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**TAMPERE UNIVERSITY OF TECHNOLOGY**

MAIJA HAKALA  
HOW TO IMPORT LOW ENERGY TECHNICAL BUILDING SYSTEM  
TO RUSSIAN MARKET

Master's thesis

Examiner: professor Pertti Järven-  
tausta

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## ABSTRACT

**MAIJA HAKALA:** How to import low energy technical building system to Russian market

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Former president of Russia, Dimitri Medvedev, has created a plan of action to cut down in halve energy consumption of Russia by year 2020. National project for improving energy efficiency has created a possibility to western companies to import more energy efficient solutions to Russian market. Are Sensus low energy technical building system of Are LTD is an answer for enhancing energy efficiency of office buildings. Are LTD has established subsidiary company ZAO Are to Russian market.

Are Sensus low energy technical building system connects heating, lighting, cooling, air conditioning and electricity as a one complex. Sensus -system can be used in office and negotiation rooms. Are Sensus is 3-piped technical building system where main purpose is to eliminate all disadvantages of traditional 2- and 4-piped systems. Sensus system is both energy efficient and economically viable because there is no simultaneous heating and cooling. Sensus system also creates pleasant indoor and lighting conditions with the panels adjusted to ceiling.

Aim of the study was to do accounting tool to ease up tender calculation for projects with Are Sensus -low energy technical building systems in Russian market. The study starts by examining of tender calculation of building projects. Invitation for tenders and tender documents are the key elements of tender calculation. Contractor makes its own tender calculation of offered project based on the information given with the invitation for tenders -letter. Tender calculation need to be done fast and as exact as possible. Tender needs to be as low-priced as possible to be chosen but still be profitable project to contractor.

There are differences between Finnish and Russian market that need to take into account. Russian culture and constantly changing legislation affect to Russian market. Competition has increased after Russia came a member of WTO. These things need to consider in tender calculation.

Calculation tool needs a good knowledge of Sensus system in order to do exact quantity surveying. After that tender calculation is easy to carry out. Consider all specialties of Russian and object of counting is simple with the accounting tool. Tool has not yet to be used in real action.

## TIIVISTELMÄ

**MAIJA HAKALA:** Kiinteistön matalaenergiajärjestelmän vieminen Venäjän markkinoille

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Venäjän entinen presidentti Dimitri Medvedev loi toimintasuunnitelman, jolla pyritään puolittamaan Venäjän energiankulutus vuoteen 2020 mennessä. Valtakunnallinen energiatehokkuuden parantaminen loi mahdollisuuden länsimaisille yrityksille tuoda energiatehokkaampia ratkaisuja Venäjän markkinoille. Myös Are Oy:n matalaenerginen Are Sensus -talotekniikkajärjestelmä vastaa Venäjällä heränneeseen kysyntään toimistotalojen energiatehokkuuden parantamisessa. Are Oy on perustanut sisäryhtiön, ZAO Are, Venäjän markkinoille.

Are Sensus -matalaenergiajärjestelmä yhdistää lämmitys-, valaistus-, jäähdytys-, ilmanvaihto- ja sähköjärjestelmät yhdeksi kokonaisuudeksi. Sensus-järjestelmää voidaan käyttää toimisto- ja neuvotteluhuoneissa. Are Sensus on 3-putkijärjestelmä, jossa on pyritty eliminoimaan perinteisten 2- ja 4-putkijärjestelmien epäkohdat. Koska yhtäaikaista lämmitystä ja jäähdytystä ei tapahdu, on Sensus-järjestelmä sekä energiatehokas että taloudellisesti kannattava. Sensus-järjestelmä luo miellyttävät sisäilma- ja valaistusolosuhteet käyttäjille kattoon asennettujen paneelien avulla.

Diplomityön tavoitteena oli tehdä työkalu helpottamaan Are Sensus -talotekniikkajärjestelmän tarjouslaskentaa Venäjän markkinoille. Työssä lähdetään liikkeelle tutustumalla rakennusprojektien tarjouslaskentaan. Tarjouskilpailussa tärkeässä osassa on tarjouspyyntö ja tarjouspyyntöasiakirjat. Urakoitsija tekee omat tarjouslaskelmansa tarjottavasta urakasta tarjouspyyntöasiakirjojen sisältämän informaation avulla. Tarjouslaskenta pitää saada suoritettua nopeasti ja mahdollisimman tarkasti. Tarjouksen on oltava riittävän edullinen tullakseen valituksi, mutta olla samalla urakoitsijalle kannattava projekti.

Venäjän markkinoilla toimiessa on otettava huomioon Venäjän ja Suomen markkinoiden erot. Venäjän markkinoihin vaikuttaa tunnusomaisesti Venäjän kulttuuri ja jatkuvasti muuttuva lainsäädäntö. Venäjän liittyttyä maailman kauppajärjestöön myös kilpailu on lisääntynyt. Nämä on otettava huomioon tarjouslaskennassa.

Laskentatyökalun täyttäminen vaatii hyvän Sensus-järjestelmän tuntemisen ja tarkan määrälaskennan. Laskentatyökalun avulla on nopea suorittaa tarjouslaskenta määrälaskennan jälkeen. Tarjouksessa on helppo ottaa huomioon Venäjän ja kyseessä olevan kohteen erityispiirteet. Laskentatyökalua ei ole käytetty toistaiseksi käytännön tarjouslaskennassa.

## **PREFACE**

I would like to thank Are LTD for giving me an interesting and inspiring subject for Master's theses. I would also like to thank every employee of Are LTD who has helped me with this project. I would also like to thank my family for supporting me through this project.

In Muonio, Finland, on 10 November 2017

Maija Hakala

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## LIST OF SYMBOLS AND ABBREVIATIONS

ADP	automatic data processing
DDC	direct digital control
ECA	Export Credit Agency
HVAC	Heating, Ventilation and Air Conditioning
I/O	input/output
PLC	Public Limited Company
PPH	Patent Prosecution Highway
VAT	Value added taxes
VTT	Technical Research Center of Finland
WTO	World Trade Organization

# 1. INTRODUCTION

Russia has admitted their energy inefficiency. Dimitri Medvedev, former president of Russia, has called for action to cut down energy intensity in Russia. This offers a demand for more energy efficiency HVAC-systems for office buildings. Sensus low energy system created by Are LTD is functional solution for the above need in Russia. Are LTD has established a subsidiary company ZAO Are for Russian market. [1] [2] [3]

Russia has a potential to cut down energy consumption to almost halve. It is estimated in World Banks' report that achieving full potential of energy efficiency in Russia would cost \$320 billion, but the benefits of it would have been paid back just in four years. Estimation of \$80 billion yearly savings for investors and end users is based on internal prices in 2007. Benefits of energy saving can rise even higher because of additional earnings from increase in oil and gas exports. Other benefits to Russia of increasing energy efficiency is that it will allow the companies to maintain competitiveness. Lower local and federal budget costs only eliminating inefficient use of energy. By being more energy efficient can Russia avoid becoming a CO<sub>2</sub> buyer and it will also improve citizens health and welfare. [1]

## **Targets and methods of study**

Aim of the study was to help Are LTD to enter Russian market. One of the main subjects of the study was to make an accounting tool (i.e. spreadsheet program) to ease and speed up tender calculation in Russian market. It was also important to find out the differences between Finnish and Russian market and stumbling blocks of Russian market. The program for quantity surveying that was used in Are in Finland and bill of materials of Sensus system was used for a help of making the spreadsheet.

Study is outlined to deal how to import Are Sensus low energy system to Russian market. Russian markets are observed by the point of entering to Russian market. What are the differences between Finnish and Russian market? Cultural differences and other specialties to bear in mind when planning a running a business in Russia. We look at Russian energy performance requirements and why it is a good time to import low energy technical building systems to Russian market.

## **Structure of study**

In theory part of the study, tender calculation is examined in building project, low energy technical building system called Are Sensus and specialties of Russian market. Tender

calculation program that is created to ease making a tender for building project that includes low energy HVAC-system is presented after theory. Program's content, calculation formulas and operating principles are presented as a result. After that we take a look back and discuss what are the main things to learn about entering Russian market and how the spreadsheet can help in making a tender.

## 2. MAKING A TENDER

Contractor needs to know where its costs come from so it can run a profitable business. Contractor needs to make tenders that are profitable. Cost estimating is a base for tender calculation. [4] [5]

Profitability in business is a difference between return and costs that are caused by operating business. Costs and profits need to direct to only for those operations that are caused by them. In making a tender contractor should count in the costs that are relative to tender and agreed percentage of company's fixed cost. Fixed costs are costs of business that are not changing when production level is changing. Management takes part in making decisions of tender. [4][5]

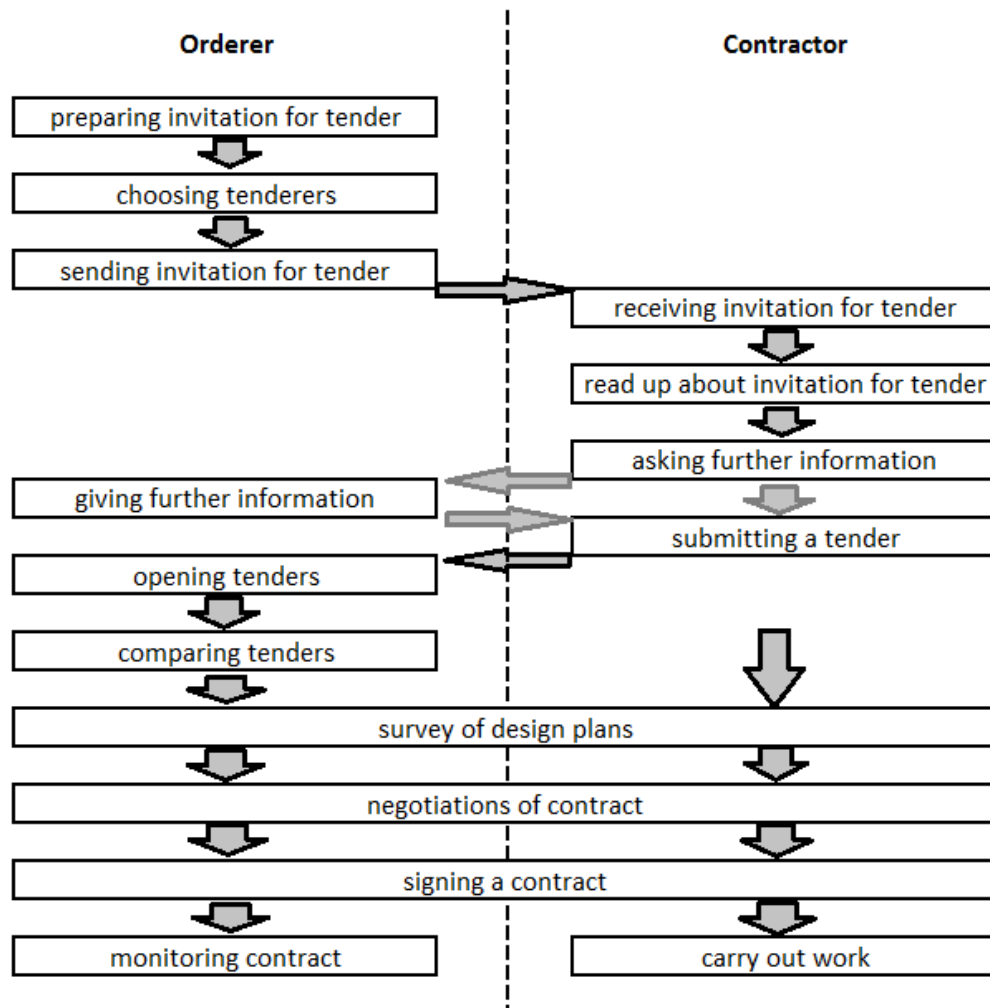
Contractor estimates costs for base of tender calculation. Contractors' cost accounting includes calculations of project, budgeted costs of project and supervision of costs. It also includes actual cost calculation during and after the project [4]. Procedures related to contractor's cost accounting are estimate summary of expenses, tender calculation, budgeting production, control calculations as supervising production and actual cost calculation. [5]

Client sends invitation for tenders and asks for tenders of building project. Contractor starts to work out a cost estimate and tender calculation, when invitation for tenders reaches contractors. Contractor also needs to estimate is it interesting for its point of view. There are given facts about project to a contractor as a starting material for tender. Material typically includes conditions of contract and technical documentation about project. Cost calculation is based on technical documentation. Conditions of contract impacts on tender calculation. Contractor submits a tender, if project is suitable for contractor's point of view. [5]

Cost accounting is both preliminary estimating and actual cost accounting. Preliminary estimating is all about quantity surveying and price setting. Quantity surveying and determination of prices is done by quantity surveyor or building economic expert. The company management takes part in tender calculation. Actual cost accounting is done after the project for giving the useful information for the future. Actual cost accounting is for controlling costs and profitability and add knowledge of costs. [4][5]

After cost accounting the tender is made and send it to orderer. Orderer estimates all tenders and chooses the most favourable one for itself. After that there can be some negotiations before signing the contract. Orderers' main task is to monitor the contract when the contract is signed. In Figure 1 it is shown different phases of competitive bidding.

