

D5.9: Energy Service Company Portfolio and know-how related to solar thermal plants

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1. EXECUTIVE SUMMARY

Energy Service Companies (ESCOs) and solar thermal installations have considerable potential to deliver affordable renewable energy to domestic and industry sectors. However, the number of ESCOs offering solar thermal projects is limited. This can be explained by a number of factors, such as the frequent failure to limit ESCOs to other forms of technology or the lack of knowledge on how ESCOs can be implemented. As a result, policy makers in many countries have tended to pay lesser attention to solar thermal technologies and their ESCo models.

Solar thermal technologies offer a great potential for providing a carbon-free response to mankind's energy demand. After decades of trial-and-error on a number of business cases, solar thermal ESCOs have been realized in a handful of countries globally, such as Austria, Germany, or Denmark. The technology itself has now reached a degree of technical maturity that makes it more reliable. Solar technologies are said to be cost-effective in most places for new constructions, but their development is limited by few demonstrations of successful solar ESCo projects.

Additionally, numerous barriers still impede the dissemination of ESCo's. The uneven level of solar thermal markets in countries with similar climate and energy conditions highlights the importance of public policies to overcome barriers to their use and new business models. Already implemented ESCo schemes may help to overcome the barriers, from direct subsidies and fiscal incentives to specific inclusion of solar thermal technologies into public agendas. Co-operative procurements could further reduce costs and accelerate the dissemination of successful energy service companies.

Companies and authorities may want to go much further by establishing new boundary conditions within the energy sector to satisfy ESCo project requirements and influence the choice of technology in favour of solar thermal technologies, as one of the most promising renewable energy sources.

2. INTRODUCTION

This document reports on Energy Service Company Portfolios and related know-how on solar thermal installations. It analyzes the requirements for ESCo establishments, describes ESCo services, barriers of new projects, and options on how to overcome them in light of solar thermal installations.

An example of a demonstration project in Austria sheds light on actual measures to realize new ESCOs and provides a template for companies to set up new projects. The aim is to inform companies interested into energy services on their options, potential clients and challenges. Additionally, suggestions for consideration by policy makers in countries all over the world are also provided. This should facilitate the expansion of solar thermal and other climatefriendly technologies.

In some cases, policies to support ESCOs and solar thermal technologies seem less developed than for other renewable energy technologies as it has the potential to contribute much more toward meeting global energy demand. Hence, understanding business models for solar thermal technologies, such as ESCo models, seems more important than ever.

If companies and policy makers want to expand the use of solar thermal technologies and of ESCo models, they should provide stronger governmental policies to support ESCo formations and renewable energy technologies, increase awareness of business model possibilities, and set straight regulations including minimum quality requirements for new installations.

3. REQUIREMENTS FOR ESCO ESTABLISHMENT

3.1. DESCRIPTION OF ESCO PORTFOLIOS, SERVICES, AND FRAME CONDITIONS FOR THEIR ESTABLISHMENT

3.1.1. Energy Service Companies (ESCO)

An Energy Service Company (ESCO) provides energy services to customers, such as the opportunity to improve energy consumption patterns to reduce energy costs. Energy services can include energy analyses and audits, energy management systems, project designs, maintenance, evaluation and operation monitoring, generation and supply of a selected energy mix, multiple energy facilities and energy risk management.

ESCOs can guarantee energy savings and/or provision for the same level of energy service at lower costs. A performance guarantee can take several forms, such as revolving around the actual flow of energy savings from a project, can stipulate that the energy savings will be sufficient to repay monthly debt service costs, or simply that the same level of energy service is provided for less money. The remuneration of an ESCO is directly tied to energy savings achieved. Hence, ESCOs can finance, or assist in arranging financing for the operation of a new energy system by providing a savings guarantee based on an on-going operational role in measuring and verifying the savings over the financing term.

Several ESCOs operating today were founded either by large companies, as subsidiaries of energy technology manufacturers, or supplying companies. Other ESCOs were founded by public sector agencies (e.g. in Greece and Spain) or public-private joint ventures. The ESCO market is at different stages of development across the EU and globally. In countries, such as Austria, Germany, Hungary, or Finland, the market is well established. The French market is largely dominated by a few very large companies. On the contrary, in Denmark, Bulgaria, Poland, Portugal, or Romania, there are few ESCOs active on the market, while in Baltic countries, Greece, Cyprus, Slovenia, and Croatia the market is in its initial phase of development. Figure 1 illustrates an example for an energy service model:

Energy Service Model

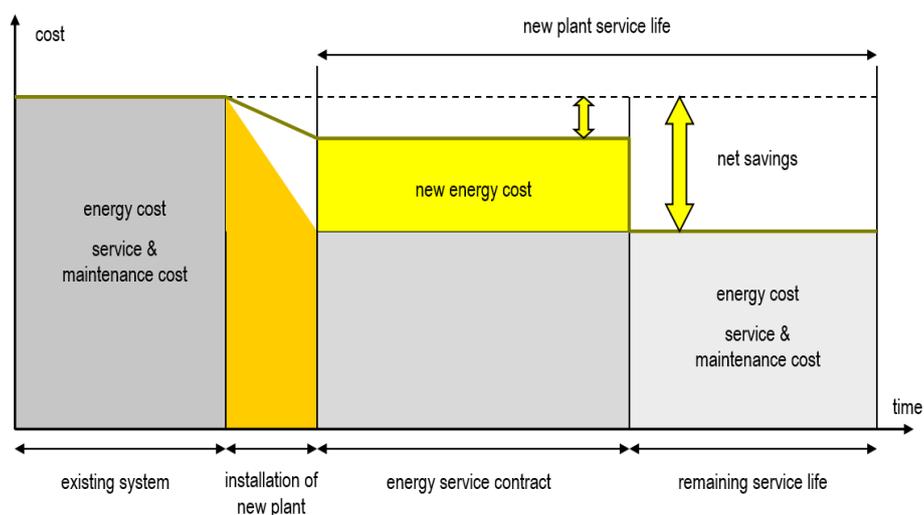


Figure 1: Example of an Energy Service Model

Figure 1 illustrates that during the energy service contract, energy costs to the customer already decreased. At the contracts termination, energy costs and service costs are even lower.

3.1.2. Requirements for the Establishment of ESCOs based on Solar Thermal Projects

Energy efficiency is one of the cornerstones of a sustainable energy strategy. Implementing a solar thermal project that pays for itself through energy savings can be a very complex undertaking not any company is able to implement. As thermal energy increasingly comes into the focus of energy efficiency measures, so do companies offer solar thermal energy efficiency projects on a widespread basis. Which solar thermal technology and ESCO model firms offer is relative to the level of technological and commercial maturity of the company and its legal-political environment.

Several factors are essential to the establishment of ESCOs for solar thermal projects. Solar thermal installations are limited to a certain range of climatic conditions. Out of this range, ESCO projects based on other technologies (such as biomass) may be more applicable. One step further, an ESCO project has to be economically reasonably financed. Public subsidies can reduce payback times and hence be key to realize a project. The public sector has been a trigger for the development of an ESCo market in many countries. Safer clients, such as the public sector, usually do not go out of business. Essential to a project's success here are facilitated public procurement procedures, legal guarantees on ownership rights, taking into account lifecycles, and clear rules how to treat solar thermal ESCo projects within public budgeting.

Companies without any history related to ESCO projects are often challenged. However, key technological milestones in solar thermal projects can facilitate the introduction of energy services. These show qualification and experience of the company and set the basis for activities related to energy management, energy savings, or performance guarantees. Hence, companies have to show detailed knowledge on the prospective and past nature of their services provided, customer details, timelines necessary for execution, energy savings achieved, required space necessary to guarantee energy outputs, average duration of projects, and details of time and cost overruns if likely. Additionally, the solar thermal projects have to be evaluated in terms of the number of different industries or sectors covered, the nature of energy related services, products offered by the company (e.g. solar cooling or solar district heating), along with the nature of benefits derived from the services and products.

Without being able to guarantee a particular level of savings based on technological achievements and an appropriate legal-political environment, any solar thermal projects of an ESCO would be at risk.

3.1.3. Portfolio and Services

The Energy Service Directive (ESD) (2006/32/EC) describes ESCOs, together with energy performance contracting and third party financing as important instruments to improve energy efficiency and reach national indicative energy saving targets.

The ESD defines ESCOs as a natural or legal person that delivers energy services and/or other energy efficiency improvement measures, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements, and on meeting agreed performance criteria. The type of contract used to implement ESCo projects ranges from most well-known schemes like EPC and TPF to country specific schemes like heat supply contracts and chauffage contracts.

Portfolio Examples:

- (1) Energy Performance Contracting (EPC)
- (2) Third-Party Financing (TPF)
- (3) Guaranteed Savings Contract
- (4) Shared Savings

(5) Plant/Operation Contracting

(6) Chauffage Contract

Energy Performance Contracting (EPC) is a contractual arrangement between the beneficiary and the provider (normally an ESCo) for energy efficiency improvement measures, where investments are paid for in relation to a contractually agreed level of energy performance.

Third-Party Financing (TPF) is a contractual arrangement involving a third party. In addition to the energy supplier and the beneficiary of energy efficiency improvement measures, the third party provides capital for the measures and charges the beneficiary a fee equivalent to a part of the energy savings achieved as a result of the energy efficiency improvements. That third party may or may not be an ESCo itself.

Under a *guaranteed savings contract*, the ESCo takes the entire design, installation, and savings performance risks, but does not take financial credit risks. The projects are financed by customers who can also obtain financing from banks, other financing agencies, or a TPF entity. The key advantage of this model is that it provides the lowest financing costs as it limits the risks of financial institutions to their area of expertise (handling customer's credit risks). Customers repay the loan and take the investment repayment risk. If savings do not cover debt services, then the ESCo has to cover the difference.

Under *shared savings*, the ESCo takes both, performance and credit risks. This model is more likely to be linked with TPF. ESCos collateralize the loan with anticipated saving payments from the customer, based on a share of actual energy cost savings. Such contractual arrangements may create leveraging and increased capital requirement problems for ESCos, because ESCos become too indebted and at some point, financial institutions may refuse to provide ESCos further capital due to high debt-to-equity ratios.

Plant/Operation contracting is a scheme common in Austria and Germany (Energiliefercontracting). In this case, the contractor plans, finances and constructs new heat production installations or takes over existing devices. The contractor is responsible for plant operation, maintenance, and attendance. The contractor buys primary energy and sells heat to the client. Energy savings are part of these projects since new or refurbished boilers work more efficiently. The client usually pays a basic price that covers the contractor's investment costs, including loan repayment. The basic price also has a component covering plant maintenance. The second part of monthly payments depends on energy consumption patterns. Most clients save significant amounts when the costs of alternative solutions (i.e. project implementation by the client) are calculated. The client only pays heat consumed on a kWh price basis (kWh prices are flexible depending on fuel prices). The contractor therefore tries to produce heat in the most efficient way. However, energy efficiency measures beyond heat production or guarantees regarding energy (cost) savings are rarely part of these projects.

