budget item to the client department's budget.
The "client" customer must submit a budget transfer request to the energy department for acceptance. Once accepted, the request is sent by the energy department to the finance department and entered into the accounts.

4/ Cost-efficiency and payback period

The energy department estimates that the energy efficiency measures will deliver the following annual savings:

kWh Heating (Gas, district heating, fuel oil)
kW Power (Gas, district heating)
kWh Electricity
kW Electric power
m^3 Water
kg CO_2 emissions

A breakdown of the calculation is appended.
In total, annual energy cost savings are estimated at:

€ (Heat)
€ (Water)
€ (Electricity)i.e., total savings of:
_____
€

Based on these total annual savings, payback is years

Project cost-efficiency is calculated on the basis of the energy saving factor, a ratio based on the energy measure's lifetime.

$$\text{Energy saving factor} = \frac{\text{Lifetime [years]}}{\text{Payback [years]}} \times 100\%$$

The energy saving factor should be more than 100%. Considering a lifetime of _____ years, the energy saving factor for the total investment is _____ %.

[Occasionally]
Since regular building maintenance work is in any event necessary, it is sometimes useful to implement the measure in question. In this case, it may not be possible to recoup all the investment from the savings made. Considering the capital invested by the energy department, the energy saving factor will then be …%.

5/ Estimation of saved energy costs

Saved energy costs are estimated by multiplying energy savings by an average energy cost. The average energy cost is calculated on the basis of the previous year's bill for the building. Saved energy costs include VAT.
Saved energy costs are estimated by the energy department in agreement with the "client" department and include any additional facilities, change in building use or any other changes that have an impact on energy use.

6/ Implementation

The "client" department supervises the implementation of the energy measures in agreement with the energy department, respecting the division of competencies.

7/ Building operation

The "client" department accepts the operation plan proposed by the energy department. Should financial savings be less than estimated, the payback period will be re-calculated as per section 4 of the agreement.
The "client" department will report any change in building operation to the energy department.

8/ Payback

The capital invested by the energy department shall be reimbursed in full to the energy department with no interest charged.
Payback corresponds to the annual amounts defined in this agreement.
Once per calendar year, in mid-year, the relevant budget item is debited of the relevant amount. The first debit takes place in the year following the implementation of the energy saving measure
As per sections 3 to 8 of this agreement, the duration of funding is approximately _____ years.

$$\text{Duration of funding} = \frac{\text{Invested capital}}{\text{Annual savings x adjusted payback factor}}$$

City, date _____

Energy department

…….

Signature

city, date _____

"Client" department

…….

Signature

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About the Infinite Solutions project

The financing schemes have been tested and implemented in the framework of the Infinite Solutions project coordinated by Energy Cities and co-financed by the Intelligent Energy Europe programme.

Contact

Project managers

Peter SCHILKEN
peter.schilken@energy-cities.eu

Jana CICMANOVA
jana.cicmanova@energy-cities.eu

energycities

infinitesolutions
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www.energy-cities.eu/infinitesolutions

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