Tasks are divided into two, ones that orderer is responsible of and the other ones that contractor is responsible of. [6]



*Figure 1. Step by step how offer procedure proceeds. [6]*

## 2.1 Invitation for tenders

First stage of entering into a contract is an invitation for tenders made by builder. Contractor gets all the information that he needs to make a tender from it. Invitation for tenders is a request for bidding and a question about the price of constructions defined by orderer. Orderer only expresses interest of achieve specified work performance in invitation for tenders, yet he doesn't engage himself to execute it. Orderer can refuse all offers if project is postponed or all bids for the contract are too expensive. In any case, there needs to be a competent and relevant reason for rejection. [6]

**Invitation for tenders** defines condition of contract and instructs of how and when the offer is made, where it needs to be sent, how long the offer needs to hold and can the contractor deviate from the terms given by orderer or builder. Tender can be rejected if

contractor deviates from the instructions given in the invitation for tender and there is not explicitly given a change. There are also some obligations and responsibilities for orderer of invitation for tenders. First contractor is entitled to expect that all information in tender documents are true unless there is a special reservation for them. Orderer who has made the tender is also obligated to answer questions about the invitation for tenders. [6]

Tender documents need to be clear and unambiguous. Terms of contract needs to be impartial and same to all contractors. Risks of construction work must deal between parties. It should to take into account parties tasks, know-how and possibility to influence. In competitive bidding, all conditions of contract must reveal in tender documents and they have to send to all contractors at the same time and with the same content. If there comes additions or changes to tender documents, those must to informed to all parties that have get the invitation for tenders. General tender documents in building business are

- invitation for tender
- contract plan
- appendix of contract borderlines
- list of unit prices
- tender form
- technical documentation.

All the information that contractor needs to calculate contract price must become clear in tender documents. [5]

The actual invitation for tenders is made with the letter called **invitation to tender**. It defines work site and asks an offer of performances described in documents attached in the letter. Invitation to tender lets contractor know where tender needs to deliver, when it latest needs to be left and how long tender bounds the tenderer. [6]

Contract document that has been added to tender is called **project terms**. It includes commercial terms and central knowledge of project between orderer and contractor. Project terms informs rules of project. It is necessary especially rarely used contract forms like target price contract. Project terms gives orderer reason to influence contractors work like in quality control or setting middle targets. Project terms can prevent some problems attached to piecework like accepting a subcontractor. Project terms also highlights items that are important to orderer, like demands for construction period or criteria of choosing a contractor. [6]

**Appendix of contract borderlines** is a document that includes rules of administration and shared operations on construction site. It also informs rules of borderlines between different construction performances. Appendix of contract borderlines is common to all contractors that are working on same site. Contract borderlines clarifies administrative system of working site and obligations to cooperation. Working sites general arrange-

ments and facilities are described in appendix of contract borderlines. Contract borderlines specifies tasks and demands of time in commissioning and acceptance of site. Contract borderlines specifies borderlines between worksites' all contractors if borderlines don't come clear from design documents. With the help of appendix of contract borderlines contractor knows all factors effecting to contract price and knows what items includes its obligations to perform. [6]

**List of unit prices** is used in contracts where ground of performance is payment basis. This kind of contracts are unit price contracts and total price contracts. Contract price is calculated in unit price contract with the help of unit prices. Whereas change work is priced with the help of list in total price contract. List of unit prices are not used in additional work if that is not particularly agreed. Unit prices are set to include projects total costs and general expenses of company. Projects marginal profit and risks are taken into account also in setting the price of project. [6]

**Technical documents** represent building project. Technical drawings, building specification and work specification are technical documents. Technical drawings give information about projects location, scope, quantity and measurements. Building specification defines quality standards, projects characteristics, decisions of structural elements and building materials. Performance instructions of disciplines are advised in work specification. [6]

## 2.2 Estimating summary of expenses

Estimating summary of expenses is calculating costs based on technical documentation of project. Projects construction costs are calculated using structural elements quantities and unit price of them. [5]

Contractor needs all documents connected to an invitation to tender as a starting material for estimating summary of expenses. For calculations contractor gets information about the project that includes condition of contract and technical documentation of project. Estimate summary of expenses is based on technical documentation of project. Quantity surveying and pricing is done in estimate summary of expenses. It is done by quantity surveyor and cost accountant. Condition of contract contributes to tender calculation. [5]

### **Cost estimate for structural elements**

Cost estimate for structural element can be used as a standard accounting in making estimate summary of expenses and tender calculation. Preliminary production plans are used while making a cost estimate of structural elements. Site specific structural elements of construction are used as calculating cost estimate of structural elements. Unit costs of structural elements come from unit prices of company. There are specified prices for every work input, building material, subcontract or equipment. Preliminary offers can be

asked for some of the structural elements or information of previous work costs can be used as a material. [4] [5]

Using cost estimate for structural elements has many benefits. Amount of work is reasonable. Precision of cost estimate for structural elements is enough to make a tender, if elements of construction are separated carefully. Using quotas costs can be compared to similar project. Using cost estimate for structural elements ensures that tender measures up standards of firms' high level of performance. It cut downs work, if cost estimate for structural elements and elements of construction can be used as base of production costs. Cost estimate for structural elements can be made by using knowledge of element of construction even if product design is imperfect. Cost estimate for structural elements is clear and short for specification and description. [5]

A list of structures of structural elements will be made in making cost estimate for structural elements. Construction plans are find out in quantity surveying. Quantities of structural elements and systems are also find out and listed as its type. Quantities of working phase and building material needs to be measured by their locations. Lists and calculations become more specific during calculation moving forward from cost accounting and tender calculation to production calculation and actual cost calculation. Because of huge amount of work and incomplete design all the structures of structural elements can't be changed to fit product designs in tender pricing. As a result of quantity survey, we get a list of structures. [5]

**Pricing cost estimate for structural elements** is possible after quantity survey. For detailed list of structures will be set the prices as unit prices of structural elements. After price setting there will come out cost estimate for structural elements. Unit costs are based on standard prices, standards, old calculations or just approximation based on situation. Market prices of the moment can be base of determining standard prices. Prices can be fixed with estimate of price development. All needed subcontractor should be cleared and get their prices by asking preliminary offers. [4][5]

### **Performance calculating**

Performance calculating is the normal mode of calculating and making input based approximation of cost in tender making. Bill of quantities is given as items of structural elements and as performances. Performances are priced based on prices of building product. [5]

In quantity surveying projects building elements are calculated using technical design and bill of quantities. Usually orderer gives only technical design and contractor needs to do quantity surveying completely. Quantities are measured from technical designs or they are determined using product model. Quantities are counted theoretically so that any

losses are not taken into account. Project will be divided into smaller divisions and quantities are calculated using measurement rules of quantity surveying. [5]

## 2.3 Tender calculation

After estimating summary of expenses, you can start processing tender. Tender calculation contains company's need for coverage and risk reservation according to the project characteristic added to projects' cost estimate. [5]

Cost estimate and need of a profit are key factors for tender calculation. Base of tender pricing is the cost estimate made from the project. Cost estimate tells contractor cost price. In tender calculation demand of coverage and risk reservation is added to cost price, because contractor needs to run a profitable business. Management of company takes part in tender calculation. [4][5]

Risk reservation needs to be counted in so the project won't come unprofitable. Risk reservation is case-specific in which takes into account project technical decisions and method of implementation and terms of contract. If technical decisions or terms of contract include risks, it is added to the cost price. [5]

Coverage means worksite cover, which needs to remain from worksite to company's use. Amount of coverage depends on volume of orders, economic situation and company's tender policy. Company's profit will be get after reducing fixed costs from company's every project's worksite cover. Whole company's profit target controls worksite cover's size. [4][5]

### 2.3.1 Making tender

Tender is an announcement from contractor in which price he is ready to do the project. Tender is based on calculated cost estimate and extra instalments like risks, change reserve of cost estimate and worksite cover. Number of extra instalments depends on project's risks and company's cost structure and tender policy. Extra instalments are added to worksite costs in making tender price. Tender price is drawn up without value added tax (VAT = 0 %). Current VAT is added on tender price, when tender is sent to the client. [5]

With help of cost estimate the company is trying to calculate what probable expense to the company is caused by the site. Cost estimate is a forecast of resulting costs. Result of estimate summary of expenses is called worksite cost. Parts of worksite cost are construction site cost, operating cost and joint costs. Working out a cost estimate methods of resource pricing and standard cost accounting are being used. Amount of additional costs depends on cost structure and tender policy of company and risks of the project. [5]

### 2.3.2 Risk reservation

Risk means result which is often unfavourable and unexpectedly coming out. In construction industry risks are caused by company itself, employer and outward circumstances. In construction industry are some typical issues linked to a possibility of risk are technical details, terms of contract, administration and inaccuracy. These risks need to be considered in cost accounting. In tender risks will be budgeted and it raises the price. [5]

Technical risk means the risk that is caused by a difficult work phase, new method or structural solution. Technical risks are considered in making the offer price. Raising work and accessory consumption or price of subcontract can be prepared in making the cost estimate. [5]

Risks that are being caused by the terms of contract will also be considered in making the offer. Risks are caused by terms in accounting document for which it is difficult to set the price. Such terms can be deviation to standard boundaries of contract. [5]

Administrative risk means for example change of branch, operating area or extend of business. It can cause procurement of machinery or staff. Estimated expenses need to be considered separately in making the tender. [5]

Risk of inaccuracy comes about inaccuracy in price setting and quantity surveying. If industrial designs are completely ready, risk of quantity surveying can be minimized. On the other hand, if industrial designs are remarkable incomplete, it should be calculated a price of the risk. Inaccuracy in price setting can be minimized getting in advance as many offers as possible from suppliers and subcontractors. [5]

Other possible risks can be related to financing, safety at work in special work site or destination country's specialities in export activity. There is also juridical risk in new method of implementation. In every case, every possible risk is considered and set the price for it and it is calculated to the tender price. [5]

### 2.3.3 Reserve for change in level of costs

Tender price is focused on working site costs and calculations are made in price level at that moment. Construction work is a long-term project which is emphasizing the instability in level of costs. Reserve for change in level of costs takes into account possible rise in price level during the constructions. The reserve for change in level of costs and expectation of coverage is dependent on economic conditions. In tender calculation instability is considered and reserve for change in level of costs is focused to working site costs. Rise in costs consists of possible rise in construction materials during the construction and rise in wages of workforce. Construction work includes lots of different kind of materials and accessories and most of them are purchased along the building schedule,

because it would require a huge amount of capital to purchase all building material in the beginning of the construction. It increases pressure for adding a reserve for rise in price level. [5]

### **2.3.4 Coverage of working site**

Company's tender policy generates project's demand for cover. The company's management can adjust corporate planning and company's business concept with tender policy to the direction they want it to go. With tender policy management company's business can be kept profitable by channelling the gross margin inside accounting period. By adjusting the gross margin management company's resource utilization degree can be kept high. [5]

Coverage of working site is management's expectation for profit in the project. Profit in the project is the same as sales margin. Coverage of working site includes also other costs that are caused by the operation of company, but are not directly used or focused resources in the project. There are different expectations for gross margin in corporations. Differences are being caused by the sizes of companies, way of operation, subcontracting level and way of entry. One contractor might include the coverage already in the cost estimate, whereas other contractor includes the same cost only to project's cover expectation. [5]

In coverage of working site is included company's central government, other unfocused cost of projects, interests, taxes, depreciations and profit. Costs of central government are corporations fixed costs. They are considered in gross margin as a percentage. Expenses of central government among others are wages of management, rents of offices, costs of information technology and other activities which serves whole company. Interests, taxes, depreciation and profit are included to operating margin. Budget of financial year or profit and loss account of previous accounting periods are used as a help in setting demand of operating margin. Demand of gross margin is considered as a percentage. Economic situation influences to the gross margin. Usually if amount of gross margin rises the possibility of getting the project decreases. Too high gross margin for current economic situation causes loss in competitive bidding and too low gross margin can lead to unprofitable operation. Optimal tender is somewhere in the middle. The possibility of getting the project is good when gross margin is decent. [5]