The so called *chauffage contract* is widely applied in France, and also frequently used in Italy, Spain, or Portugal. The contracts typically cover 20-30 years. The ESCo provides all associated maintenance and operation measures. Chauffage contracts are very useful where customers want to outsource facility services and investment.

The choice of financial scheme largely depends on the individual ESCos' experiences and conditions it faces at financial institutions. These can vary considerably, depending on contracts and relationships with banks and other institutions. Due to the characteristics of ESCo business models and long-term projects, ESCos are advised to be committed to risk management measures.

Financing Services:

- ESCo financing
- Customer financing
- Third party financing (TPF)

Figure 2 shows main ESCo Stakeholders:

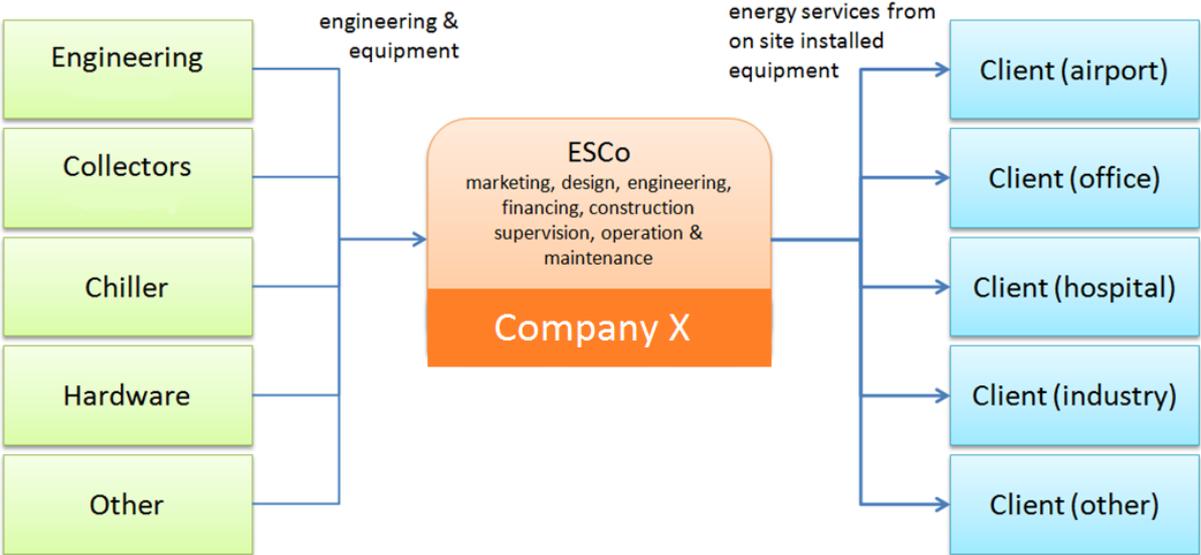


Figure 2: ESCo Stakeholders

Critical investment factors are securities required, transaction costs, taxation, or balance sheet effects. Large ESCOs can be able to structure their investments based on their own capital. Small ESCOs are more likely dependent on financial institutions, willing to invest into energy projects. Unfortunately, if financial institutions are not familiar with ESCo business models and projects, conservative institutions are reluctant in lending capital.

In countries where ESCOs are challenged, governmental institutions can stimulate the market through instruments such as soft loans or grants, funding of demonstration projects, information dissemination and education programmes, as well as appropriate financial guarantee mechanisms. International institutions, such as the European Bank for Reconstruction and Development (EBRD), the World Bank, or the Global Environmental Facility (GEF) already provide ESCo investment schemes. However, international and national funds often favour short term investments.

Potential ESCo Service Clients:

The public sector has been a central trigger for the development of an ESCo market in many countries. Examples of potential clients from the public sector are:

- *Medical service institutions/student homes/retirement homes:*
Buildings of this category are very interesting ESCo customers due to their continuous occupancy and energy consumption patterns.
- *Institutions of higher education/schools:*
Educational institutions can have an interest to outsource their energy supply due to a lack of in-house know-how. Additionally, energy efficiency projects in this category can be standardized and multiplied due to similar energy usage patterns. Standardization might enable the ESCo to implement a number of projects and enjoy economics of scale.
- *Buildings in the ownership of state/regional/local authorities (libraries, archives, museums, exhibit spaces):*
Projects in this category are interesting as long as contracts can be standardized.
- *Residential sector:*

This sector is the most problematic one for ESCo activities. Although saving potentials are significant, transaction costs tend to be high. Many private owners can increase the complexity of a project. Single energy efficiency projects in this sector are too small to attract the attention of large financial institutions, but by pooling smaller projects, e.g. buildings, into one larger project, they become attractive ESCo opportunities. Preconditions necessary for the implementation of an ESCo project can be set as a minimum number of residents or a housing size. Standardized business model and services should be developed that will enable simpler contracting. Except energy supply, ESCo projects in the sector include energy efficiency measures such as windows change, improved insulation of buildings etc. With the support of a local community it is possible to develop a large market for ESCo projects.

- *Service sector clients:*

Hotels have significant energy consumption offering large potential for ESCo projects. The suitability for an ESCo project depends on their seasonal occupancy and location i.e. climatic conditions.

Large office buildings offer numerous possibilities for the implementation of ESCo projects. These projects can be standardized and implemented many times.

Banks and similar institutions are small but numerous energy consumers. These projects can be standardized and implemented as well.

Buildings in the transportation sector, including terminals, or airports have some potential. Airports are a distinctive case, as these are complex systems with a high-energy consumption. There is an important role in preliminary energy audits and defining suitable ESCo measures in this category.

- *Shopping centres, stores, restaurants, bars:*

This category includes diverse objects of different sizes. The smallest and simplest are in the same time the most numerous ones, while large shopping centres have more complex energy systems.

- *Industrial sector:*

In the industrial sector, ESCo projects are less frequent due to various reasons. One reason might be a lack of motivation to use their own capital resources for energy efficiency instead of capital improvements needed for their core business. This is especially the case in a non-energy intensive industry. Large companies that would be the most profitable clients for ESCos consider that they can implement and finance energy efficiency improvements themselves since they have sufficient funds and technical in-house expertise. Also, they might not be willing to allow ESCos to check the core industrial processes because of confidentiality and specialized knowledge required to implement changes there. Moreover, time spans considered in many companies are shorter than payback-periods for many ESCo projects and life-cycle costs are rarely taken into account. On the other hand, this sector offers large opportunities for implementing ESCo measures.

Data from ESCo projects suggest that in Germany, the majority of projects have been realised in the public and service sector. Also in countries, such as Poland and Spain, the majority of projects are conducted within the service sector, while the UK public sector is a major ESCo client. The industry sector is the most important client in Croatia and Bulgaria, while in some countries (e.g. Finland, Ireland, Italy) ESCo projects are being implemented across the different sectors (services, industry, residential and public sector).

4. BARRIERS AND HOW TO OVERCOME THEM

Barriers to the diffusion of ESCOs based on solar thermal technologies are technical, economic, legal, cultural or behavioural. Besides technical limitations, barriers include high investment costs, failures to account for the public energy security and environmental benefits, insufficient training of professional installers, legal barriers such as permitings, and a lack of awareness of the potential by customers as well as policy makers. A range of policy,

administrative, financial, contractual, and market barriers are responsible for the weak performance of an ESCo industry. One of the most common barriers reported is the low awareness of such models on the demand side. It is unknown how ESCos operate and the benefits derived from implementing ESCo projects (e.g. FR, PL, DE, HU). These circumstances are manifested by a lack of exemplary cases to show experiences and expertise. The uneven level of solar thermal markets in countries with similar climate and energy conditions highlights the importance of public policies to overcome the barriers to their use.

Regulatory barriers are the second most common hurdle for the development of an ESCo industry. These problems can include long public procurement procedures, where the assessment may not be based on energy savings criteria but only on price (e.g. HU). Another barrier is the lack of clear rules how to treat ESCo projects within public budgeting (e.g. CR). Complex administrative procedures in the public sector, with regulations that are not suitable for solar thermal energy service projects exist in countries such as Italy or Ireland. As mentioned already, unfavourable procurement procedures such as in the Baltic countries are another challenge, as well as a lack of standardized documents and established processes (e.g. FR, GR, PT).

One central barrier of solar thermal systems is a lack of competence and knowledge of planning engineers for complex systems and many installers – even for simple systems. Even if they use quality equipment, systems may not work properly if not installed carefully.

Some barriers are equally distributed among EU countries, while others are related to the specific conditions in each country. In countries where the ESCo market is not yet developed or is still in its initial phase, barriers are often basically related to barriers of any ESCo market in general.

The following table provides an overview of main ESCO barriers across EU countries:

Table 1. Overview of barriers that impede the development of solar thermal ESCO projects in the EU

Barriers	AT	BE	BG	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE	UK	GR	
Low awareness on the demand side		?	•	•		•	•	•	•	•	•	•		•	•	•	?	•	•	•									
Problems in implementing ESCo projects in the public sector	(•)	?	•	•			•		•	•	•	•		•	•	•	?	?		•								•	
Financial institutions not willing to finance ESCo projects or provide bad lending practices		?	•	•	•	•	(•)				•	(•)		•	(•)	(•)	?	?	•										
Lack of standardized documents and procedures	(•)	?	•	•	•		•			(•)	•				•	•	?		•	•	•								
Lack of existing ESCo projects/expertise		?		•		•	•	•			•			•	•	•	?	•		•	•					•		•	
Low energy prices		?	•					•	•			•					?	?		•				•		•		•	
Lack of energy consumption data		?							?			•					?	?						•					

•	Existing problem
(•)	Partially existing problem
?	No information available
	Problem does not exist

The uneven level of ESCO projects in countries with similar climate and energy conditions in the EU highlights the importance to overcome the barriers to their implementation.

Measures to overcome these barriers may include support to research on solar thermal ESCO projects, demonstration programmes and support to market deployment through public outreach and professional training, guarantees of performances of systems and the diffusion of solar energy service contracts. Co-operative private and/or governmental procurement could reduce costs and accelerate dissemination. Reducing import tariffs would also help internationally disseminating solar thermal technology hardware. Additionally, Public Relations and communication activities, such as seminars and workshops could present characteristics and advantages of ESCO projects, exemplifying economic and environmental benefits.

Energy savings criteria for specific technologies are a core factor next to price considerations. On a political level, ESCo rules support the development of ESCo markets. Also, administrative easement favors new ESCo structure, as well as standardized documents. These increase trust into new energy service systems.

Key measures are furthermore the implementation of a well organized ESCo business sector with ESCo Associations to provide information on legal boundaries, existing ESCo models, to lobby for the implementation of stimulative regulations, and to provide advices and tools to the sector.