### **2.3.5 Different contract types**

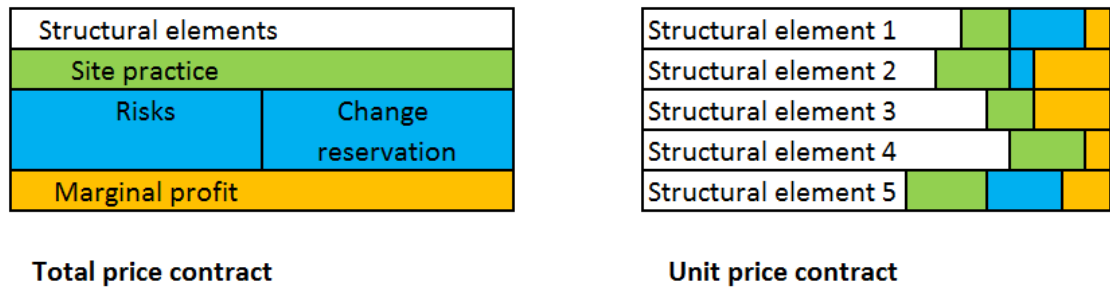
There are some special characteristics in making tender of contracts which have different payment basis. Contract price can be based on performance or cost. Performance-based prices are fixed as total price or unit price. Cost-based price is based on existing costs during the construction. Contract price can be fixed as basis on a cost and fee contract or target price contract. Contractor is being paid by basis of works' total performance or

performance units in performance-based system. In cost-based system contractor gets payments according actual work and purchase costs. [6]

In **total price contract** follows typical tender calculation procedure. In total price contract contractor is committed to do construction work as described in contract document in calculated firm total price. Total price is paid to contractor staged according to construction progress. Risks of expenses and amount are in contractors' side. Contractor defrays costs if prices or amounts of building materials change during the project. Extra and change work that come up during construction time will be priced by the unit price list which is added to the tender or at cost price. Unit prices of extra and change work include job category costs, costs of site practices bonded labour input, reservation of risks and coverage of working site. [5][6]

In **unit price contract** orderer makes a contract with contractor about work performances divided to exact units from which contractor has made a fixed offer. There is no need to know final amount of work performances in unit price contract while making the offer. The exact way of constructing, general conditions and estimated extend need to become evident from the construction plans to give a tender price. Quality requirements of work, current conditions and probable extend of contract also need to appear in documents of tender calculation so that contractor can give a tender price on basis of unit prices. Tender calculation in unit price contract is based on bill of quantities. Tender price is product of quantities and unit prices. Tender price changes if quantities change. Builder has the risk of quantities. [5][6]

Cost estimate in total and unit price contracts don't basically differ from each other. There are still some differences in tender calculation in total price contract and unit price contract. Reservation of risk and coverage of working site are added as whole in working site costs in total contract. Thereby it will get a fixed tender price. Instead unit price contract every title in bill of quantities needs to be offered separately so that costs of working sites site practices are divided to every title of unit price. In Figure 2 it is shown the difference between total price contract and unit price contract of calculating extra instalments. Every title of unit price gets also its own risk reservations and own part of total coverage. In unit price contract contractor can have variety in tender pricing. Unit prices can be work out separately for work and material. Work costs can be defined time-wise. Costs of site practices can be share out equally to all titles or depending on time so that works at early stage get more than final stage works. Because of that unit price contract is good for jobs that work phases and contents can be defined, but final quantities will be known in executing the construction. Excavation works are typical of those works that quantity risk is not reasonable to put on contractors. [5]



*Figure 2. How extra instalments of tender are added in total price contract and in unit price contract [5]*

**Cost and fee contract** is a construction contract in which the builder reserves the right to invoice for wages and material separately. Costs are proven by invoices and paid according as costs are resulting. Risk of costs is in orderer and contractors gets fee of supervising construction. Contractors work is to plan, supervise and control execution of work and take care of purchasing labour and accessories and supervision of work. Cost and fee contract requires very good trust between builder and contractor. This contract type is usually used when work is urgent, but plans are unfinished to fix the total price. In this kind of contract there is no exact information about the final price before the job is finished. [5][6]

There can be a target price in cost and fee contract, then it is called **target price contract**. Target price contract is usually started with unfinished plans and planning, purchasing and building is bonded to each other and lead by project management. In target price contract contractor builds project and client pays costs which have cumulated in building the project. Terms of contract have been agreed between contracting parties. Everything that goes under or above the target price is shared out with builder and contractor according to the contract. If total cost goes under the target price, contractor gets agreed fee of under spending budget. On the other hand, if total cost overruns the target price is the exceeding part of costs shared between parties in agreed proportion. To the project can be named a price ceiling, which is a highest price, that orderer must pay to contractor. Costs that are paid to contractor are directly divided invoiced part and special compensation on basis of documents. Special compensation includes expenses of central administration and entrepreneur's profit. It can be fixed sum or agreed percentage of invoiced costs. Contractors are competing with the amount of general expenses and coverage of project. Target price is not really payment basis but it is used to encourage contractor to save in building expenses and to find cheaper solutions together with design engineers and orderer. Target price contract might be better solution than cost and fee contract to orderer if project is defined from work units and extent so that ceiling price and target price can be fixed in making the contract. [5][6]

Basis of payment share the risk of change in prices and amounts different ways between contractor and builder. In total price contract risk of price and amount is with the contractor. In unit price contract price risk is with the contractor and the risk of amount is with the orderer. Then in the target price contract risks of price and amount are shared between contractor and builder and in the cost and fee contract both the risk of prices and amounts are with the orderer. It is shown in Figure 3 how risks are divided between contractor and orderer. [6]

Payment basis						
Performance basis			Cost basis			
	Total price		Unit price	Target price	Cost and fee	
Contractor	price risk	quantity risk	price risk			
Both				price risk	quantity risk	
Orderer			quantity risk		price risk	quantity risk

**Figure 3.** *Payment basis of contract prices and the risks caused by them. [6]*

Tender must meet the invitation for tenders. Usually orderer demands to highlight if there is difference between tender and invitation to tender. It helps to avoid misunderstandings if the differences are highlighted. [6]

Tender is based on documents connected to invitation to tender. That is why contractor needs to trust the information that is given. For every instruction contractor gives the meaning that is usually given among experienced worker. Tenderer needs to give supplementary questioning to orderer if there is something in invitation to tender that is unclear or there isn't any mention. Otherwise tenderer needs to take economic risk of it by itself. [6]

Tender need to deliver to orderer before deadline. Tender becomes a binding agreement when orderer has the knowledge of the content of a tender. Contractor can withdraw its tender before deadline ends or latest at the same time when tender is to find out. In special cases tender can be cancelled when tenders are find out. Those cases are like if there is an obvious writing error or essential calculation error. [6]

Tender is binding at the time that is informed in invitation to tender if contractor doesn't tell otherwise in its tender. Binding strength stops when orderer accept another tender or dismisses a tender. Contractor should get answer about its tender in a reasonable time even if there is not informed a validity time in tender or invitation to tender. [6]

## 2.4 Offer estimation and choosing the contractor

Builder must estimate the offers when the time for offering has ended. Builder can base his decision of contractor to lowest price or the most favourable offer for itself in economically. In using the type of contract that includes planning comprises design solution and its quality also a part of selection criteria. Orderer should estimate is the submitted

tender acceptable. Orderer can base his decision on his own calculations or ordered cost estimate in general price level. [5][6]

If the decision is based on economically most favourable solution, contractor has to inform which where the key factors and values in comparing economic efficiency. Client also needs to notify design solutions as valuation criteria and values in making the invitation to tenders, so that tenders can focus in those circumstances that are important for orderer. There is usually made a table comparing the tenders where are presented for instance price of contractors, breakdown of prices, possible deviations of contract plan, list of unit prices etc. This is the latest moment to find out contractors' technical capacity and financial position. [6]

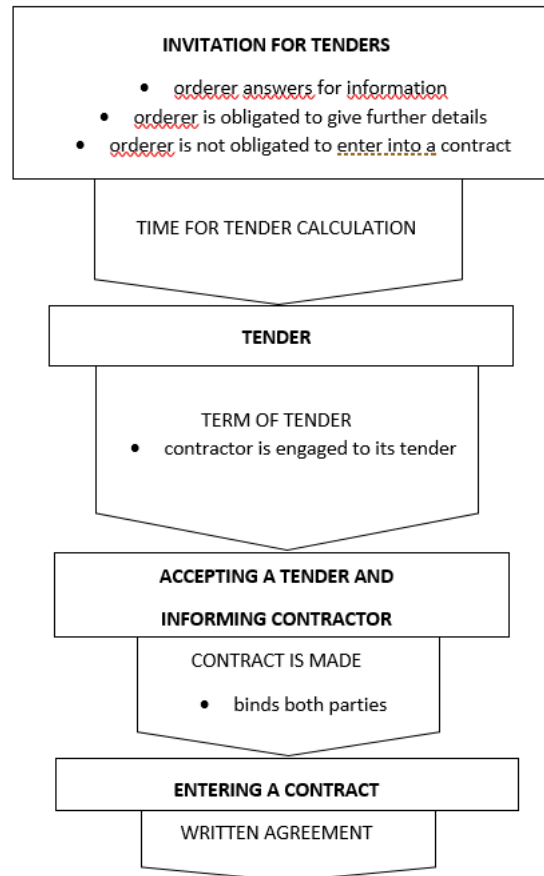
## 2.5 Entering into contract

Entering into contract comes after approving a tender. One condition of entering into contract is that approval is equivalent to tender. There can't be any conditions or limiting that aren't mentioned in tender. It is orderers counteroffer, if approval isn't equivalent to tender. Counteroffer waits for contractors approving. Contractor that is chosen to the project should be aware of its selection immediately after selection and in the term of offers. Other tenderers need also to be informed in reasonable time. [6]

Building contract is legal when contractor gets orderers approving response. Both parties need to fulfil their obligations, when contract is born after approving tender. One of these obligations is to sign building contract. After signing building contract and its documents defines both parties' final rights and obligations in contract. Usual documents attached to building contract are [6]:

- building contract
- record of contract negotiations
- general terms of building contract
- invitation to tender
- all written further clarification given before tender
- contract schedule
- other conditions of contract
- appendix of contract borderlines
- tender
- bill of quantity and measurements
- list of change work unit prices.

Steps from invitation for tenders to entering into contract are shown in Figure 4.



*Figure 4. Basic stages for entering into contract. [6]*

### **3. ARE SENSUS – LOW ENERGY TECHNICAL BUILDING SYSTEM**

Are Sensus is a building service system. Are Sensus integrates heating, cooling, ventilation and electric installations into a single system. Are Sensus is mainly used in office buildings. One of Are Sensus advantages is low energy costs. Other advantages for owners and users of building that use Are Sensus system are pleasant indoor temperature, good indoor air quality, glare-free lighting, standardized and reliable action and easily modifiable workspace. Because of using Are Sensus panels, system also allows good acoustics. Are Sensus can be assembled in a competitive price. [2]

#### **3.1 Technical building services**

Building system is used as a common name to property and complex of technical services, systems and devices connected to it. Technical building services includes also property's energy efficiency and environmental effects. Factors related to pleasant indoor environment are also included to building services. [7]

Main purpose of technical building services is to provide wanted and controllable conditions to different functions in property. The most essential part of technical building system is HVAC- system and electricity. Systems for cooling, access control, tele, data and fire control are also included to building services. Control automation connected to technical building system is called building automation. [7]

Heating traditionally means that heat is produced converting fuel energy in to heat energy. Fuel can be natural gas, coal, peat, oil or bio fuel to name a few. There are many different heat generation devices that can be used, for example heating boiler, heat exchanger of district heating, heat pump or electric heating devices. Heat exchanger distributes heat from heat generator to where it is needed. Heat distribution and heat emission is usually dealt with radiator or underfloor heating that water circulating or electrical. Electrical room devices can also work as heat generation equipment. [7][8]

Good air conditioning is a requirement for healthy and fresh indoor air. Air conditioning cleans out pollution and exhausts excessive dampness of the indoor air and replaces it with a fresh air. Air conditioning unit is defined how the air is exhausted and how the replacement air is brought in. Air conditioning system can be natural ventilation, mechanical extract ventilation system or balanced ventilation system. There is a better impurity control in balanced ventilation system than in combination of natural ventilation and mechanical extract ventilation system. Balanced ventilation system can filter off also fine

particulates. Usually balanced ventilation system includes heat recovery unit which transfers heat from exhaust air to supply air. Supply air can also be cooled down then it is called as a ventilation. [7][8][9]

Service water of building is piped in to building from municipal water system or from well. Wastewater is piped to municipal sewerage or individual wastewater treatment plant. Fire safety is part of technical building system. Fire alarms are sprinkler systems are important part in firefighting and noticing fire. [7]

All the technical appliances can be controlled, measured, monitored or adjusted with building automation system, like lighting, heating, air conditioning or cooling. Fire alarm and intruder alarm system can be integrated to building automation system. Building automation system consists of sub-distribution boards. Sub-distribution boards are connected to each other with data bus. Principal component of sub-distribution board is controller where all wanted functions are programmed. All sensors, actuating systems and all other components like light control points are connected to I/O -modules (input/output modules) of sub-distribution board. Operations in sub-distribution board can be monitored and controlled from separate monitoring station. Monitoring station consists of a computer and building automation software. [7][8]

Important part of good technical building system is well planned electricity network. Electricity is transferred to end users through transmission network. Most important is to have enough sockets in right places and have an efficient and adjustable lighting. [7][8]

### **3.2 Basics of Are Sensus**

Are Sensus is a low-energy system that can include heating, lighting, cooling, ventilation and electric equipment. Are Sensus can be used in office- and negotiation rooms. In other spaces of office buildings conventional system can be used. [10]

Are Sensus system were developed to eliminate disadvantages of building service technologies that use 2- or 4-piped solutions. One of the main targets in developing Are Sensus was to plan system which liquid circulation and room devices along with configuration of pipe system is as simple as possible. Also, to develop buildings heating solution that is as simple as possible from its equipment technology and buildings inner heat transfer liquid circulation and pipe system. Equipment technology needs to be simple for example of its control system and valve and pump solutions. Still it needs to have a possibility to heat or cool down the room with the same room devices liquid circulation. System needs to be able to heat some of the rooms and cool some of them at the same time or to cool all rooms at the same time or heat all rooms at the same time. Other main target in planning Are Sensus was to invent a system and equipment for the system so that using it buildings need of total energy, including both heating and cooling energy, is as low as possible. Another target was to plan a system where liquid departing from room devices

stays as unchangeable as possible in different operating situation. All that was to minimize investment costs. [11]

### **Heating and cooling**

Workspaces are heated and cooled with Are Sensus panels which are installed to ceiling. There is flowing warm or cold water depending does the space need cooling or heating. [10]

Panels are mounted in the ceiling. All technical adjustments are assembled above panels so that they are not visible. That's why there is no need for dropped ceiling. If there is dropped ceiling, can Are Sensus panels be assembled as a part of dropped ceiling with 20 mm open joint. Heating and cooling transfers in to the air as an infrared radiation. It gives the advantage of working condition without draught. In conventional systems heat is brought in to the room by circulating indoor air through heating and cooling equipment. Panel creates more stable temperature profiles than conventional radiator. [10]

### **Ventilation**

Supply air is brought in through supply air equipment. Air is blown along surface of panels. There can't sense any blowing, because air moves along smooth panel surface and don't fall down. At the same time the surface of panel heats or cools supply air, precisely what is needed in that room. [10]

### **Lighting**

Using Are Sensus panel in lighting brings lighting conditions into a high level. Lighting fittings are assembled below panels. Surface of panels reflect light giving glare-free lighting. There is also possibility for direct lighting, which worker can switch on if it's needed. Combination of direct and indirect lighting together with reflecting panel is very flexible solution in offices that are meant mainly monitor working. Lighting fits different working layouts without any renovation. Lighting works excellently in traditional offices as well as open offices. [12]

### **Room temperature adjustment**

Room temperature adjustment of Sensus system is in every room in traditional offices. Several panels can be controlled with the same control device in open office. Employees can change their own room temperature by using temperature control devices. Follow-up studies proves that if it is wanted it's possible to have several degrees temperature difference between rooms next to each other even if doors are open. Room temperature adjustment works better in Are Sensus system than traditional system both in separate office rooms and in open offices. This is a result of that heating and cooling is mostly transferred in to air as an infrared radiation. Infrared radiation influences on the people and surfaces

under the panels directly where heating or cooling is needed. In Are Sensus panels the room temperature adjustment is quick because panels' infrared radiation can be felt immediately. In traditional system heating and cooling affects more slowly to room temperature because it spreads around office. [10]

### **Electricity supply**

In Are Sensus system electricity supply and connections to APD-devices (automatic data processing) in offices are distributed from ceiling with bootlegs. Electricity supply which is carry out in a ceiling with bootlegs is easily changeable when layout changes. That is because bootlegs are easy to move. Electric cables are not in sight because they are assembled above panels. [10]

### **Automation system**

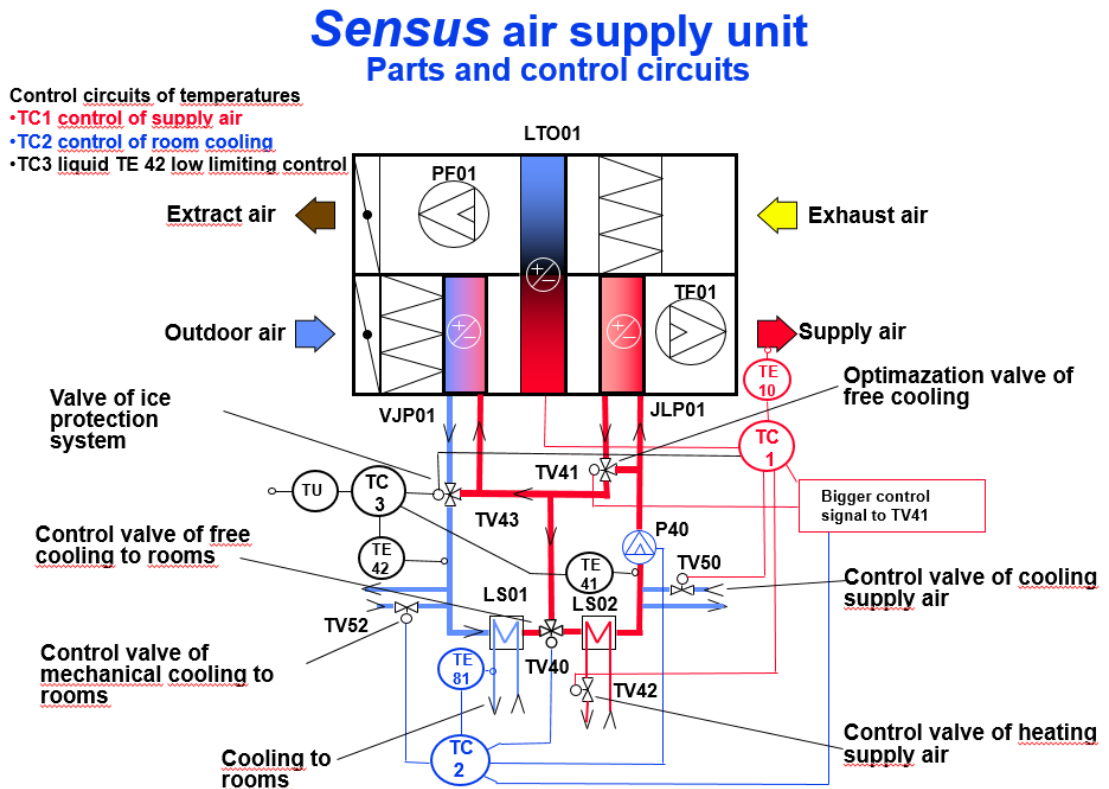
Automation system works with programmable DDC-technology (direct digital control). Automation system adjusts, controls and monitors different devices. Under automation systems control is air supply units and those low-energy centres, powered roof ventilations and heat distributing centre. Room temperature and room humidity of every floor can be controlled and monitored separately. Main energy meter and main water flowmeter are also under automation systems monitoring. All needed electrical control points are under control of automation system. [10]

## **3.3 Characteristics of Are Sensus**

Are Sensus is a system where rooms are cooled or heated by liquid circulation so that some of the rooms are cooled and some of them are heated or all rooms are heated or cooled at the same time. In Are Sensus system cooling and heating energy is piped to room devices with 3-piped system. At the system heating liquid is piped to its own body pipe from the heat production device to room devices. At the same time cooling liquid is piped from its own body pipe from refrigerating machine to room devices. Return flow of heating and cooling liquid is piped from room devices to both heat production device and refrigerating device with a shared return pipe. Extra heat in return flow of cooling and heating liquids can be used to heat buildings supply air by using refrigerating machine. It is also possible to use the extra heat in return flow of heating liquid to warm up rooms which needs heating over heat production machine [11]

Basically rooms are heated and cooled with the same room device or devices with liquid circulation in Are Sensus system. Cooling and heating equipment includes heat production device, refrigerating machine, possible data bus and room devices that are connected to heating and cooling devices with heating liquids pipe system. Also at the body pipe of heating liquid has its own body pipe from the heat production device to room device and own body pipe from refrigerating machine to room device and there is also equipment

and functions in refrigerating machines to use extra heat of return heat transfer liquid to warm up supply air. Configuration of Sensus system is shown in Figure 5. In top there is heat recovery unit (LTO01). PF01 and TF01 are fans with continuous control. There is also filters for exhaust air and outdoor air and air control devices for extract and outdoor air. [11][13]



**Figure 5.** Configuration of Sensus system [14]

Room is cooled and heated with the same room device, which has heat transfer liquid circulation. Heat transfer liquid is piped from heat production machine with connecting lead of heating to room devices. Heat transfer liquid is piped the same from refrigerating machine with connecting lead to room devices. Connection leads of heating and cooling are united before or after the room device or inside of room devices joining return liquid circulation. Same room device can either cool or heat up the room, because of this kind of heat transfer liquid circulation. Control device monitors room device so that it heats or cools the room at different times so that room temperature is always what it is wanted to be. [11]

Temperatures of heating and cooling water are kept close to each other. Flow of heating liquid is divided to heating and cooling devices according to combined liquid flow of rooms heated and cooled. Temperature of heating liquid that comes from refrigerating machine and heat production device is adjusted with data bus. Temperature of heating liquid that returns from room devices is kept as unchangeable as possible in different

operating situations. This means that temperature of return liquid from refrigerating machines is kept as high as possible when room devices still can cool down enough to keep room temperatures at the level they are wanted to be. Temperature of the liquid leaving from heat production device is adjusted so that it is as low as possible and still can heat up rooms enough to keep the room temperatures as they are wanted to be. Adjustments of temperature are made with the information received by data bus from the room devices to heat production devices and refrigerating machines. Temperature of both liquids is wanted to be as close as possible to each other but at the same time inside temperature of the building has to be able to keep at the level it is wanted to be. [11]

Data bus relays information between room devices, refrigerating machine and heat production device. In the body pipes of heat transfer liquid has its own body pipe from heat production device to room devices and own body pipe from refrigerating machine to room devices. Refrigerating machine has equipment and functions for heating buildings supply air with extra heat of return heating liquid. On the other hand heat production device has equipment and function for heating and adjustment of heating liquid piped to room devices. Refrigerating machine and heat production machine can physically be one and the same device, which both heats up and cools down. [11]

Room device includes all components and functions that are needed for heating and cooling the room and adjusting devices. Refrigerating machine includes all equipment and functions that are needed for cooling and adjusting heat transfer liquid piped to room devices. Refrigerating machine includes all equipment and functions that are needed to transfer released heat of cooling for example to supply air, heating water, service water or groundwater. [11]

The biggest difference between Sensus systems and commonly used system is the temperature of heat transfer liquid. Temperature of heat transfer liquid used in heating is usually between 70°C to 80°C. In Are Sensus system temperature of return flow is only between 17°C to 30°C. Using heat of return flow for heating supply air has accomplished that 3-piped system is no longer energy-intensive. Instead it is energy-efficient. In Sensus system there is no need to buy heat when outside temperature is somewhere over 0°C to 5°C. In traditional heating and cooling systems there is still necessary to buy heat significantly higher temperatures than in Sensus system even if air conditioning unit has a heat recovery unit. [11]

Return heat can be used to heat up the rooms, which need to be heated, with the heat production device. Heat energy is transferred from the rooms where it is too hot to the rooms where heat is needed. This cuts down buildings total energy consumption. [11]

With the help of data bus the modes of system that use too much energy can be prevented. Data bus prevents that same room can't remove extra heat as a worthless waste heat and

at the same time heat production device to purchase energy, like heat from a district heating network. On the other hand, it is possible to utilize all waste energy and at the same time use purchased energy. [11]