Further measures include:

- Establishment of a clear legislative framework capable to regulate all contract related details;
- Definition of a clear legal status for ESCos in each country and internationally to boost an ESCo uptake;
- Energy agencies (and other organisations) providing expertise and assistance to legal and policy representatives such as municipalities in implementing ESCo projects to increase the uptake of ESCo schemes;
- Development of legal ESCo definitions, ensuring that reliable service is provided, not to harm the whole ESCo industry by giving it an unclear reputation;
- Facilitating the development and legal existence of ESCos offering a whole array of technologies and fuels to provide the most efficient and suitable concept for clients;
- Development of standardised contracts for ESCo projects to download;
- Legal schemes to pool smaller projects to increase the project profitability;
- Standardized measurement and verification procedures to control the design and implementation of ESCo projects, such as the International Performance Measurement and Verification Protocol (IPMVP) which is a model used around the world for measuring and evaluating energy efficiency projects;
- Project risk forecast and clear risk analysis based on a legal framework;
- Increasing public awareness and trust into ESCo projects and their economic and environmental benefits based on local structures;

Most companies also have to invest into their competence and knowledge of planning engineers for complex solar systems. Quality collectors and products, systems carefully installed – and new knowledge on ESCO models applicable to the specific company are of key to overcome present barriers in solar thermal technology.

5. EXAMPLE OF A SOLAR THERMAL ESCO MODEL: THE DEMO OF KREMSMÜNSTER

ESCO demonstration projects based on solar thermal energy are supposed to expand the scale of their implementation. Demonstration projects illustrate the capabilities of such technologies, including development and construction of system integrators, how to overcome barriers of ESCOs and lay a foundation for subsequent large-scale development.

ESCO demonstration projects can face difficulties and problems in their progress. Time management problems in the early stage of demo projects are one such challenges. Some enterprises get off to a late start in the preliminary work, and their progress is slow in going through ESCO and technological procedures. Additionally, some governments are not acquainted with solar thermal projects in the process of procedures for preliminary work, resulting in longer periods of processing in some aspects. However, if rush work is adopted, it is difficult to ensure project quality. Demo projects are also a central venture to clarify private and public financing models. The projects shed light on questions such as if subsidies are available, or if stringent control over the rate of return, equity ratio, and investment decisions hinder the progress of solar projects. Additionally, reasonable profits need to be acquired. Demo projects indicate if fair and open competitive environments for ESCO projects actually exist on the specific market.

In order to shed light on solar thermal ESCOs in the Austrian Oil and Gas Industry, a contracting model had been designed for a large scale solar thermal plant at the oil and gas company RAG (Rohöl-Aufsuchungs Aktiengesellschaft) in Kremsmünster, Upper Austria. Despite environmental concerns, oil and gas companies still are a central pillar to global energy supply. In order to increase the share of renewable energies within this sector, solar thermal ESCOs are one option to demonstrate the strength of the solar thermal industry.

The core business of the selected company RAG includes the exploration, development and storage of oil and gas. Through the use of company-owned storage facilities. RAG does not only ensure the supply of petroleum products within Austria, but also plays an important role for the security of petroleum supply in Central Europe. Additional activities include trade and transport of gas and projects in the renewable energy sector.

The biggest heat consumers of RAG are:

- Oil storage tanks (4 x 60,000 m³) for keeping the oil pump able
- Oil production station for oil separation processes
- Feeding into the district heating network Kremsmünster

The idea of the project was to rebuild an empty oil tank at the production facilities of RAG in Kremsmünster in such a way, that it could be used as a seasonal thermal energy storage system. In addition, a large scale solar thermal plant with a thermal capacity of approx. 5 MW should have been integrated, which enables saving up to approx. 1 Mio m³ gas per year. The seasonal storage system would enable an energy efficient operation of the different heat suppliers and heat consumers. On the one hand, the storage tank would provide heat to the oil tanks in the winter time. On the other hand, it would enable an optimized load management of the CHP plant. The demonstration plant could be implemented, no heat delivery contract could be established. The reason for that was the very low oil price in 2013/2014, which prevented RAG from signing the heat delivery contract.

An energy service contract was designed to deliver heat based on a large scale solar thermal plant between RAG and solar.nahwaerme.at Energiecontracting GmbH (later named as SNW) as contract partners.

5.1. OBJECT OF AGREEMENT

RAG provides heat to the district heating system of Kremsmünster. The company SNW builds a solar thermal large-scale plant at the RAG location Kremsmünster and delivers heat to RAG, which RAG in return delivers to the district heating system of Kremsmünster.

The energy transport fluid was water of a temperature of 90°C. Energy delivery and distribution should have started depending on the solar thermal plant installation in 2015, but no later than the 31st of December 2016.

The plant to be installed was a solar thermal large scale pilot project for SNW, and should have been monitored to evaluate actual energy outputs under the unique energy generation setup. Gained experiences and Knowhow based on the pilot project were limited to scientific study evaluations. The future commercial usage of data gained was subject to restrictions under section 19 of the energy delivery contract.

Though it was considered a pilot project, SNW was obliged to refer to current legislations and best available technology standards.

5.2. PLANT CONSTRUCTION, ENERGY DELIVERY INTERFACE AND PROPERTY LINES

The solar thermal plant would have been designed, installed, operated, monitored, and repaired by SNW, including plant components (collector field, tanks, expansion vessel, puffer storage, circulation pump, heat exchanger) and connection facilities to the local district heating network of RAG up until a defined interface (hydraulic scheme). The before mentioned components belonged to SNW and were in its responsibilities. A hydraulic concept was integrated part of this contract.

RAG was obliged, during the duration of the contract, to provide the following infrastructure – which was necessary to build and operate the solar thermal plant to guarantee a safe and interference-free operation of the solar plant:

- Electricity
- Water
- Internet access

Any costs which could occur and require action were arranged in a separate operations-management contract.

The collector field of the solar plant, with a size of around 10,000m² (the exact size and place of the plant will be defined during the planning phase) would have been built south of the cogeneration plant in the meadow. Furthermore, a buffer storage was located there as well to cover the peak load. The dimensions of the storage were defined during the planning phase accordingly. The exact location at the property of RAG, which can be used by SNW free of charge, were also defined according to a mutual agreement. Any other usage beyond this agreement was prohibited (as well as the simple access to the area).

The generated heat of the solar thermal plant was going to be provided throughout the year, supported by the storage for the district heating system of RAG. The transfer of heat from SNW to RAG was at a defined intersection point.

SNW was obliged to build, operate, and maintain the solar thermal system components. RAG provided all connections to the local district heating network, including the before-mentioned intersection point in accordance with all legal norms, decisions, regulations and edicts.

SNW had to obtain the agreement of all property owners for locations which are not owned by RAG.

The dimensioning and design of the system for delivered heat were provided based on a mutual agreement between RAG and SNW. Both parties had to ensure that all system components are well adjusted and avert negative system impacts.

5.3. CONTRACT QUANTITY

The amount of heat which was calculated based on the heat price, was defined as:

RAG signed the agreement to buy the minimum heat amount of 3,500 MWh per calendar year (evenly distributed), whereas the annually minimum heat amount of 3,500 MWh will be charged regardless of RAG's consumption. Furthermore, SNW had no claims against RAG if the minimum amount of heat was not reached. Heat amounts above the defined minimum will be charged with an agreed heat price. SNW was obliged to deliver these heat amounts to the defined intersection point with a water temperature of 90°C to RAG.

In case that the combined heat and power (CHP) plant of RAG (based on waste heat of the internal power production) and the solar plant of SNW are able to provide heat at the same time, RAG preferred to use heat of the CHP plant. The design and operation of the solar thermal system had to consider that no competition between the solar thermal and the CHP plants should occur. RAG tried to compensate the loss of demand due to the plants' competition at the rest of the year. SNW had no legal rights to claim here.

In the case that SNW does not deliver agreed heat amounts due to technical reasons, the annually minimum heat amount would have been reduced to 8.2 MWh per day of not delivering heat (24h hours of not delivering the amount as in the agreement stated). There would have been no other claims on the side of SNW.

5.4. HEAT PRICE AND INVESTMENT INTERESTS

Three different cases occurred:

a) Variable part (heat price): RAG payed to SNW an amount of heat, which will be delivered from the solar thermal plant to the defined intersection point and measured with a calorimeter, based on a mutual agreed heat price per MWh.

The first heat price included all additional costs, but without value added tax. All expenditures, costs etc. of SNW in connection with the contract would have been paid from the heat price.

b) A buffer storage with about 300m³ volume would have been used for the solar thermal system as well as for the already existing CHP plant to cover peak load storage demand and therefore be used from both parties to the same extent. The one-time investment of the buffer storage including the pipelines and equipment was about EUR 400,000.-.

As both parties used the same storage, they agreed that the costs of the buffer storage, including the pipelines and equipment, will be split. A buffer storage with about 300m³ volume would have been used for the solar thermal system equipment. RAG was entitled to buy the part of SNW by the end of the contract (no matter what reason) at book value. During the duration of the contract, SNW was not entitled to sell its part of the storage to a third party.

c) The parties of the contract took into notice that the solar thermal plant at hand can be counted as an energy efficiency measurement according to the energy efficiency law. Both parties declined that the advantages and the proceedings (especially the sale of the measurement) will be divided equally among both parties. Both parties had to consent to sell the plant.

5.5. HEAT PRICE DEFINITION

Both parties agreed that the heat price can not be defined at the stage of contract agreement, as the economic framework conditions of the cooperation were not settled yet. The contract partners therefore agreed that the heat price would have been settled in October 2015 through an addendum to this contract, which both parties would have signed. Both parties agreed that the contract will be resolved with immediate effect if both parties have not made an agreement until latest 31.12.2015. In this case, all payments proceeded had to be transferred back to the other party completely, no party had any claims if the contract was not concluded.

5.6. VALUE ASSESSMENT

The defined heat price (point 4a and 5) is guaranteed through the following formula:

$$W = W0 * (0,3 * T/T0 + 0,3 * G/G0 + 0,4 * I/I0)$$

W the work price insured through the value insurance

W0 will be defined as the heat price per 1.1.2016

T Standard wage index „workers, industry “(2006 = 100), published in „Statistischen Nachrichten“ of Statistik Austria every first working day of the Month

T0 Reference value

Standard wage index like in „T“, but the value of January 2013 (121,1)

G Wholesale price index „without seasonal effect (2005 = 100) published in „Statistischen Nachrichten“ of Statistik Austria the last published monthly value on the first working day of the current quarter

G0 Reference value

Wholesale price index like in „G“, but the value of January 2013 (122,4)

I Import gas price in EuroCent per MJ, calculated from the value and amount of the natural gas, import called statistic number

I0 Reference value

Import gas price like in „I“, but the average of the 3 values from December 2012, January 2013 and Februar 2013 (0,8533)

In case that one of the above-mentioned parameters will not be published, another reference value will be chosen mutually between the parties, which is as close as possible to the parameter not available anymore, but similar to content and effect.

The insurance was adapted in value according to operations annually.

If the costs of the heat generation and the generation and transmission of energy change because of new, additive, omissions, raised or reduced taxes, assessments, similar laws or legal introduced actions, the parties shall discuss and define price adaptations mutually as per the agreed loyalteclause.

5.6.1. MEASUREMENTS

SNW had to provide, install and, if needed, replace the measuring equipment free of charge. RAG had to provide the space for evaluation, supply and possible remote work for SNW. SNW and RAG understood both to agree in this context. SNW was responsible for costs of installation, maintenance and regular calibration of the measurement equipment.

RAG allowed SNW the entrance to the measurement equipment places, but the times had to be coordinated between RAG and SNW.