In Sensus system buildings inner heating and cooling systems can be combined to one system. This simplifies the system compared to other solutions and decreases number of devices. It is needed only one liquid circulation without change valves of liquids flow route in every room device. There is also only needed one circulation pump that is placed to return body pipe of the heat liquids that come from room devices. Sometimes there might be need for two pumps, because of placement of appliances. System also allows many circulation pumps, but it's not economically profitable at the situations when one circulation pump is enough. [11]

Every room needs only one room device. This device can both cool and heat but not simultaneous and it doesn't depend on mode that other room devices have. Are Sensus needs only 3 pipes for the flow of heat transfer liquid per every room device, but yet it is possible to have same function as 4-piped system. Which means heating and cooling can be on simultaneously in different rooms. [11]

It is possible to use heat sources with low temperature in Are Sensus system. To heat up the room can for example use solar energy, condensing power or heating pump. This is possible because surface of room devices heat exchanger is large. Cooling function needs large panel surfaces. On the other hand this affects so that temperatures of cooling and heating liquids is close to each other which is efficient and ecological for energy production. It is also possible to use same heating devices condensation heat to heat up rooms and evaporation heat to cool down rooms in Are Sensus system. To have cooling and heating liquid close to each other, it is energy efficient, but it's not relative to devices functioning. [11]

The temperature of heat transfer liquid returning from room devices is kept as static as possible in every different operating situation by adjusting temperature of cooling and heating liquid coming to room device by its demand. This enhances function and efficiency of cooling and heating appliances and it saves energy. This also reduces possible failures, like controller faults, influence on functionality of total system. [11]

### **3.4 Advantages and differences of Are Sensus compared to traditional HVAC-system**

Are Sensus has many advantages compared to traditional HVAC-system (heating, ventilation and air conditioning). Are Sensus is energy efficient and environmentally friendly. Are Sensus system ensures a pleasant working temperature and indoor climate all year.

Office spaces are also easily adjustable. Are Sensus has lower investment and operating costs than traditional HVAC-system. [11][12]

### **3.4.1 Energy efficient system**

By using Are Sensus can be gained 15-20% energy saving in heating and building services energy consumption compared to using traditional high-class HVAC-systems. Cooling is needed for a long time during year in modern, well insulated buildings. [12][15]

Are Sensus system can accomplish the advantages of 4-piped system, when some of the rooms can be heated and some of the rooms can be cooled at the same time. At the same time Are Sensus has not the known disadvantages of 3-piped system. Are Sensus systems heat of return flow is for example transferred to air conditioning units and is used in heating the supply air. In Sensus system both usually useless extra heat of cooling the rooms and return heat of heating the rooms can be used in heating supply air. Usually only return heat of heating the rooms are used to heat supply air. Rooms extra heat is free energy and it reduces consumption of heating energy. [11][12]

Sensus air conditioning units has an effective free cooling system using outdoor air. Former Helsinki University of Technology has made some studies that over 50% yearly cooling demand is produced with free cooling. It can work simultaneously with mechanical cooling all the way to +15°C outside temperature. Traditional free cooling as a comparison turns off when outside temperature is under +5°C. Because of this consumption of energy is lower in refrigeration machines of Sensus system than in traditional systems. [12]

There are separate refrigeration machines for air conditioning and refrigerating convector in Sensus system. Air conditionings big refrigerator starts up only when temperature rises over +10°C because of effective free cooling. It reduces consumption of electrical energy. Air conditionings refrigeration machines cooling efficiency factor is first-class in Are Sensus. The temperature of refrigerated fluid is high, something between +10°C to +18°C. [12]

The advantage of Are Sensus system is that heating and cooling simultaneously in different rooms is possible. Compared to 4-piped systems construction of Are Sensus is simpler. In 4-piped system it is needed to have two room devices or one device with two separate liquid circulation or one device with one liquid circulation and complex change valves to change heating liquids flow route. Compared to that Are Sensus system needs only one device and one liquid circulation. Heating and cooling simultaneously different rooms isn't possible in 2-piped system. [11]

There is no simultaneously heating or cooling in the same room. This reduces consumption of both heating energy and electrical energy of cooling. Overheat is not wasted at the same time when district heating is used as heating the building like it is done in conventional solutions. Room temperature is adjusted with one temperature controller so that heating and cooling can't be on at the same time. It is common usage also in traditional radiator heating nowadays. [12]

Cooling capacity that is needed is approximately 20% lower in Sensus than for example in cooling beam. This also reduces consumption of electrical energy. Large and cool panel surface reduces operative temperature that is felt by people. By using Are Sensus panels air temperature can be kept approximately 1°C higher than in traditional system and still the feeling of temperature stays the same. And as an extra advantage Sensus spaces are windless. On the other hand, in winter room temperature can be kept 1°C lower because warm panel rises persons feeling of warmth. This is tested and measured by Institute of Occupational Health. This lower indoor temperature also reduces consumption of electrical energy approximately 5%. [12]

Sensus air conditioning units has a powerful, rotating heat recovery. Supply air's temperature efficiency is approximately 75-77% in Sensus system. [12]

Sensus system decreases contract water quantity of district heating approximately 13% compared to conventional systems. This is a positive result of low temperature level of Sensus. Every air conditioning units that are equipped with cooling works with low temperature. Return water is 25°C compared to normal 40°C. This reduces of charge of contract water of district heating. [12]

Using panels in indirect lighting reduces consumption of electricity in lighting. Panels are mat surfaced and reflects light very well. Approximately 89% of light is reflected. Lighting is also smooth because of indirect lighting. Lighting is controlled by presence detector in offices which reduces lightings consumption of electricity by 30-40% [12]

### **Environmentally friendly**

Are Sensus is environmentally friendly. Approximately 90% of buildings environmental load is caused by building energy consumption. Are Sensus low-energy system decreases buildings environmental load, because of lower energy consumption. According to a research done by VTT (Technical Research Center of Finland) Are Sensus system reduces carbon dioxide emissions in office buildings. Are Sensus system can also use alternative energy resources like air source heat pump or geothermal heat pump. System doesn't require hot water for heating. Cooling water needs to be only somewhere between 10°C to 18°C compared to traditional systems where cooling water needs to be cooler. [12]

### 3.4.2 Pleasant and appropriate for users

Offices are heated and cooled with the panels assembled to ceiling. Warm or cool water is circulating in the panels depending on the need for cooling or heating. Temperature distribution is smoother with panels than normal radiator heating. As a result of examination of Finnish Institute of Occupational Health it is said: “Research shows that with Sensus ceiling heating/cooling system has accomplished clearly better temperature conditions both in winter and summer conditions compared to reference state in the same building complex where has been used traditional heating radiator.” [12]

In Sensus spaces air quality is considered good because of efficient and windless ventilation. Supply air is brought in with supply air terminal devices which are assembled into corridor walls. Supply air is blown through panels’ smooth surface. Ventilation is windless because air sticks to panel surface and doesn’t fall down. [12]

Using Sensus panels in lighting creates high quality lighting comfort. This has been proved in Helsinki University of Technology’s measurements in lighting laboratory. Lightings are hung up under panels and reflected through panels shedding indirect lighting. Lighting is controlled according to users’ presence. Users can affect on their own lighting by switching on or off lightings under or above lamp with pulling coupling. [12]

In Sensus system temperature adjustment is individual in every room. Temperature controllers have adjustment wheels so that persons can change their room temperature by themselves. Studies have shown that it is possible to have 3-4°C difference between rooms next to each other. Temperature adjustment is quick, because you can instantly feel the warmth or coolness of panel. In traditional system heating and cooling are slowly affecting to room temperature by spreading into the air. [12]

One of the advantages of Are Sensus system is easily modifiable workspace. Are Sensus offices spaces wall layout can be changed effortlessly and at low cost, because there are no technical fixtures mounted on the walls. Work desk space is easy to reallocate, because lighting is good in the whole room. Electrical and ADP (automatic data processing) connections are easy to move with socket columns. Any office room can be made as meeting room only adjusting air flow. Sound insulation between rooms is better in Are Sensus than in conventional system, because there are no radiator or pipe and wire canal lead-ins in Are Sensus, which usually make sound insulation worse. [12]

### 3.4.3 Lower costs

Are Sensus has lower investment and operating costs. Lower investment costs come from simpler construction of system. Lower operating costs are influenced by systems energy efficiency. [11]

Fewer pipes compared to 2- and 4-piped system lowers investment costs and makes easier to place pipes and room devices in to the building. When there is less room devices it also means less service. It usually makes easier and better to vary and furnish the rooms with less room devices. Space requirement of technical installations is usually a problem in buildings of today. [11]

There is no need for radiator for supply air or cooling radiator in supply air terminal device because besides of heating the room can room device cool down or heat up supply air. This simplifies system, lowers investment costs and saves space. [11]

### **3.5 Are Sensus as a project**

What to do after receiving invitations for tenders? Are has two choices to give a tender regular HVAC system with automation and cooling system or to give alternative tender of Are Sensus system. If they decide to give a tender from regular system, they just need to measure quantities of building design and calculate the price. If Are gives an alternative tender of Are Sensus system, they need to specify changes of planning and price. [17]

Are Oy can give an alternative tender of Sensus system for already planned solution used by regular HVAC technology. In case of making Sensus tender for building project that is planned for regular HVAC system, it is mandatory to specify all the changes that has to be made for building design and price changes. [17]

There are many changes that has to be made for HVAC installations if tender is changed from already planned traditional solution to Sensus system. Radiator and radiator pipes are removed from all the Sensus spaces, but still left to the spaces that use traditional technology. All cooling radiators and those networks are removed from Sensus spaces. The Sensus panels need to be added to the planning and should be sized to fit the spaces and 3-pipe system is needed to the panels. System of 3-pipes includes pipes for heating, cooling and return. In front of big windows areas needs heating pipes into floor. Changing from the traditional solution to Sensus system affects also to insulation for example insulation of return pipe can be cut out. Changes in valves compared to traditional solution and Sensus system has to also take into account. There is changes in prices like in supply air ventilators price. There is also a possibility to power reduction in refrigerating machine in Sensus system which can affect to its price. To the air supply units that are connected to Sensus spaces needs to add low-energy centre to the engine room. Air supply unit needs to specify and required pipes and accessories need to be checked. There is changes also in heat distribution centre. Heat exchangers size reduces and Sensus system needs its own exchanger. These have an effect to the price. [17]

There is also changes into the installation of electricity and automation when tender is changed from already planned traditional solution to Sensus system. The price of lighting reduces because of the reflecting surface of panels needs less power from lighting. Also

needs to choose lighting that fits to Sensus panels. Traditional switch can be cut out from Sensus spaces because presence detector with its cabling are added to the panels. There are also some changes in cabling and building automation system. Pipe channels can be left out from Sensus spaces. Cabling for working centres are moved from corridor trays to above or to forehead of panels. Socket pillars can also be added to Sensus project if wanted. There is also changes in building automation if the traditional solution is changed to Sensus system. [17]

By changing from already planned traditional solution to Sensus system increases risks of total building to tenderer. There are price effects of planning changes. Controlling the planning also produces costs. [17]

Tender can also be made from architectural design. Then usually first is calculated a rough pricing from statistical numbers of similar objects. Usually there is used some numbers from traditional solutions. Objects special characteristics needs to be noticed also making the rough calculation. All the changes that were taken into account in changing from traditional system to Sensus needs to be noticed at this point. After that can be made a rough planning to architectural design. [17]

In Sensus project tender usually includes something extra compared to traditional offer. Tender and its attachments in Sensus project include [17]:

- tender of cooperation
- presentation of Sensus buildings
- an example tender of one Sensus building that is carried out
- system description of Sensus
- contract borderlines
- goal for energy saving and user satisfaction
- maintenance and service.

**Purchasing in Sensus project** is done mainly like in other projects. Purchasing department orders key components from regular supplier. Project manager makes purchase schedule. The key components of Sensus low-energy system are panels of room that use Sensus system, Sensus air conditioning units and other air conditioning units, control valves of panels, low-energy centres, supply air terminal devices and automation. [17] [18]

### 3.5.1 Essential parts of building Sensus

There are some things that has to be noticed in building Sensus house. In scheduling and logistics have to take into account some specialities. In Sensus project there is also some specialities in pipeline operations in heating and cooling. Panel mounting needs also to

be planned well. Ventilation and electricity installations are done like in traditional building solution, but automation work differ from traditional building solution in Sensus project. [17]

In scheduling and logistics are some specialities to take account. Delivery time of panels, air supply units and low-energy centres is approximately 8 to 10 weeks. Panels should be ordered and packed floor by floor. [17]

There are some essential parts of pipeline work in heating and cooling in Sensus buildings. Working practice and materials are ordinary, but pipeline connections are different than usually. It is required special attention in making pipeline connections in Sensus system. All the connection between panels and low-energy centre needs to be checked before filling the system with liquid. It is important to remove air from the system. Adjustment of flow rate is work of specialist. There are some instructions to be followed. [17]

In panel mounting there is also some things that should take into account in building Sensus system. It is necessary to contemplate who will be mounting the panels. In Finland panels are mounted by air conditioning mechanics. In mounting panels to false ceiling the fitting needs to be exact to false ceiling structures. Panels need to show in architectural drawings where can be seen the exact places to mount them. [17]

Automation work in Sensus project is more demanding than in regular project. Automation work requires orientation to the system programmer and first user. In Finland programmer and first user are usually same person. Functional tests are very important after automation work. [17]

Ventilation and electrical installations are done like in other projects. Lighting are usually mounted from the panels. This impacts to the support spots of panels and potential openings. When ordering the panels, it is already mandatory to know what kind lighting is chosen. [17]

## **4. DIFFERENCES BETWEEN FINNISH AND RUSSIAN MARKET**

There are differences between Finnish and Russian market. For example, there are many cultural differences between Finnish and Russian market. It is important to understand local culture and local business operations in Russia. These differences are dealt with in the following. [19]

### **4.1 Basic information and specialities of Russian market**

It is important to understand that many specialties and future challenges of contemporary Russia is based on the time before revolution of Russian imperium in October 1917 and period of Soviet Union. Background of thinking and operation models from Soviet Union time are still affecting strongly to the system. [19]

There are some special challenges in establishing Finnish company to Russian market. Most of the risks establishing in Russian market can be avoid with the help of specialist and good preparation in getting to know how the market works. Company needs to have stable financial situation and needs to know the market before establishing to Russian market. It is always important to have knowledge of Russian culture and habits and Russian language skills can't be overemphasized. Friendship is a big deal in Russian market and so is cooperation with authorities. It is also important to have a reliable Russian partner. Other things to consider are like certificates, permissions, customer relations, logistics, transport, possible rental agreement. There is also a lot of risk related to employees and outside consultants. It is especially important to do your homework before entering to Russian market. [19] [20]

#### **4.1.1 Cultural differences**

##### **Employees**

Productivity of labor isn't as high as in Finland, but it can be influenced by effective leadership and guidance. Finnish workers can sometimes work as an instructor in Russian working environment. Goal is to spread Finnish operation mode and innovations to coworkers in Russia. New generation of Russian employees has changed their working habits more western. They are now ready take more responsibility and they understand that it is okay to fail sometimes. There are some demands on legislation and because of, it is required to add more administrative employees in company and that's why productivity stays low. One of the special characteristics is that basically Russian employees are only obligated to carry out work that are defined in work contract. [19] [20]

Concept of time is different in Russia. Things are reacted fast and with short period of time but usually the work is done in the last minute before deadline. Because of that rush is an ordinary thing in working in Russia. Differences between temperance can be seen in work places but on the other hand those differences are fixed as fast as they came from. [19] [20]

In the last few years has hard competition kept employees position high. As a down side for employer has been that it has been difficult to engage employees because they have easily changed employer with the hope of bigger salary. In western companies can staff be engaged for example paid sick leave, health insurance or different kind of pension plans. It is important to remember that wage level is rising in Russia. Still wage level is lower than in Finland but it is rising every year. There is no big need for trade union in Russia because companies have kept so good care of their staff. The number of members in trade unions has reduced from over 95 percent in year 1995 to little over 20 percent in year 2010. [19] [20]

Engaging staff is important part of business. Especially it is important to engage key personnel. Lack of skillful middle management in Russia is caused by Russian company culture where decisions are made at the top of hierarchy. Business in Russia is more people oriented than company or organization oriented. For example, when key personnel changes company can all his clients follow him. Companies should invest to education because staffs' former education doesn't necessarily meet with the need of company and because education adds engaging. [20]

Nexus of social relations of employees are very important in Russia. Russian customer is most likely to buy from or via its own network. It is not easy to western employee to come part of these networks. On the other hand, it is necessary to be alert of chicanery when choosing staff. It is possible that in company's purchasing apartment there is a buyer that doesn't buy the most inexpensive version by its price-quality ratio instead chooses the one that buyer himself benefits the most as a consultant fee. Because of this there are some western companies that take on only western employees to procurement and purchasing manager. Some of the local workers lob for local products regardless of the total price or quality. Many Finnish company has discovered that it is a good practice to hire Finnish student that are studying in Russia. Work permit is now easier to get if you are studying in Russian university. [19] [20]

Many companies also underestimate the costs of various outsourcing services in their budget. Professional services in law, financial administration, recruitment, management consultant, marketing and communication outside the own company can be economically profitable. For example, Russian society is digitalizing. When internet has become more common it has opened new marketing and communication channels. Old time coverage is not reached anymore in the old ways. Nowadays it is necessary to remember social

medias importance in marketing and sales. It is important to bear in mind cultural specialties, to stand out from others and network efficiently in Internet marketing. [20]

### **Business premises and urban communications and utility services**

Russia is no longer country of low costs. Good business premises have been even more expensive than in Finland although there is a lot of change in markets. Costs are affected for example exchange rate of ruble and common market situation. The position of tenant is not very strong in Russia. The rent can be raised or rental agreement can be cancelled suddenly. Usually companies start in too small rented premises but they should forecast more the need of premises. [20]

Urban communication and utility services are usually offered by monopolistic market, those are expensive and getting the connection can take a while. There have been situations that company has paid a lot of permission to join local electricity network, but the connection is not delivered to the site after two years. Because of this it is typical that in beginning of operation electricity is generated by aggregate. [20]

### **4.1.2 Increasing competition**

Competition has increased in Russian market. It is recommended to do market settlement before entering to market. It is typical to under- or overestimate the markets. It is not worth to enter Russian market extremely cautious and slowly or under own. Before entering to Russian market, it is recommended to be in contact with local trade promoter. When choosing staff to sales, middle management and management, it is important to take care that person understood well Russian customs and management culture. Staff need to have knowledge of Russian language and Russia need to be familiar as a working environment. This usually means the sharpest persons of company. [20]

As starting or raising export it is good to remember export guarantee of Finnvera. Finnvera is a special fund owned by Finnish government and it is Finland's official Export Credit Agency (ECA). Finnish company can guarantee its export receivables to Russian companies with export guarantee of Finnvera. With the help of this, Finnish company can increase its market share by giving credit for Russian client. [20] [21]

By acting based on the law and regulations is a good way to prepare for any inspections and cooperation among authorities. It is unfortunately possible to "order" tax or other authoritative inspection to a heavy competitor in Russian market. Also, it is possible to give groundless information to make running a business difficult. All bank accounts are closed when company is under investigation. It basically stops all business. This kind of action has been diminished in Russia, but it is not totally ended. Russian client appreciate that foreign partners continue working together under though times. [20]

### 4.1.3 Immaterial rights

It is significant to take care of company's trademarks and domain names. It is important to notice that when foreign company registers its subsidiary company, it doesn't give any protection to its name in Russia. Only way to get some protection of registered business names is to register subsidiary company's name and possible logo as a trademark. Trademark has a good legal protection in Russia. As starting to export it is important to register the trademark immediately under own company name after registering the subsidiary company. If you neglect to register the trademark, it is possible that you need to change the name in Russia, because importer can register the original trademark under its own name. It is also important to forbid to register company's domain name or company name in retail and agent contracts. [19] [20]

Patent agency of Russian federation, called as Rospatent, has started to work in collaboration with Finnish patent and registration office in 1<sup>st</sup> of March 2011 among others. Cooperation has started to ease up and quicken formalities connected to patent registration in limits of PPH-program (Patent Prosecution Highway). Foreign juristic and natural person needs to use a registered patent agent from Rospatent to apply for a patent in Russia. Inventor's right belongs to inventor in Russia, but monopoly and right to apply for a patent belongs to company if there is not made a contract otherwise. [19]

### 4.1.4 Legislative infrastructure

Typical to Russian legislation is the multiplicity of laws. Laws are clear and detailed, but there can be a lot of statutes and other application directives under laws. These statutes and applications can be in contravention of the original law and it can be difficult to interpret these. Russian society is changing constantly and so is also license procedures that are affecting companies' daily routine for example for work permits. That's why it is important to keep legal expertise updated. [19] [20]

There is a lot of bureaucracy connected to construction industry in Russia. Bureaucracy slows down foreign companies' business. There is a lot of bureaucracy connected to granting planning permission and implementation of buildings. There are many administrative sectors that take part in granting a permission. Bureaucracy makes difficult to forecast costs. Official issues are taken care of governmental authority and if they are not, reason is something else than bureaucracy. Still it is recommended to avoid corruption in every case because it will start an unfortunate spiral where it is difficult to get away. [3] [20]

Russia is not so exact of building permit in practice than Finland is. One of the main reasons is that getting a building permit takes huge amount of different approval and documents. It is not possible to get those documents fast enough so in general constructions

are started before getting the official building permit. This means that before getting all the official permits can building be used as a “testing” for a long time. This way approving authority can’t usually interfere to it. [19]

It is also good to remember in the middle of Russian bureaucracy to obey the right order. First comes international agreements, after that governmental laws and last ones are local laws and official regulations. Company should be prepared to that administrative process can slow down or even stop if the management of local administrative changes. Written agreements with previous administrative don’t necessary bound anymore. Change of management usually mean changing the whole staff that’s why authoritative relations should not rely only for one person. That is why it is necessary to value good relations to people who prepare issues. [3] [20]

### **Tax agreement and social security**

Taxation has been very innovative in Russia. It has at least been basically identical for every company and has not distort the competition. Only challenge for Finnish operator has been tax agreement between Finland and Russia and missing the agreement in social sector. Tax agreement between Finland and Russia is from year 2002 and it is not updated after that. There is some defect that should be corrected so that in competitive conditions Finnish tenderer would be in equal situation. Finnish entrepreneur result some extra expenses because it needs to pay statutory social security contribution to Russia also from foreign employee. Company needs to pay social security taxes to both countries when Finnish employees insist Finnish social security contribution. Paying social security taxes to both countries rolls back firms’ competitive capacity. Double paying could avoid by a contract between these two countries, but Finland and Russia doesn’t have this kind of agreement. [3] [21] [23]

### **Building codes and regulations**

Building is regulated with a lot of different building codes and other regulation given by authorities in Russia like in other countries. Documents of building codes of Russian federation consists of four parts. The first part of building codes and regulations of Russian federation called SNIIP, includes basic regulations and requirements for construction planning and structural planning. Second part is for building standards of Russian federation, GOST. Building standards include quality requirements for material, structure etc. Architecture and building rules, SP, are the third part of documents. Architecture and building rules consist of instruction books and manuals of planning. In those manuals, it is presented thoroughly how to execute demands presented in SNIIP. Fourth document includes administrative standard documents like standards of department of health or fire safety requirements. [3]

### 4.1.5 Custom clearance

Earlier custom clearance and border crossing have been the biggest trouble of Russian trade. Custom clearance and import duty have become easier after Russian became a member of WTO (World Trade Organization). Membership has also resulted in decreasing import duty payments. Transparency has become better after membership and electronic custom clearance has decreased corruption. Among custom clearance can licenses and quotas became a barrier because it is useful to transfer production inside custom border. [20]

There are five phases in custom clearance. First step is authorization, registration and filing custom declaration. After that is evaluation of goods and making sure that non-tariff regulations are obeyed. Third step is to control currency and custom value. There needs to be all legal documents to control currency of goods. Custom value in importing Russia is based on the following documents: delivery contract, invoice, trade passport, document from the bank of importer, that is to confirm the payments of delivered goods and Shipment Export Declaration. Trade passport means all the documents connected to transaction and these are delivered to bank in Russia which checks the documents and approves transfer of currency. Next up is to supervise payment of clearance charge. The final phase is to check out goods physically and issue good into circulation. [19]

Finnish companies still have inadequate information of custom clearance system and unwillingness to use experts. Sometimes things are tried to solve by taking a short cut in regulations. Only good way is to tend to correct them in court. [20]

## 5. ACCOUNTING SYSTEM

The main aim of the Master Thesis was to make a tool to ease tender calculation for Sensus-projects in Russian market. Accounting tool was executed with Excel-spreadsheet program. At this chapter, we get to see how does it look like and how does it work.