SNW had to give RAG the possibility to track the heat delivery amounts and temperatures on their own at any time.

The heat amount used to charge will be recorded by an officially calibrated heat flowmeter. The temperature will be measured on the second side of the heat exchanger continuously.

In case of malfunction or damage of the measuring equipment, RAG has to inform SNW immediately. The repair costs will be covered by SNW, except the damage is caused by RAG.

RAG could have applied for a retesting of the measurement equipment through SNW or also at the bureau of standards. If RAG applied at the bureau of standards, RAG had to inform SNW of the appliance.

5.6.2. SETTLEMENT AND PAYMENT

The heat price was understood inclusive of value-added tax. The value-added tax had to be cited extra in the invoice.

A fixed monthly amount was determined on the basis of prognosed energy deliveries between both contractual parties. At the end of each calendar year, SNW had to provide a table with the actual delivered energy and drew the final settlement, including a credit or additional payment.

The advanced payment for the following year was calculated on the basis of the amount of the previous year, whereas it was possible to decide mutually to make adjustments due to extraordinary divergences (extreme exposure, break down times, etc.).

The payment was due on the 10th (tenth) of each month. The final settlement was due to payment within 30 (thirty) days after receipt of the invoice, a credit of RAG was counted at the following advance payment/s and allowed RAG to reduce these with this amount.

Standard terms affecting the heat delivery contract included:

- Assurance and Warranty
- Acts of nature
- Liabilities
- Terms of Allegiance
- Severability clause
- Type of written form
- Assignment agreement
- Law applicable
- Confidentiality Agreement

5.6.3. NOTICE OF CANCELLATION

If the heat delivery was not seen duly done until 31.12.2016, each party was allowed to resolve the contract with immediate effect unilaterally. In this case, SNW had to transfer all already received payments back to RAG. There were no more claims in case of a termination of the contract.

Furthermore, an orderly termination was not possible, but this contract can be resolved from both parties due to important reasons at any time. The information of the important reason and the notification had to be done with a registered letter:

- If an insolvency procedure or a similar procedure is opened for the assets of the other contractual party or the start was declined due to non-sufficient assets;
- If the other contractual partner breaches important contractual parts and does not fulfill these within a reasonable deadline after renewed reminder;
- If the operation for RAG or SNW is not further possible through official statement or any other reason;
- If the heat delivery of RAG to the district heating networks – no matter what kind of legal reasons – is not or only in parts done;
- If a situation of force majeure persists longer than 30 days and is the reason for not delivering contractual agreed heat deliveries;

The termination comes into effect at the day of receiving the registered letter.

5.6.4. PERIOD OF CONTRACT

If no party declared within a letter, latest 24 months prior to a deadline, that the contract ends at the 31.12.2036, the contract will prolonge automatically for another 12 months. An ordinary termination is then possible, considering the termination deadline of 12 months every 31.12.

For the parts of the plant which are part of RAG property, it was agreed that RAG can, in case of resolving the contract, demand either that SNW removes the parts of SNW, or that RAG will overtake the parts from SNW for value agreed upon.

6. EPC – ENERGY PERFORMANCE CONTRACT TEMPLATE

A template for energy service contracts provides a valuable tool for new and established solar thermal projects of ESCos. Templates are sample documents that have already some details in place. Information on the specific company, client and solar thermal technology have to be added, completed, removed or changed. Once the template is completed for one project, such as the demo project above, the ESCO can edit, save and manage small passages according to new projects.

Energy performance contract templates may ordinarily (although not necessarily) begin with a PREAMBLE and basic DEFINITIONS. Subsequently, the template states the project's SCOPE and the type of CONSTRUCTION, such as a solar thermal plant. These abstracts are followed by notices of ACCEPTANCE, OWNERSHIP RIGHTS OF THE SOLAR THERMAL PLANT, EASEMENT and the specified OPERATIONS. ESCos should especially take care of SUPPLY AND CONSUMPTION OF SOLAR ENERGY they offer, since technological capabilities and environmental conditions can critically influence energy supply. Financial aspects are settled in sections on FEES and PAYMENTS. Sound calculations are core to any ESCo activities. Legal aspects should be covered in sections such as TERM AND TERMINATION, RIGHTS AND OBLIGATIONS AFTER TERMINATION, [[ESCO]]'S WARRANTIES, [[CLIENT]]'S WARRANTIES or LIABILITY. Depending on the country of ESCo operations different laws and obligations may occur. These have to be taken into account. Some clients also require specific INSURANCES and depending on the specific country, FORCE MAJEURE may include environmental disasters or even the act of war.

Further core chapters of a template include the ASSIGNMENT, special NOTICES, a CONFIDENTIALITY section, PROMOTION REGULATIONS, or the WAIVER. Another critical part is the THIRD PARTY RIGHTS AUTHORITY which is also influenced by legal-political conditions, as well as APPLICABLE LAW, DISPUTE RESOLUTION, or CORRESPONDENCE & REGISTERED ADDRESSES. Finally, the ANNEXES should not be underestimated. In the addendum, central additions required to be made to the EPC document should be stated. Technical requirements, limits of operation and necessary client preparations can be stated here.

An exemplary template can be found attached to this report (section 8, Appendix).

7. ESCO CALCULATION SUPPORT TOOL

The purpose of this tool is to give some preliminary information to the investors who are considering changing, for instance, the heating system or make energy saving investments in co-ordination with an ESCO. The ESCO calculation support tool can be found in an attached excel sheet. At least one variable must be added: Energy Used, Energy Price, Interest Rate and Time Period. For more detailed instructions use the manual¹.

¹ Manual for Excel Calculation Tool for Assessing Customer's Profitability of Investment with ESCO Companies, available at PITAGORAS Project website: <http://pitagorasproject.eu/documents2>

8. APPENDIX

[SOLAR] ENERGY PROVISION AGREEMENT

(NR: 00000)

BETWEEN

[[local ESCO, full name]],
[[Country]]

AND

[[CLIENT, FULL NAME]],
[Country]

FOR

[[CLIENT, FULL NAME]] Project XY,
[Country]

PREAMBLE

THIS SOLAR THERMAL ENERGY PROVISION AGREEMENT ("*Agreement*") is entered into as of the DD. MMMM YYYY by and between

[[local ESCO, full name]], ([[ESCO]]), with its registered address at Street, ZIP Code, Town, Country, Reg. Nr: xxxxxxxx

and

[[client, full name]], ([[CLIENT]]), located at Street, ZIP Code, Town, Country, with its registered address at Street, ZIP Code, Town, Country, Reg. Nr: xxxxxxxx

(together, the "*Parties*").

WHEREAS:

[[ESCO]] is engaged in the business of generating and selling heating and cooling energy through the installation of a Large Solar Thermal ("LST") system and related equipment;

[[CLIENT]] operates an {FACILITY} located in {Country}, which is planned to start its operation in MMMM YYYY ("[[CLIENT]]'s Facilities");

It has been agreed that a LST shall be constructed and owned by [[ESCO]], which in turn shall provide [[CLIENT]] with thermal energy for heating/cooling.

NOW, THEREFORE, in consideration of the premises and mutual covenants, conditions and agreements hereinabove and hereinafter set forth and such other good and valuable considerations, [[CLIENT]] and [[ESCO]], each intending to be legally bound **DO HEREBY AGREE AS FOLLOWS:**

DEFINITIONS

Except as otherwise expressly provided herein, all italic and capitalized terms used in this *Agreement* shall have the respective meanings as set forth below:

- a) "*Acceptance Certificate*" shall mean the protocol to be signed by the *Parties* in accordance with clause 0 and Annex IV
- b) "*Acceptance Date*" shall mean the day when acceptance has occurred in accordance with clause 0 and Annex IV.
- c) "*Acceptance Test*" shall mean the test confirming the performance of the LST system as described in Annex IV
- d) "*Commissioning Phase*" shall mean the period between MMMM YYYY and MMMM YYYY as per Annex III and Annex IV
- e) "*Installer*" shall mean [[ESCO]] or its subcontractor carrying out the installation work for the *Solar Thermal Plant*
- f) "*Deed*" shall mean the deed to be signed between [LAND OWNER] and [[ESCO]] as attached in Annex VII
- g) "*Confidential Information*" shall mean information of commercial value which has been kept confidential by the Party from whom the information originates and which has not come into the public domain during the term of this *Agreement* in breach of any obligation of confidence
- h) "*Documentation*" shall mean a detailed description of the LST and drawings of the entire *Solar Thermal Plant*
- i) "VDI 2067" shall mean fundamentals and economic calculations of building installations in accordance to the instruction of VDE (Verein Deutscher Ingenieure) association of German engineers, as per Annex V
- j) "*Effective Date*" shall mean the date when this *Agreement* is signed.
- k) "*Fee*" shall mean the fees and charges for the provision of hot water as well as of cooling water as set out in clause 0 and Annex VI
- l) "*General Contractor*" shall mean the company responsible for construction of the [[CLIENT]]'s facilities, hired by the [[CLIENT]].

- m) “*Interfaces*” shall mean the interface between the *Solar Thermal Plant* and the hot water and cooling water distribution system to be installed by [[CLIENT]] as well as the interface between the *Solar Thermal Plant* and the roof of [[CLIENT]]’s Facilities. The Interfaces will be set out in the *Documentation*.
- n) “*Installation Plan*” shall mean the time schedule set out in Time Table Annex III
- o) “*Metering Equipment*” shall mean the meters measuring the quantities of solar energy consumed by [[CLIENT]], as per clause 0
- p) “*Minimum Off-Take*” shall mean the minimum annual quantity of x,xxx,xxx.00 kWh of cooling water and of yyy,yyy kWh of hot water, to be consumed and paid for by [[CLIENT]].
- q) “*Operations*” shall mean the activities as set out in clause 0
- r) “*Project Manager*” shall mean a nominated representative of each Party who shall have the overall responsibility for the coordination from the installation phase up to *Acceptance Date*.
- s) “*Solar Thermal Plant*” shall mean the large solar thermal system including all balance components such as cooling towers, storage tanks, control units [and energy efficiency components] to be installed by [[ESCO]] at [[CLIENT]]’s facilities.
- t) “*Term*” shall mean the term of this *Agreement* as defined in clause 0.

SCOPE

[[ESCO]] shall install, maintain and operate the *Solar Thermal Plant* at [[CLIENT]]’s facilities for the *Term* and shall provide [[CLIENT]] with water heating and cooling energy in accordance with this *Agreement*.

[[CLIENT]] shall provide [[CLIENT]]’s Facilities fit for the installation of the *Solar Thermal Plant*, provide all *Interfaces* for such installation and shall procure and pay for its requirements of water heating and cooling energy in accordance with this *Agreement*.

CONSTRUCTION OF SOLAR THERMAL PLANT

- [[ESCO]] shall install the Solar Thermal Plant at the premises of [[CLIENT]]’s facilities. Details of the Interfaces and timing are as agreed during tendering/engineering phase and detailed in Annex I and III. Any changes to the location or time shall be discussed and mutually agreed between the Parties. The Parties intend to fulfill their obligations in accordance with the master program as stipulated in the

contract between [[CLIENT]] and the General Contractor so as to ensure that the project is not delayed or incurs additional costs.