This accounting tool is not used in any real project. The numbers that are used in this tool is a combination of different projects so that it is as comprehensive as possible. Numbers in example figures are fictitious and they are not based in any real tender.

### 5.1 Construction of accounting tool

Tool is made up of 14 different sheets. The cover sheet is Summary. After that comes 9 sheets that specifies different type of costs. Sheets are

- Material
- Work
- Subcontract
- Supervision
- Planning
- Additional work
- Programming
- Working site
- Other costs

After that there are four sheets for quantity surveying. These sheets are divided to four main systems as Electricity, Tele, Ventilation and Heating & Plumbing.

Summary sheet shows the summary of tender calculation after completing the filling of spreadsheet. In Summary-sheet you can see the basic information of tender as follows like it is shown in Figure 6:

- objects name
- tender number
- who has done the tender
- date of making the tender
- volume in square meters
- volume in cubic meters
- total costs of project
- calculated offer
- approved offer

- gross margin in percent
- approved gross margin in percent
- costs per every square meter
- costs per every cubic meter.

All the costs are shown without taxes and with taxes. After that there is a breakdown of costs caused by different type of costs. It shows for example total cost, gross margin, calculated offer, percentage of total costs and approved offer of materials. There is also a column for comments. The end of summary sheet shows material costs, working hours and working costs divided between four main systems. After that the same information is also presented by dividing it to smaller parts of main systems, like it is shown in Figure 7.

Object	Building X		
Tender no	at0036		
Handled by	Mister XX		
Date	xx.xx.20xx		
m <sup>2</sup>	2 700,00		
m <sup>3</sup>	3 600,00		

	%	tax-free	with tax
Total costs		9 468 927,45	11 646 780,77
Calculated offer		10 883 824,66	13 387 104,33
Approved offer		10 760 144,83	13 234 978,15
Gross margin %	13,00	1 414 897,21	1 740 323,56
Approved gross margin%	12,00	1 291 217,38	1 588 197,38
Eur/m <sup>2</sup>		3 985,24	4 901,84
Eur/m <sup>3</sup>		2 988,93	3 676,38

tax %	23,00
-------	-------

Type of cost	Total cost	Gross margin	Calculated offer	Percentage	Approved offer	Comment
Material	3 227 960,15	13,00	3 710 299,02	34,09	3 668 136,54	
Work	6 175 762,30	13,00	7 098 577,36	65,22	7 017 911,71	
Subcontract	53 080,00	13,00	61 011,49	0,56	60 318,18	
Implementation	0,00	13,00	0,00	0,00	0,00	
Programming	0,00	13,00	0,00	0,00	0,00	
Planning	3 375,00	13,00	3 879,31	0,04	3 835,23	
Supervision	8 750,00	13,00	10 057,47	0,09	9 943,18	
Auxiliary construction work	0,00	13,00	0,00	0,00	0,00	
Site facilities	0,00	13,00	0,00	0,00	0,00	
Tools	0,00	13,00	0,00	0,00	0,00	
Other costs	0,00	13,00	0,00	0,00	0,00	

**Figure 6.** View of Summary sheets' upper part.

31	<b>Costs ordered by main systems</b>											
32			<b>Material costs, €</b>	<b>Working hours</b>	<b>Working costs, €</b>							
33												
34												
35	<b>Electricity</b>		875502,02	15363,33548	225687,3982							
36	<b>Tele</b>		257563,784	340624,56	5003774,786							
37	<b>Ventilation</b>		821081,89	3 493,73	51 322,88							
38	<b>Heating &amp; Plumbing</b>		1 062 590,77	13 285,06	195 157,53							
39												
40	<b>System by system</b>											
41	<b>System name</b>	<b>System code</b>	<b>Material costs</b>	<b>Working hours</b>	<b>Working costs</b>							
42	<i>Electricity</i>											
43	Cable rack system	H101	30 692,27	794,14	11 665,93							
44	Raceway system	H102	4 947,16	107,61	1 580,82							
45	Floor duct system	H103	31 217,10	512,94	7 535,08							
46	Suspension system	H104	5 658,60	184,50	2 710,31							
47	Lead-ins	H105	1 500,00	0,00	0,00							
48	Rail bridges	H106	36 800,00	660,00	9 695,40							
49	20 KV Distribution system	H201	55 900,91	226,99	3 334,55							
50	0,4 KV Main distribution system	H202	137 365,62	2 145,47	31 516,98							
51	Electricity measurement system	H203	269,74	17,97	263,91							
52	Stand-by supply system	H204	62 206,94	74,77	1 098,43							
53	UPS-distribution system	H205	4 768,83	58,89	865,05							
54	HPAC-systems electrification	H301	7 694,69	529,65	7 780,52							
55	Machines electrification	H302	4 724,16	444,66	6 532,01							
56	Sockets	H401	68 336,72	3 741,95	54 969,30							
57	Lighting track system	H402	2 011,53	48,06	706,00							
58	Connector and harness system	H407	10 237,36	40,00	587,60							
59	General lighting system	H501	62 236,84	2 372,30	34 849,08							
60	Safety lighting system	H506	48 764,45	632,40	9 290,01							
61												
<table border="1"> <tr> <td>Summary</td> <td>Material</td> <td>Work</td> <td>Subcontract</td> <td>Supervision</td> <td>Planning</td> <td>Auxiliary consti</td> </tr> </table>						Summary	Material	Work	Subcontract	Supervision	Planning	Auxiliary consti
Summary	Material	Work	Subcontract	Supervision	Planning	Auxiliary consti						

Figure 7. View of Summary sheets costs divided into smaller parts.

Next nine sheets of accounting tool give an overview of where the costs come from. Tender number is shown in every sheet, so that it is easy to identify to the right project if information is printed. After tender number in material cost sheet you can see material costs, solid material costs, if there are any, and total of material costs, as it shows in Figure 8. Total of material costs is calculated as follows:

$$\text{Total of material costs} = \text{material costs} + \text{solid material costs} \quad (1)$$

	A	B	C	D	E	F	G
1							
2	<b>Tender no:</b>	at0036					
3	<b>Material cost €:</b>	3 016 738,46					
4	<b>Material solid €:</b>						
5	<b>Material total €:</b>	3 016 738,46					
6							
7							
8							
9	<b>Material</b>						
10							
11	<b>Type of cost</b>	<b>Description</b>	<b>Calculated sum</b>	<b>Percentage</b>	<b>Price</b>	<b>Unit</b>	<b>Total, additional material</b>
12	Material	Reserve for cost escalation	3 016 738,46	7,00	0,00	0,00	211 171,69
13	Material	Purchase target	3 016 738,46	0,00	5,00	10,00	50,00
14	Material	Freight charges	3 016 738,46	0,00	0,00	0,00	0,00
15	Material	Customs clearance	3 016 738,46	0,00	0,00	0,00	0,00
16			3 016 738,46				0,00
17			3 016 738,46				0,00
18			3 016 738,46				0,00
19			3 016 738,46				0,00
20							
21							
22		<b>Total cost of material</b>	3 227 960,15		<b>Percentage</b>	34,09	
23		<b>Gross margin %</b>	13,00				
24		<b>Calculated offer</b>	3 710 299,02				

Figure 8. Overview of Material sheet.

After that there is different types of additional material costs that needs to take into account. Total of every line of additional material costs is calculated using

$$\text{Total of material cost} = \text{Calculated sum} \times \frac{\text{Percentage}}{100} + \text{Price} \times \text{Unit} \quad (2)$$

Calculated sum comes from Material total € -cell. Percentage, price and units are added if they are needed. If there is a risk of costs increasing, it is possible to estimate already in calculating offer. Total cost of material is calculated by adding Material total to sum of Total, additional material.

$$\text{Total cost of material} = \text{Material total } \text{€} + \sum \text{Total, additional material} \quad (3)$$

Calculated offer can be calculated after knowing the total cost of material and gross margin. Gross margin comes from front sheet, i.e. Summary-sheet. Calculated offer of materials is calculated by using Formula 4.

$$\text{Calculated offer} = \frac{\text{Total cost of material}}{1 - \text{gross margin}/100} \quad (4)$$

Materials percentage of total cost can be calculated after knowing total cost of material and total costs. Total costs is a sum of every type of costs and it comes from Summary-sheet after completing quantity surveying. Material percentage is calculated by using formula 5.

$$\text{Materials percentage} = \frac{\text{Total cost of material}}{\text{Total costs}} \times 100 \quad (5)$$

Last four sheets are for quantity surveying. Sheets are Electricity, Tele, Ventilation and Heating and Plumbing. On those sheets, there are lists of every component of Sensus project, like you can see in Figure 8. There are four sheets in accounting tool which are filled with numbers of components. In every of those sheets has the same columns as Tele-sheet in Figure 9. Name of the columns are as follows:

- System number
- System name
- Product code
- Product name
- Installation method
- Quantity
- Unit
- Unit price
- Total price of materials
- Subcontracting
- á work
- working hours.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	System   System name   Product cod   Product name				Installation	Quantity	Unit	Unit price	Total price of	Subcontract à Work	Working hours		
2	Door telephone system												
3	J103	Door telephone SY0299SY	Telecomm. cable interior	MHS 5X2X0.5		590	M	0,242	142,78		1,5		885,00
4	J103	Door telephone SY0291SY	Telecomm. cable interior	MHS 10X2X0.5		80	M	0,363	29,04		1,5		120,00
5	J103	Door telephone SY0188SY	Telesignalization cable	KLMA 4X0.8+0.8		350	M	0,257	89,95		0,0235		8,23
6	J103	Door telephone SY0432SY	Installation cable	MMJ 3X1.5S coil		180	M	0,36	64,80		0,0235		4,23
7	J103	Door telephone SY0176SY	Plastic pipe	JM 20		45	M	0,21	9,45			2	90,00
8	J103	Door telephone SY0171SY	Aluminum pipe	JAPP 20		10	M	0,67	6,70			5	50,00
9	J103	Door telephone SK201SK	Installation accessories			1	units	40	40,00			0	0,00
10	J103	Door telephone SK201SK	Door telephone accessory	Tamcent		1	units	2461,49	2.461,49			0	0,00
11	J103	Door telephone SK201SK	Systems installation work			12	units	0	0,00			75	900,00
12	J103	Door telephone SK201SK	Pictures and graphs			2	units	0	0,00			115	230,00
13													
14	Antenna system												
15	J201	Antenna system SY0544SY	Aerial cable	TELLU 13		230	M	0,24	55,20		1,5		345,00
16	J201	Antenna system 0232187SM	High-frequency cable	TELLU 7		690	M	1,39	959,10		2		1.380,00
17	J201	Antenna system 7060185SM	Antenna centre plate	TV+radio+sat		3	pcs	1,18	3,54			0	0,00
18	J201	Antenna system 7526507SM	T7234	Programming device +AVANTT7234		1	pcs	60,82	60,82			0	0,00
19	J201	Antenna system 7540260SM	Support pipe	LATP 50/2 45MM to masts		1	pcs	15,82	15,82			60	60,00
20	J201	Antenna system 7540267SM	Support pipe	60X2000 LATP 60/2		1	pcs	33,4	33,40			60	60,00
21	J201	Antenna system 7540275SM	Accessory set	LAMT 30 LATP 50 for 2		1	pcs	13,35	13,35			0	0,00
22	J201	Antenna system 7540285SM	Accessory set	LAMT 29 LATP 60 for 2		1	pcs	7,7	7,70			0	0,00
23	J201	Antenna system 7540905SM	Surface cabinet	LAPK 1 600X470X140MM		3	pcs	60	180,00			180	540,00
24	J201	Antenna system 7541186SM	Multicoupler	5-2300 MHZ LAJX 408 4-Multicoupler/8DB		9	pcs	0	0,00			12	108,00
25	J201	Antenna system 7541186SM	Distribution block	5-2300 MHZ LAHX 415 4-distribution block/15DE		12	pcs	0	0,00			12	144,00
26	J201	Antenna system 7541188SM	Distribution block	5-2300 MHZ LAHX 818 8-distribution block/18DE		12	pcs	0	0,00			16	192,00
27	J201	Antenna system 7541421SM	F-connector	FL 75 T-7R TELLU 7 rotatable		22	pcs	1,35	29,70			10	220,00
28	J201	Antenna system 7541424SM	F-connector	FL 75 JN extension female-female		22	pcs	0,3	6,60			0	0,00
29	J201	Antenna system 7541436SM	F-connector	F-terminator FL 75P		5	pcs	0,27	1,35			1	5,00
30	J201	Antenna system 7541524SM	F-couple connector	for 2 cable F-81-HQ DUAL		28	pcs	2,5	70,00			5	140,00

**Figure 9.** Every main system sheet has the same headlines for every column. Here is an example of Tele-sheet.

System number is series of numbers and letters to ease listing systems. For every product, it is given a product code so that it is easier to find and list products. Installation method gives the information of different ways of installation. Installation method affects for products unit work hours. Quantity is the quantity of a product needed in project. Unit tells in which measurement of unit the quantity is measured. Unit can be measured up as meters, pieces and units, meaning for example how many times some installation has to be made or how many hours installation takes. Unit price tells products unit price. Unit prices are based on familiar and earlier used suppliers' former prices. Unit prices can be updated before starting quantity surveying.