- The general obligations of [[ESCO]] during the construction, implementation phase and whilst the *General Contractor* has possession of site are detailed in Annex I. [[ESCO]] has employed *Installer* to perform its obligations.
- The installation of the *Solar Thermal Plant* is planned to begin after this *Agreement* becomes effective and be finished in accordance with the *Installation Plan*. If the installation is delayed for any reasons whatsoever, the implementation plan shall be amended to take account of such delay. If [[ESCO]] can demonstrate that the delay has been caused by [[CLIENT]] and/or the *General Contractor* and has resulted in an increase in cost for the installation, [[ESCO]] may at its sole discretion invoice [[CLIENT]] for such cost. The *Parties* agree that such additional entitlement shall be the only consequence for any delay in installation.
- If [[CLIENT]] requests any changes to the agreed upon design of the *Solar Thermal Plant*, the *Parties* shall meet and discuss the impact on time and cost. If such impact is agreed upon, [[ESCO]] shall ensure that the changes are implemented by the *Installer*.
- Both *Parties* shall appoint a *Project Manager*, who shall have the responsibility and commensurate authority for the overall progress of the installation.
- The general obligations of [[CLIENT]] during the *Term* are set out in Annex II. In order for [[ESCO]] to be able to have the *Solar Thermal Plant* installed, [[CLIENT]] shall prepare the *Interfaces* in accordance with [[ESCO]]'s directions.
- [[CLIENT]] shall ensure that its hot and cold water distribution system is installed in accordance with all specifications and measurements and that it is functioning without defaults.
- [[CLIENT]] undertakes to provide [[ESCO]] and the *Installer* during construction and operation of the *Solar Thermal Plant* free of charge with all required infrastructure and consumables such as electricity, water or internet access. Details are set out in Annex II.
- [[CLIENT]] undertakes, within 14 days after the *Effective Date*, to transfer a cash deposit of EUR/USD XX,XXX,XXX ("*Deposit*") as an escrow into a bank account in the name of [[ESCO]] at Raiffeisen-Landesbank Steiermark AG Austria (RLB) as a security for payment of the *Minimum Off-ake*. [[ESCO]] undertakes, within two months after the *Effective Date*, to transfer an amount of EUR/USD xxx,xxx into the *Deposit*, so that the total amount of the *Deposit* shall be EUR/USD x,xxx,yyy. [[ESCO]] shall have the right to offset the *Deposit*, in whole or in part, in the event and to the extent that [[CLIENT]] at any time does not comply with its payment obligations under this *Agreement*. The *Deposit* shall be topped-up by [[CLIENT]] in the amount of any such set-off within thirty days from the date of notice of such set-off by [[ESCO]].
- Once the loans granted by RLB have been repaid by [[ESCO]], but latest on 1 January 20xx, the *Deposit* shall be paid back to [[CLIENT]] in equal annual tranches, such that the *Deposit* is refunded in full by the end of the initial term. [[ESCO]] shall be entitled to earlier repayments. Starting on the day of the first repayment by [[ESCO]] to [[CLIENT]], the *Deposit* shall become interest bearing at the [LIBOR/EURIBOR/.], calculated at the annual average rate.

ACCEPTANCE

Once the TOP has been issued, [[ESCO]] and the *Installer* shall begin with the commissioning/start up of the LST. [[ESCO]] shall give [[CLIENT]] at least 24 hours' notice of the start of the *Acceptance Tests* and permits [[CLIENT]] to observe the testing.

It is intended to have the *Acceptance Test* performed between April 20xx and June 20xx, so that rectification measures, if any, can be undertaken by [[ESCO]] until August 20xx. An *Acceptance Certificate* shall be issued by *Installer* and signed by [[ESCO]] when the *Acceptance Test* has been performed successfully. The energy produced by the LST from the date of issuance of the *Acceptance Certificate* shall be consumed and paid by [[CLIENT]].

Details of the commissioning period and the *Acceptance Test* as well as rectification measures (Certificates, Checklists), if any requested by [[CLIENT]], are set out in Annex IV.

OWNERSHIP OF THE SOLAR THERMAL PLANT

Title to the *Solar Thermal Plant* shall remain at all times with [[ESCO]].

[[CLIENT]] shall either obtain or support [[ESCO]] in obtaining all necessary approvals from relevant authorities for the installation, operation and maintenance of the *Solar Thermal Plant*.

[[CLIENT]] shall not remove, alter (except as otherwise required or permitted under this *Agreement*) or assign, pledge, mortgage, permit any lien to exist on the *Solar Thermal Plant*. For the avoidance of doubt, [[CLIENT]] unreservedly acknowledges that the *Solar Thermal Plant* shall not constitute part of the actual building and throughout the *Term* shall not cause damage to or permit anything which may damage the *Solar Thermal Plant*.

EASEMENT

[[CLIENT]] shall grant, or cause to be granted, to [[ESCO]], its representatives and/or agents all rights-of-way, access rights, easements, licenses and other rights with respect to [[CLIENT]]'s facilities as are necessary for [[ESCO]] to perform its obligations and exercise under this *Agreement*. [[CLIENT]] shall obtain, or cause to be obtained (in form and substance satisfactory to [[ESCO]]) non-disturbance agreements or, if applicable, waivers and/or consents from each of its mortgagees or landlords with respect to all rights of way, access rights, easements, licenses and other property rights which [[ESCO]] requires to perform its rights and obligations under this *Agreement*.

Any access shall be in compliance with safety, security and operational requirements of [[CLIENT]].

The *Parties* shall, upon [[ESCO]]'s request, execute a separate agreement, based on the acceptance of the building owner, for the grant of such rights-of-way, access rights, easements, licenses and other rights in relation to the obligations contained in this *Agreement*, especially unobstructed access to the *Solar Thermal Plant*.

OPERATIONS

Within 10 days of commencement of commissioning and start up of the *Solar Thermal Plant*, [[ESCO]] shall operate the *Solar Thermal Plant* for the *Term*. [[CLIENT]] shall ensure that it can consume all energy generated by the *Solar Thermal Plant* during the commissioning phase (start up – *Acceptance Date*).

The full operation and generation of energy is estimated to start DD MMMM YYYY. At this date the *Solar Thermal Plant* shall be handed over from the *Installer* to [[ESCO]]. The generated energy will be charged according to the *Tariff* as set out in Annex VI from the date of the *Acceptance Certificate*.

The *Operations* shall consist of the following activities of [[ESCO]]:

- Annual servicing of the *Solar Thermal Plant* in accordance with the respective specifications of the manufacturer; and
- Maintenance and repair in case of defects of the *Solar Thermal Plant*; and
- Constant supervision and optimizing of the operation of the *Solar Thermal Plant* via telemonitoring facilities; and
- Modifications as well as replacement of non-economical parts of the *Solar Thermal Plant* as deemed necessary by [[ESCO]]; and
- Provision of online data and the input information of the *Solar Thermal Plant* for the educational system of [[CLIENT]]. The monitoring hardware and graphical displays will be provided by [[CLIENT]].

In case of any works at the *Solar Thermal Plant*, [[ESCO]] shall be entitled to suspend the provision of water heating and water cooling for the period required to conduct such works. If possible, [[ESCO]] shall notify [[CLIENT]] sufficiently in advance of such works.

The cost of *Operations* shall be borne by [[ESCO]] and are included in the *Fee*. However, the cost for any defect which has not been caused by the willful misconduct or gross negligence of [[ESCO]] shall be paid for by [[CLIENT]].

[[CLIENT]] shall ensure that [[CLIENT]]'s facilities, its hot and cold water distribution system as well as all *Interfaces* are at all times properly maintained and fully functioning to supply hot and cold water, in order to ensure the performance of the *Solar Thermal Plant*. [[ESCO]] shall ensure that the LST is at all times properly maintained and fully functioning.

[[CLIENT]] shall provide the following, free of charge, during the *Term*

- a connection (*Interfaces*) and in house distribution system for hot and cold water of sufficient size and quality, properly maintained at all times, for the supply of hot and cold water; and
- electrical connectivity which ensures a secure and undisturbed operation of the *Solar Thermal Plant*; and

- sufficient electric energy/power supply to ensure a proper function of all equipment of the *Solar Thermal Plant*; and
- a water supply and discharge system of sufficient size and quality; and
- sufficient water for re-cooling the cooling towers of the *Solar Thermal Plant*. The demand will be between 8 – 10 liters per kWh cooling production *Solar Thermal Plant*.
- water for the filling of the *Solar Thermal Plant*; and
- all necessary permissions and approvals in the country for the operation of the *Solar Thermal Plant* as a user
- a data link with continuous internet access for the supervision of the *Solar Thermal Plant*.

Details are set out in Annex I and II and VI (consumption figures).

SUPPLY AND CONSUMPTION OF SOLAR ENERGY

[[ESCO]] undertakes to provide an annual minimum amount of solar energy equal to the *Minimum Off-Take*. If in any year [[ESCO]] should not be able to provide the *Minimum Off-Take* for reasons [[ESCO]] is responsible for, [[ESCO]] shall be obliged to optimize the *Solar Thermal Plant* over a period of three (3) years.

[[CLIENT]] undertakes to consume all energy generated by the *Solar Thermal Plant* and provided at the agreed *Interfaces*.

If [[CLIENT]] is not able, for operational reasons, to take all the energy provided by the *Solar Thermal Plant*, [[CLIENT]] shall be obliged to pay for the *Minimum Off-Take* at the then relevant *Fee*.

[[CLIENT]] shall, as a back-up, operate its own energy system for cooling and hot water which shall provide energy if and to the extent the energy provided by the *Solar Thermal Plant* is not sufficient to cater for [[CLIENT]]'s needs.

The *Metering Equipment* as per [country/institution] standard shall be installed and maintained by [[ESCO]] and remain, during the *Term*, the property of [[ESCO]]. All quantities of energy measured at the meter are considered consumed by [[CLIENT]].

All *Metering Equipment* calibrated to kWh (heat meter) will be tested and calibrated by [[ESCO]] periodically in accordance with the manufacturer's instructions and good industry practice and standards. Test and calibration records will be issued to [[CLIENT]] upon request. Further, [[CLIENT]] may request additional meter tests at any time; provided, however, if a meter is subsequently found to have a variance for accuracy in accordance with EN 1434 (European Standard for heat meters) or adequate country's regulation, [[CLIENT]] will bear the cost of such testing. The country's standards if available shall prevail.

FEES

The fee for the provision of hot water shall consist of a monthly base price and an operating price and shall be calculated in accordance with Annex VI.

The fee for the provision of cooling water shall consist of a monthly base price and an operating price and shall be calculated in accordance with Annex VI.

The *Fee* shall be adapted on a semi-annual basis in accordance with the formula set out in Annex VI.

PAYMENT

The *Fee* is net of any taxes, duties or other disbursements, which shall be borne by [[CLIENT]]. However the invoice, stipulating the fee, will include GST, which is payable by [[CLIENT]].

[[ESCO]] shall issue invoices on a monthly basis. The invoices shall be based on the projected annual off-take of hot and cooling water and the prevailing energy prices. Details are set out in more detail in Annex VI.

Payments shall be due and payable within 14 days from the date of invoice. In case of delayed payments, interest of 10% above [LIBOR/EURIBOR] shall accrue on a daily basis.

Within 28 days after the end of each calendar year [[ESCO]] shall provide [[CLIENT]] with an overview of the quantities consumed during the previous year and the respective fee ("Annual Account"). The difference between the payments invoiced during the previous year and the payments calculated based on actual consumption shall be accounted for in the invoice of the month following the provision of the Annual Account.

Objections against the Annual Account may be raised by [[CLIENT]] within a period of thirty days of receipt of the Annual Account. Thereafter the Annual Account is considered approved.

[[ESCO]] shall be entitled to demand a pre-payment of the *Fee* up to an amount of two monthly payment rates if payments have been overdue for more than twenty days.

In case of any damage of the metering equipment [[ESCO]] is entitled to bill on the basis of the *Minimum Off-Take* in respect of the time quantities have not been measured correctly.

TERM AND TERMINATION

This *Agreement* shall be in full force and effect and be legally binding upon the *Parties* and their permitted successors and assigns as of the date hereof and shall remain in effect for a term of twenty (20) years as of the *Acceptance Date* ("*Initial Term*"). After this time this *Agreement* can be extended by mutual agreement at terms to agreed at that time.

This *Agreement* may be terminated in writing by registered letter with immediate effect by [[ESCO]]:

- if [[ESCO]] is prevented, by [[CLIENT]] or any party claiming rights to [[CLIENT]]'s facilities or the land to which such facilities are attached, from accessing [[CLIENT]]'s facilities and the *Solar Thermal Plant* and conducting the *Operations* for a period of no less than two (2) weeks, and [[CLIENT]] has, after being officially informed about such restrictions, not removed such restrictions within a period of two (2) months; or
- if payments are overdue for more than three (3) months; or
- if [[CLIENT]] does not sign the *Deed* on or before DD.MMM YYYY.

This *Agreement* may be terminated in writing by registered letter with immediate effect by either Party, if

- the other Party commits a material or persistent breach of any of its obligations under this *Agreement* and (in the case of a breach capable of being remedied) does not remedy such breach within 30 days of receiving from the other Party written notice of the breach and a request to remedy the breach.
- distress or execution is levied on the other Party's property or if the other Party has a receiver, administrator, administrative receiver or manager appointed over the whole or any part of its assets, becomes insolvent, compounds or makes any arrangement with its creditors, commits any act of bankruptcy, is wound up or goes into liquidation, or if the other Party suffers any analogous proceedings under foreign law

RIGHTS AND OBLIGATIONS AFTER TERMINATION

In case of termination by [[CLIENT]], [[CLIENT]] shall be entitled to (1) either purchase the *Solar Thermal Plant* at its book value, including cost of financing and further investments as determined in accordance with VDI 2067, if [[ESCO]] could not nominate a successor in title, who undertakes to take over the full obligation (professional operation and maintenance of the LST) of this *Agreement*, or (2) have the *Solar Thermal Plant* removed at no cost to [[CLIENT]].

In case of termination by [[ESCO]], [[ESCO]] shall have the option to (1) sell and [[CLIENT]] shall be obliged to purchase the *Solar Thermal Plant* at its book value, including cost of financing and further investments as determined in accordance with VDI 2067 plus the *Fee* for the *Minimum Off-Take* calculated until the end of the *Initial Term* ; or (2) to remove the *Solar Thermal Plant* from [[CLIENT]]'s facilities with all costs of removal to be borne by [[CLIENT]]. In case of termination by [[ESCO]] under clause 1, [[CLIENT]] shall be obliged to reimburse all cost incurred by [[ESCO]] in relation to the engineering, installation and equipment up to the date of termination.

At the end of the *Initial Term* or any extension thereof, [[ESCO]] shall have the choice to either sell the *Solar Thermal Plant* to [[CLIENT]] at its book value, including cost of financing and further investments as determined in accordance with VDI 2067 or to remove it from [[CLIENT]]'s Facilities.

Termination shall not affect or prejudice any right to damages or other remedy which the terminating party may have in respect of the event giving rise to the termination or any other right to damages or other remedy which any party may have in respect of any breach of this *Agreement* which existed at or before the date of termination.

[[ESCO]]'S WARRANTIES

[[ESCO]] warrants that the *Solar Thermal Plant* will be new, of good quality and of latest state of art of LST systems.

During installation and building the *Solar Thermal Plant* [[ESCO]] shall ensure that *Installer* shall follow strictly the local laws and regulations.

[[ESCO]] warrants that the *Solar Thermal Plant* during the *Term*, will provide the annual *Minimum Off-Take* quantities, if [[CLIENT]] fulfils its obligations under clause 3 and the *Operations* were not hindered for reasons of Force Majeure or third party's actions or inactions. The sole remedy for breach of the warranty under this clause 0 shall be correction of defects by [[ESCO]] within a reasonable time from notification by [[CLIENT]] of the defect.

The above warranties are in lieu of all other express or implied warranties or conditions including, but not limited to, implied warranties or conditions of merchantability and fitness for a particular purpose. [[ESCO]] specifically denies any implied or express representation that the *Solar Thermal Plant* will be fit

- to operate in conjunction with any other *Interfaces* than those identified in the *Documentation* or
- to operate uninterrupted or error-free.

Any unauthorised modifications, use or improper installation of the *Solar Thermal Plant* by [[CLIENT]] shall render all the [[ESCO]]'s warranties and support obligations null and void.

Subject to clause 0, [[ESCO]] shall defend, hold harmless and indemnify [[CLIENT]] against all loss, damage, claims, liabilities, fees, costs and expenses arising out of any action brought against [[CLIENT]] based on a claim that the *Solar Thermal Plant* infringes any intellectual property right of any third party, provided that:

- [[ESCO]] is notified promptly in writing of any such claim;
- [[CLIENT]] makes no admission or settlement of such claim without [[ESCO]]'s prior written consent;
- [[ESCO]] has sole control of the defence and any negotiations for compromise; and
- [[CLIENT]] provides, at [[ESCO]]'s expense, such assistance as [[ESCO]] reasonably requires.

If the *Solar Thermal Plant* becomes or, in the opinion of qualified legal counsel, is likely to become, the subject of any such claim, [[CLIENT]] will permit [[ESCO]] to replace all or part of the *Solar Thermal Plant* without any charge to [[CLIENT]]; and/or to modify the *Solar Thermal Plant* as necessary to avoid such claim; and/or to procure for [[CLIENT]] a licence from the relevant complainant to continue using the *Solar Thermal Plant*.

[[ESCO]] shall have no liability for any claim of intellectual property infringement resulting from any unauthorised modification of the *Solar Thermal Plant*.

[[CLIENT]]'S WARRANTIES

[[CLIENT]] warrants to provide [[CLIENT]]'s facilities fit for the installation of the *Solar Thermal Plant*, provide all *Interfaces* for such installation and to procure and pay for its requirements of water heating and cooling energy in accordance with this *Agreement*.

[[CLIENT]] warrants not to remove, alter (except as otherwise required or permitted under this *Agreement*) or assign, pledge, mortgage, permit any lien to exist on the *Solar Thermal Plant*.

LIABILITY

To the extent not covered by the insurances described under clause 0, [[ESCO]]'s entire liability under this *Agreement* or for any cause of action related to the *Solar Thermal Plant* shall be limited to EUR X,000,000. [[ESCO]] shall not be liable for any incidental, special, direct or consequential damages of any nature, including lost profits and opportunity costs in connection with or resulting from performance or non-performance of their respective obligations under or in connection with this *Agreement*.

The exclusions in this clause 15 shall apply to the fullest extent permissible at law, but [[ESCO]] does not exclude liability for death or personal injury caused by the negligence of [[ESCO]], its officers, employees, [[ESCO]]s or agents for fraud or any other liability which may not be excluded by law.

INSURANCE

During construction and until *Acceptance Date* [[ESCO]] shall maintain or have maintained such insurances as are required by [the national authorities] to cover the liability of [[ESCO]] in respect of personal injuries or death or damage to property and caused by any negligence, omission, breach of *Agreement* or default of the [[ESCO]], his servants or agents or any person employed or engaged upon or in connection with the installation of the *Solar Thermal Plant*. Furthermore [[ESCO]] shall maintain an insurance to cover the liability of [[ESCO]] in respect of personal injuries or death or damage to property and caused by the operation of the *Solar Thermal Plant*.

Upon *Acceptance Date*, [[CLIENT]] shall insure and keep insured during the *Term* the *Solar Thermal Plant* in the joint names of [[CLIENT]] and [[ESCO]] against all damage, loss or injury from whatever cause arising up to the value determined by [[ESCO]]. Such insurance shall be effected with an insurer in terms approved by [[ESCO]]. In the event that [[CLIENT]] defaults in taking out or maintaining such insurance policies as aforesaid, [[ESCO]] (without prejudice to any other rights or remedies available) may itself insure against any risk in respect of which the default has occurred and any amount paid by it in respect of premiums shall be recoverable from [[CLIENT]].

FORCE MAJEURE

Neither [[CLIENT]] nor [[ESCO]] shall be in default in respect of any obligation under this *Agreement* if the Party is unable to perform its obligation by reason of an event of Force Majeure, provided that the suspension of

performance shall be commensurate with the nature and duration of the event of Force Majeure and the non-performing party is using its best efforts to restore its ability to perform.

Force Majeure shall mean any event that prevents or delays a Party from performing in whole or in part any obligation arising under this *Agreement* and neither was within the reasonable control of the non-performing Party nor could have been prevented by reasonable actions taken by the non-performing Party, including, without limitation, an act of God, explosion, fire, lightening, earthquake, storm, civil disturbance, strike, lock-out, changes in law, orders of governmental authorities, and equipment failures that are not due to the negligence of the non-performing party.

ASSIGNMENT

Neither Party shall assign this *Agreement* without first having obtained the written consent of the other Party, provided, however, that either Party may assign its rights and delegate its duties hereunder without first obtaining the other Party's consent to any subsidiary or affiliated entity controlled by the assigning party, on the condition that the assignee agrees in writing to assume all of the obligations of the assigning party hereunder.

NOTICES

Any notice required to be given under this *Agreement* shall be sufficiently served if sent by facsimile (subject to confirmation of receipt by the receiving Party), telegram, registered post, courier or hand and addressed to the principal or registered office of the Party to be served. Any such notice shall be deemed to have been received and given at the time when in the ordinary course of transmission, it should have been delivered at the address to which it was sent. However, all official court related process shall be served according to the Rules of Court.

The initial point of contact shall be as stated in clause 0.

CONFIDENTIALITY

Each of the *Parties* shall treat as confidential all *Confidential Information* of the other Party supplied under or in relation to this *Agreement*. No Party shall divulge any such *Confidential Information* to any person except to its own employees and then only to those employees who need to know the same. Each Party shall ensure that its employees are aware of, and comply with, the provisions of this clause.

The foregoing obligations shall remain in full force and effect notwithstanding any termination of this *Agreement*.

PROMOTION

The *Solar Thermal Plant* and its utilization by [[CLIENT]] may be used by both *Parties* as a reference project towards third parties. The *Parties* therefore shall undertake all reasonable endeavors to support each other's requests for the presentation of the *Solar Thermal Plant*.

Both *Parties* agree that each can make use of the LST at [[CLIENT]] facilities for advertising and public relations purposes like: pictures, videos, internet links, visitors of potential clients, etc. However [[CLIENT]] retains the control of visitors, but the permission to visit the LST together with prospective [[ESCO]] clients should not be unreasonably withheld.

WAIVER

No right under this *Agreement* shall be deemed to be waived except by notice in writing signed by the waiving Party. The failure of either Party to enforce, at any time or for any period of time, the provisions hereof or the failure of any Party to exercise any option herein shall not be construed as a waiver of such provision or option and shall in no way affect that Party's right to enforce such provisions or exercise such option. No waiver of any provision hereof shall be deemed a waiver of any succeeding breach of the same or any other provision of this *Agreement*.

ENTIRE AGREEMENT, ORDER OF DOCUMENTS

The *Agreement* constitutes the entire agreement between the *Parties* with respect to the matters contained herein and replaces any previous document, agreements and commitment whether oral or written. No amendment or modification hereof shall be binding unless duly executed by both *Parties*. In case of any discrepancies between this *Agreement*, its Annexes and the *Documentation*, the *Agreement* shall have priority over the Annexes and the Annexes shall have priority over the *Documentation*.

SEVERABILITY

Any provision hereof that is prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction and to the fullest extent permitted by applicable law, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof and without affecting the validity or enforceability of any provision in any other jurisdiction.

COUNTERPARTS

This *Agreement* may be executed in separate and several counterparts, each of which shall be deemed an original and all of which shall constitute one and the same instrument.

THIRD PARTY RIGHTS

This *Agreement* and the documents referred to in it, are made for the benefit of the *Parties* to them and their successors and permitted assigns and are not intended to benefit, or be enforceable by, anyone else.

AUTHORITY

Each party warrants that it has full capacity and authority, and all necessary licenses, permits and consents to enter into and perform this *Agreement* and that those signing this *Agreement* are duly authorized to bind the Party for whom they sign.

APPLICABLE LAW

This *Agreement* shall be construed in accordance with and shall be enforceable under the laws of Singapore.

DISPUTE RESOLUTION

Any dispute arising out of or in relation to this *Agreement* shall be referred to and finally resolved by arbitration in [COUNTRY] in accordance with the Arbitration Rules of the [Arbitration Authority] for the time being in force which rules are deemed incorporated by reference to this Clause. The Tribunal shall consist of three arbitrators. The decision of such Tribunal shall be final and binding upon the *Parties*. The language of the arbitration shall be English.

CORRESPONDENCE & REGISTERED ADDRESS

All the correspondence, invoices, credit or debit notes, etc., must be issued in the name of [[CLIENT]] must be addressed to:

[[CLIENT, FULL NAME]]

Address

Address

ZIP Code, Town

Email: name@domain.suffix

Tel: +xx yyy zzzzzzzz Mobile: +xx yyy zzzzzzzz

Fax: +xx yyy zzzzzzzz

All the correspondence with [[ESCO]] must be duly identified with either of the ESCo Agreement or related references and addressed to:

[[local SOLID ESCO subsidiary, full name]]

Address

Address

ZIP Code, Town

Email: name@domain.suffix

Tel: +xx yyy zzzzzzzz Mobile: +xx yyy zzzzzzzz

Fax: +xx yyy zzzzzzzz

IN WITNESS WHEREOF the Parties have caused this Agreement to be duly executed and delivered as of the date and day first above written

.....

Date, Place Date, Place

.....

[[local ESCO, full name]] [[CLIENT, FULL NAME]]

APPENDIX

GENERAL CONSTRUCTION OBLIGATION OF [[ESCO]]

[[ESCO]] shall, with due care and diligence, design, execute and complete the *Solar Thermal Plant* fit for Acceptance as detailed in Annex IV. [[ESCO]] shall provide all superintendence, labour, Plant, Construction Equipment, materials, goods and all other things, whether of a temporary or permanent nature required in and for such design, execution and completion of the *Solar Thermal Plant* as per Clause 3 of this *Agreement* and shall remedy any defects.

Without prejudice to the generality of paragraph (1) of this sub-clause, and to [[ESCO]]'s obligations under the *Agreement*,

- a. [[ESCO]] shall be fully responsible for the design of the *Solar Thermal Plant*, and shall complete the design in accordance with [[CLIENT]]'s plans
- b. [[ESCO]] shall be fully responsible for the choice of materials, goods, plants, workmanship to enable the *Solar Thermal Plant* to be constructed and completed and/or be fully operational in accordance with [[CLIENT]]'s plans;
- c. [[ESCO]] shall be fully responsible for the preparation, development and coordinating of all design *Solar Thermal Plant* and construction at all stages of the *Solar Thermal Plant* from design stage to completion and use of the *Solar Thermal Plant*, including the obtaining of all necessary licenses and approvals as may be required by the authorities or under any enactment, order, ruling or regulation; except Clause 6 of this *Agreement*;
- d. [[ESCO]] shall be fully responsible for the adequacy, stability and safety of the installation of the LST ;

EMPLOYMENT OF QUALIFIED PERSONNEL

The [[ESCO]] shall engage suitably qualified installer/personnel as required by relevant applicable laws to install the *Solar Thermal Plant*. All fees, costs and expenses so incurred by [[ESCO]] shall be deemed to be included in the *Agreement Sum*.

Where an Accredited Checker or Registered Inspector is required for the *Solar Thermal Plant*, they shall be engaged by [[CLIENT]].

No person shall be engaged by [[ESCO]] if [[CLIENT]] on reasonable grounds objects to the engagement of such qualified personnel, in which event [[ESCO]] shall promptly nominate and engage other suitably qualified personnel.

SUFFICIENCY OF SOLAR THERMAL PLANT

The [[ESCO]] shall be deemed to have satisfied himself before submitting the documentation as to the correctness and sufficiency of the *Solar Thermal Plant*, which shall be deemed to cover all his obligations under the *Agreement* and all matters and things necessary for the proper design, execution, completion and operation of the *Solar Thermal Plant*.

The [[ESCO]] shall be deemed to have reviewed all of the *Agreement* and have satisfied himself that the drawn and written information provided in the *Agreement* are sufficient and adequate to enable him to prepare, complete and bring the [[ESCO]]'s *Solar Thermal Plant* to full completion in accordance with the *Agreement*..

DESIGN, SPECIFICATIONS AND OTHER INFORMATION

[[ESCO]] shall design and provide all necessary specification for the *Solar Thermal Plant* in accordance with the site plans and requirements of [[CLIENT]]. Any design detail, plan, drawing, specification, note, annotation and information required shall be provided by [[ESCO]] in such sufficient format, detail, extent size and scale and within such time as may reasonably be required to ensure effective execution of the *Solar Thermal Plant* and/or as otherwise required by [[CLIENT]]. An overall view of [[ESCO]] concept/design is shown in the enclosed Hydraulic scheme.

PRIOR WRITTEN ACCEPTANCE

[[ESCO]] shall make any material deviation, alteration, addition and/or omission from the accepted design without the prior acceptance in writing by the [[CLIENT]], if it turns out that such alteration is more economical or technically feasible and to the benefit for the parties. Any acceptance or approval by [[CLIENT]] of such submission shall not relieve or in any way limit the responsibility of the [[ESCO]] under the *Agreement*.

GENERAL OBLIGATION OF [[CLIENT]]

[[CLIENT]] GENERAL RESPONSIBILITIES

In addition to the obligations and responsibilities of [[CLIENT]] as stipulated in this *Agreement* the following precautions, preparations, coordination, supplies, etc., shall be provided in time by [[CLIENT]]:

- 1) The in-house ACMV installation must be designed, installed (of state of the art) and in accordance with international standards (Comparable to DIN, ISO, EU standards).
- 2) Adequate space for the technical rooms (for the solar components, equipment and control units) must be given and allocated for the solar system, provided that these required spaces are requested from the [[CLIENT]] at the earliest possible time.
- 3) Statics Requirements
 - a. Design, supply and mounting of the supporting structures for the installation of the collectors, cooling machine and the cooling tower.
 - b. The statics requirements are to be checked by the [[CLIENT]].
 - c. The exact weight and size of the above mentioned components will be submitted during detailed engineering phase.
 - d. Foundation must be adequate for storage tanks, cooling machine, cooling tower and other heavy equipment.
- 4) The dimensioning of individual foundations must be in accordance with local building laws and regulations, which shall be carried out by a qualified engineer provided by the [[CLIENT]]. The location of the foundation blocks will be nominated by [[ESCO]].
- 5) The cranes and operators shall be allocated by [[CLIENT]] to [[ESCO]] for the installation of the collectors (lifting devices, tools and tackles to position chiller and other heavy equipment), in accordance to the time schedule as specified in Annex III.

- 6) Delivery and mounting of substructure and elevation for collector field.
- 7) All material for back-filling of pipe trenches
- 8) Gas connection for preparing domestic hot water backup system.
 - a. A gas connection system and an adequate chimney has to be provided by [[CLIENT]]
 - b. [[ESCO]] shall be informed in written form by [[CLIENT]] about the type of gas (i.e. liquid gas: propane, butane, or natural gas etc).
- 9) Allocation of shafts/ducts/trenches for the risers from the roofs to the technical rooms.
- 10) Distribution system of chilled water:
 - a. Provision of the whole pipe work after the chilled water pump unit (Pump unit 3).
- 11) Distribution system of domestic hot water.
 - a. Provision of the inflow of the cold water pipe into the hot water tank and the outflow of the hot water pipe to the distribution system.
- 12) Continuous internet connection near the control unit shall be made available.
- 13) The [[CLIENT]] has to provide the followings for remote monitoring:
 - a. Network access for internet
 - b. Broadband access, minimum 56k/bps
 - c. Dynamic IP address
 - d. Electricity supply
- 14) Installation of the power connection for the cooling machine and the pumping groups (wattages will be submitted after detailed engineering and procurement phase).
- 15) Water supply
 - a. To supply all utilities, water, personnel (maintenance group) for filling the entire solar system (tanks, pipes, collectors, etc) with water for testing and commissioning of the LST under the supervision of the [[ESCO]].
- 16) Water treatment
 - a. The supply of fresh water has to be treated chemically by [[CLIENT]] before it flows into the re-cooling system.
 - b. [[ESCO]] will take care of the biological treatment after the re-cooling system. (According to EU standards, a biological water treatment is needed after the cooling tower due of the settlement of bacteria in the re-cooling system.) All costs of such treatment shall be borne by [[CLIENT]]
- 17) Allocation of potential equalizing bar, according to the [COUNTRY] law and regulations.
- 18) Lightning protection system (if needed according to [COUNTRY] law).
- 19) Fire preventions as required by [COUNTRY] law.

20) Precautions, proper design of drainage systems in the technical rooms. Special requirements and data will be submitted by the [[ESCO]] during detailed engineering phase.

PERFORMANCE DATA

The enclosed monthly yield data stipulates the performance of the *Solar Thermal Plant*. During commissioning period the calibrated heat meters (metering equipment) will be jointly inspected and the below list of monthly yield now in MBTU shall be converted according to the units displayed at the heat meters as well as recorded in the control system.

Table 1 Monthly Yield of LST



Date: 22.April 2010

Monthly YIELD

SOLID Energy Services

Customer:
Project:
Prize Basis:
Installed Capacity:

	MINIMUM [kWh]		MAXIMUM [kWh]	
	Cooling	Hot water	Cooling	Hot water
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
TOTAL				

MONTH	MINIMUM [MBTU]		MAXIMUM [MBTU]	
	Cooling	Hot water	Cooling	Hot water
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
TOTAL				

TEST PROCEDURE, START-UP, CONSUMPTION OF PRODUCED ENERGY, OPTIMIZING

a) Commissioning

Immediately after completion of the installation (also partly) of LST, the Installer will carry out the cleaning and testing. [[CLIENT]] representatives will have the right to participate during Commissioning of the LST at [[CLIENT]] Campus. During the filling, the Installer will carry out mechanical functional test of each individual equipment (pump, control valve, motor, control system, etc.) installed and also perform the leakage and tightness tests of the hydraulic system.

The Commissioning Period shall be approximately 3-4 months.

After the Commissioning, the LST will be started up and put into operation and all necessary parameters and data for the normal operation to generate Energy shall be met according to estimated average yield as set out in Table 1 under this Annex.

b) Acceptance Tests

The Acceptance Tests shall be conducted by Installer under the supervision of [[ESCO]] International GmbH/Austria. The Acceptance Tests shall comprise of a functional test and tests of individual parts of the equipment and/or units of the LST (AC & DHW). The test procedure of the Acceptance Tests will be worked out jointly with [[ESCO]] and the Installer. [[CLIENT]] will be timely invited to be a witness of the Acceptance test.

After the Acceptance Test, equipment or parts which have not met the guaranteed values shall be re-calibrated to improve the performance of the LST. In the event that the guaranteed Monthly Yields as per Table 1. are not met due to reasons outside [[ESCO]] control (weather conditions, etc.), it is agreed that Acceptance Tests shall be repeated, but the 1. Acceptance Certificate shall be not withheld.

The Acceptance Certificate for the LST shall be issued to [[ESCO]] and signed by the Installer and as a witness by [[CLIENT]] after the Performance Tests are carried out. Please refer to the drafted Forms as per Annex VIII

c) Consumption of produced Energy (heat ,cold)

The stipulated solar yields mentioned are the average energy outputs over a whole year.

The cooling production XXXX kWh/day is the maximum cooling energy output for one day which can be reached by the Solar Thermal Plant. If the [[CLIENT]] needs less cooling energy than this maximum output the mentioned average energy output over a whole year as mentioned in the table could not be reached because it has to be considered that on some days you have surplus of usable solar energy. The Metering Equipments are installed as per technical specification and stipulated in the flow Diagrams.

Even if production during maximum solar radiation- very sunny days- is optimal , or in periods with minimum consumption [[CLIENT]] will also utilize the entire solar energy production.

d) Optimizing, Final Performance Data

The Optimizing Period of 3 years for the LST for [[CLIENT]] will start after the completion of the Solar Thermal Plant and the full Operation of the LST. All the performance values will be defined jointly with [[CLIENT]] and [[ESCO]] during the optimising period.

It is mutually agreed that Optimizing Period of another 3 years can be extended if the agreed and stipulated Performance Values are not reached in order to enable [[ESCO]] to make alteration on the Solar Thermal Plant, to gain the optimum output of Energy. [[ESCO]] can decide if is necessary to carry out these alteration.

[[CLIENT]] shall issue the Final Acceptance Certificate to [[ESCO]] after the 3 years period, and provided that all the stipulated guaranteed data as specified above are met.

The Final Acceptance Certificate shall specify all relevant parameters of the LST as stipulated by [[ESCO]].

All forms of protocols, test reports and other documentation during commissioning can be provided by [[ESCO]] upon request to [[CLIENT]]. Samples see Annex VIII.

TARIFF - FEES/CHARGES

The enclosed Tariffs stipulates the fees and charges invoiced to [[CLIENT]] for energy generated by the *Solar Thermal Plant* and to be utilized by [[CLIENT]] at the takeover points (interfaces) and measured by the Heat Meters installed at the interfaces. The parameters (Temperature °C and Flow m³) will be stipulated and agreed upon with [[CLIENT]] and [[ESCO]] during project period and/or optimizing. Please refer to the Consumption Calculation Methodology for LST.

Table 1. Summary of Consumption Fees and Capacity Charges

SOLID Energy service, ESCo Cost Scheme

TARIFF



Customer:
Project:
Prize Basis:
Installed Capacity:

Date:

TYPE	Production/Consumption		Fees/kWh [/kWh]	Fees/Charges with MINIMUM consumption		Total/year []	NOTES
	min. [kWh]	max. [kWh]		∅Consumption fee [/year]	∅Capacity charges [/year]		
COOLING							
HOT WATER							
TOTAL							

ESCo Tariff

Summary of annual consumption fees and capacity charges will be calculated according to the actual prevailing values as follows:

Monthly consumption x electric tariffs for AC (published ¼ year by SP), or gas tariffs for DHW (published frequently by City Gas) + capacity charge = Sum Month 1

The total sum (Annual Account) will be compensated by the estimated advance payment paid by [[CLIENT]] of the year xxxx. The difference, if positive will be considered for the coming year estimated advance payment and is payable to an agreed period to [[ESCO]].

The monthly advance payment of the consumption fee and the capacity charges for the forthcoming year will be calculated by the total of the fees and charges from previous year divided by 12.

THESE FEES/CHARGES WILL BE ADJUSTED SEMIANNUALLY ACCORDING TO BELOW SET OUT FORMULAS:

P_{xxxx} shall mean the prices/values of fee prevailing in the year xxxx

P₂₀₀₉ shall mean the prices/values of fee prevailing in the year 2009

CPI_{xxxx} shall mean the prices/values of the Consumer Price Index published by [COUNTRY] Department of Statistics for the year xxxx

CPI₂₀₀₉ shall mean the prices/values of the Consumer Price Index published by [COUNTRY] Department of Statistics for the year 2009

ET_{xxxx} or GT_{xxxx} shall mean the prices/values of the Electric Tariff or Gas Tariff published by [COUNTRY UTILITY] , quarterly for the year xxxx

ET₂₀₀₉ or GT₂₀₀₉ shall mean the prices/values of the Electric Tariff published by [COUNTRY UTILITY] or Gas Tariff published by City Gas respectively, quarterly for the year 2009

Consumption Fees:

Capacity Charges:

$$P_{ET\ xxxx} = P_{2009} \times ET_{xxxx} / ET_{2009}$$

$$P_{ET\ xxxx} = P_{2009} \times CPI_{xxxx} / CPI_{2009}$$

$$P_{GT\ xxxx} = P_{2009} \times GT_{xxxx} / GT_{2009}$$

EXAMPLE EQUATION: (FOR ELECTRICITY)

2009 Consumption Fee $P_{2009} = 243.908 \times 0,22_{2009} / 0,25_{2008} = 214,639$

2009 Capacity Charges $P_{2009} = 369,740 \times 100_{2009} / 99,4_{2008} = 371,971$

Total 2008 613,648 "\$, €, etc" Total 2009 586,610

Example Table – Historical Escalation: (~ annual changes from the year before)

YEAR	Electric Tariff ET Ø (%)	Gas Tariff GT Ø (%)	Consumer Prices Index CPI (%)
2004	- 6	+/- 0	+ 1,4
2005	+ 20	+ 15	+ 0,5
2006	+ 16	+ 10	+ 1,0
2007-09	Energy prices fall due to international economic crises		
2009	Energy prices ~ + 0,5 % of 2006 Energy prices		

ENERGY CONSUMPTION CALCULATION METHODOLOGY FOR LST SYSTEM

The following Table 2 and Table 3 summarize the key figures which will be used for the energy usage calculation. The metering devices will collect the data on an hourly basis and tabulate the performance for a day. The information collected will be compared to a baseline and the differences from the baseline will indicate the performance of the LST system. The baseline for both Table 2 and 3 are derived accordingly to the load requirements as agreed by [[CLIENT]].

Chiller System

For the chiller system, two key metering devices, installed at the interfaces, namely temperature sensors and the flow rate meter (*Metering Equipment*) will be used to provide information on the supplied chilled water from solar to TRANE main chilled water header. The baseline minimum of 5°C and a flow rate of chilled water of 254m³/hr will give a refrigerant capacity of 420 t_{ref}

DHW System

A heat meter (*Metering Equipment*) will be used and placed at the outlet of the domestic hot water tank to determine the amount of heat energy being taken up by the campus load. A minimum consumption per day of 15m³ at 55°C is granted by [[CLIENT]] and can be alternatively monitored using two temperature sensors and 1 flow rate meter.

Table 2. Proposed Hourly Data Comparison for Chiller System

	Electric Power Use by Chiller System (kW)	Incoming CHW Temperature from Trane (°C)	Delta Temperature by Solar Chiller (°C)	Flow Rate (m ³ /hr)	Cooling Tonnage Produced (_{ref})	Chiller Efficiency (kW/ _{ref})
Baseline	142.8	16	5	254	>420	0.34
Measured						
1 st hour						
Measured						
X hour						
Total difference from Base						

Table 3. Proposed Hourly Data Comparison for DHW System

	Electric Energy use by DHW System (kWh/hr)	Incoming PUB Temperature (°C)	Supply Temperature after Heat Exchanged (°C)	Flow Rate (m ³ /hr)	Total Supply of Hot Water produced (m ³)
Baseline	0.273+B*	20	55	5	15
Measured					
1 st hour					
Measured					
X hour					
Total Difference from Base					

*0.273kw is the power requirement for distribution of energy to the hot water storage tank, while B will be gas boiler, which will only be activated if there is insufficient heat energy.

USE OF [[CLIENT]] UTILITIES

This *Agreement* is based on [[CLIENT]] providing the following electricity and water free of charge.

- a. Power Consumption

The assumed power consumption (electricity) of the entire *Solar Thermal Plant* is ~15 % of the total solar production (solar yield). The actual power consumption for LST will be recorded in the power meters, which are located at the control panels.

Specific Energy demand to operate the LST: (LST operating at optimum under full load)

Cooling: 0, 3276 kW/t_{ref}

DHW: 1, 2589 kW/m³

b. Water Consumption

The estimated water consumption for re-cooling of the cooling tower of the *Solar Thermal Plant* is 8 – 10 l/kWh cooling production

Consumption in excess of these figures materially affects the cost effectiveness of the system. If on an annual basis the consumption is more than 10% higher than the figures set out above and in addition the consumption of [[CLIENT]] of energy has been in line with [[CLIENT]]'s user profile (as attached), then such additional consumption will be calculated at prevailing rates and without additional charges or penalties deducted from the fees and any payments due.