Worksheet calculates Total price with the following formula 6 after feeding the quantity.

$$\text{Total price} = \text{quantity} \times \text{unit price} \quad (6)$$

Subcontract column has a mark if the work is bought from subcontractor. Cost of work that is bought from subcontractor is informed in Euros. Unit work means, how many hours it takes to assembly one product. Unit work is an estimation of average time in hours that it takes to assemble the product. Total working hours is get by multiplying quantity of product and unit work. Sheet automatically calculates Total working hours by using following formula

$$\text{Total working hours} = \text{quantity} \times \text{unit work} \quad (7)$$

Every Electricity, Tele, Ventilation and Heating & Plumbing sheet has its summary of *material costs*, *total working hours* and *total working costs* as you can see in Figure 10.

J701	Automation sys:SY0471SY	Pilot cable MMO 27X1.5	4	550 M	3,17	1 743,50	0,0347	19,09	
J701	Automation sys:SK201SK	Cabling	1	1 units	23834,59	23 834,59	0	0,00	
J701	Automation sys:311084SU	Supplementary costs, Guaranteed salary	1	2008 pcs	0	0,00	1	2 008,00	
<b>Materials total, €</b>							<b>875 502,02</b>	<b>Total working hours</b>	<b>15 363,34</b>
								<b>Work total, €</b>	<b>225 687,40</b>
<b>Subcontracting, material</b>							<b>0,00</b>		
							<b>Material total €</b>	<b>Working hours, tota Working total €</b>	
Cable rack system	H101				30 692,27		794,14	11 665,93	
Raceway system	H102				4 947,16		107,61	1 580,82	
Floor duct system	H103				31 217,10		512,94	7 535,08	
Suspension system	H104				5 658,60		184,50	2 710,31	
Lead-ins	H105				1 500,00		0,00	0,00	
Rail bridges	H106				36 800,00		660,00	9 695,40	
20 KV Distribution system	H201				55 900,91		226,99	3 334,55	
0.4 KV Main distribution system	H202				137 365,62		2 145,47	31 516,98	
Electricity measurement system	H203				269,74		17,97	263,91	
Stand-by supply system	H204				62 206,94		74,77	1 098,43	
UPS-distribution system	H205				4 768,83		58,89	865,05	
HPAC-systems electrification	H301				7 694,69		529,65	7 780,52	
Machines electrification	H302				4 724,16		444,66	6 532,01	
Sockets	H401				68 336,72		3 741,95	54 969,30	

**Figure 10.** Total material costs, total working hours and total working costs are shown at the end of every sheet. Like they are shown in this Figures Electricity-sheet.

Total Material costs of every complex is calculated by using formula 8 and it is named Materials total.

$$\text{Materials total} = \sum \text{Total price of material} \quad (8)$$

Total working hours is calculated as follows:

$$\text{Total working hours} = \sum \text{Working hours} \quad (9)$$

and total work costs in Euros of avery complex is calculated by

$$\text{Total work cost} = \text{Cost of standard hour} \times \text{Total working hours} \quad (10)$$

Cost of standard hour is determined in Work-sheets basic information.

Subcontracting material costs are also summarized to the end of an interleaf. Formula of subcontracting material costs is as follows:

$$\text{Subcontracting, material} = \sum \text{Subcontracting} \quad (11)$$

At the end of Heating, Plumbing –sheet there is total where it is summarized every Material sheets total together. You can see how it looks like in Figure 11.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		System nu	System na	Product code	Product name	Installatio	Quantity	Unit	Unit price	Total price of	Subcontracti	à Work	Working hours	
1253		171 insulation	LA30LA		Sewage pipeline insulation		1	units	1500	1 500,00		0	0,00	
1254		171 insulation	LA30LA		Service water pipe system insulation		1	units	9000	9 000,00		0	0,00	
1255		171 insulation	LA30LA		Slope heating foundation		1	units	4000	4 000,00		0	0,00	
1256														
1257														
1258														
1259														
1260														
1261														
1262														
1263														
1264														
1265														
1266														
1267														
1268														
1269														
1270														
1271														
1272														
1273														
1274														
1275														
1276														

Materials total, €	1 062 590,77	Total working hours	13 285,06
		Work total, €	195 157,53
Subcontracting, material	0,00		

Total cost, materials	3016738,46 €
Total hours, work	372766,66 h
Total cost, work	5475942,59 €
Subcontracting, material	53080 €

	Material total €	Working hours, total	Working total €
Regional network	110	25 865,64	124,72
Heating network	120	186 058,66	3 676,30
Heating network, Sensus	120SR	-26 414,89	-998,30
Radiators	121	13 111,63	113,50
Pumps	122	4 200,00	10,00

**Figure 11.** Example of the summary of total costs and hours in the end of Heating, Plumbing -sheet

Total cost of materials is calculated using following formula 12

$$\begin{aligned}
 \text{Total cost, materials} = & \text{Materials total, €(Electricity)} \\
 & + \text{Materials total, €(Tele)} \\
 & + \text{Materials total, €(Ventilation)} \\
 & + \text{Materials total, €(Heating, Plumbing)}
 \end{aligned} \tag{12}$$

Similar formula is used in calculating *Total hours, work, Total cost, work* and *Subcontracting, material*.

There are also specified total costs of materials and work, and total hours of work for every product group at the end of every main system sheet, as you can see in Figure 12.

		Material total, €	Working hours total	Working total €
Door telephone system	J103	2 844,21	2 287,46	33 602,71
Antenna system	J201	2 321,48	5 123,00	75 256,87
Audio system	J202	61 131,69	45 396,88	666 880,17
AV-system(audio-visual)	J203	16 851,84	22 402,75	329 096,40
Invite in-system	J302	3 083,21	3 254,00	47 801,26
Busy signal - light system	J304	1 113,48	470,00	6 904,30
Time display system	J305	3 692,49	3 975,00	58 392,75
Request for help system	J308	1 419,36	3 202,75	47 048,40
Working time and access cont	J402	1 707,12	5 372,00	78 914,68
Alarm device system	J403	5 314,64	23 058,00	338 722,02
Video monitoring system	J405	6 485,63	25 394,02	373 038,08
Fire alarm system	J407	81 728,46	64 731,71	950 908,82
General cabling system	J501	69 870,18	135 957,00	1 997 208,33

**Figure 12.** Specified total costs of material and work and total working hours for every system

## 5.2 Filling in the accounting tool

Every accounting tool has its own way to fill in it. At this chapter, we look through how to fill in this accounting tool. It includes both filling in basic information and quantity surveying.

At first in calculating tender and before starting quantity surveying it is necessary to study sites technical drawing and do all necessary changes for plannings to change traditional HVAC-system to Sensus system. It is possible to count the quantity of every component from ground plan by using paper and pencil. Counter needs to know well Sensus system and how its built so that he knows what parts and components are needed in every spot and can estimate need of those components, like where sockets are needed. It also needs measuring and estimating of how many meters every pipe is needed.

First step of filling the accounting tool is fill in the basic information of object like objects name, tender number etc. In Figure 13 it is shown the basic information part. Every cell that needs to be filled is highlighted as yellow to ease filling the accounting tool and to show what information needs to be written.

<b>Object</b>	Building X
<b>Tender no</b>	at0036
<b>Handled by</b>	Mister XX
<b>Date</b>	xx.xx.20xx
<b>m<sup>2</sup></b>	2 700,00
<b>m<sup>3</sup></b>	3 600,00

*Figure 13. Basic information of project in Summary-sheet.*

After filling the basic information of project, need Work-, Subcontract-, Supervision- and Planning-sheets need also to be filled with basic information of those fields. To Work-sheet it is determined *Cost of standard hour*, *Length of working day* and *Handicap supplement* like it is shown in Figure 14. In starting to tender calculation check those out, that they are up to date. Cost of standard hours are reported in Euros. Length of working day is reported in hours. Handicap supplement is reported in percentage, if there are need for that in object in question.

<b>Tender no:</b>	at0036
<b>Cost of standard hour €:</b>	14,69
<b>Working hours (hours):</b>	372 766,68
<b>Length of working day (hours):</b>	8,00
<b>Handicap supplement %</b>	
<b>Total cost (h*€):</b>	5 475 942,59
<b>Total cost (nh inst. method):</b>	
<b>Work &amp; Fitters</b>	

*Figure 14. Basic information of Work-sheet.*

In Subcontract-sheets basic information need to be filled in *Subcontract price per hour* and *Subcontract hours* like it is shown in Figure 15 if there is any subcontract that is priced with hourly basis. *Subcontract material €* is got it from quantity surveying.

<b>Tender no:</b>	at0036
<b>Subcontract price per hour:</b>	
<b>Subcontract material €:</b>	53 080,00
<b>Subcontract hours:</b>	
<b>Subcontract total €:</b>	53 080,00

### Subcontract

*Figure 15. Basic information of Subcontract sheet.*

In Supervision-sheet estimated *hours of supervision* and *supervision price per hour* need to be filled in like it is shown in Figure 16. After that total costs of supervision are calculated from the formula 12

$$\text{Supervision total €} = \text{Supervision hours} \times \text{Supervision price per hour} \quad (13)$$

<b>Tender no:</b>	at0036
<b>Supervision hours:</b>	250,00
<b>Supervision price per hour:</b>	35,00
<b>Supervision total €:</b>	8 750,00

### Supervision & Management

*Figure 16. Basic information of Supervision-sheet.*

Planning-sheet need to be filled with basic information; *planning hours* and *planning price per hour* in Euros like it is shown in Figure 17. This can be filled after the planning is done, so that it is known how many hours it took for planning, or it can also be estimated by knowledge of previous similar projects. Total cost of planning is calculated by using formula 14

$$\text{Planning total €} = \text{Planning hours} \times \text{Planning price per hour} \quad (14)$$

<b>Tender no:</b>	at0036
<b>Planning hours:</b>	135,00
<b>Planning price per hour:</b>	25,00
<b>Planning total €:</b>	3 375,00

**Planning**

*Figure 17. Basic information of Planning-sheet.*

There is no basic information to be filled in Auxiliary construction work -, Programming-, Working site - or Other costs -sheet. Tender number will automatically be shown in every sheet when it is filled to Summary-sheet.

After fulfilling all basic information to spreadsheet, it's time to start filling specialties of object. In these nine sheets, that are specified by origin of costs, have space where to fill in special costs. Special costs are costs that are different in every tender. They depend on tender boundaries and other special characteristics of project. These specialties can be like reserve for cost escalation, project discount, accommodation cost, daily allowances, food allowances, travelling expenses or guarantee in Subcontract -sheet.

After filling all those basic information and specialties, it's time to fill in quantity accounting tool. There are four sheets in accounting tool which are filled with numbers of components. Sheets are Electricity, Tele, Ventilation and Heating and Plumbing. In every of those sheets has the same columns as Electricity-sheet in Figure 18. In making quantity surveying there is everything else as a starting material, but you need to fill in quantity of every item that is needed.

	A	B	C	D	E	F	G	H	I	J	K	L	M
	System	System name	Product code	Product name	Installation method	Quantity	Unit	Unit price	Total price	Subcontract	Work	Working hours	
1													
2	<b>Cable rack system</b>												
3	H101	Cable rack sys 074010SP	KS 20-200	horizontal shelf (> 800 m),MEKA		64	M	3,109	198,98		0,218	13,95	
4	H101	Cable rack sys 074050SP		Intermediate support bracket KS 20-200 (0.5m)		32	pcs	2,32	74,24		0	0,00	
5	H101	Cable rack sys 074090SP	KS 20-300	horizontal shelf (> 800 m), MEKA		415	M	3,249	1 348,34		0,218	90,47	
6	H101	Cable rack sys 074100SP	L-piece	KS 90-300		2	pcs	18,97	37,94		0	0,00	
7	H101	Cable rack sys 074110SP	T-piece	KST-300		108	pcs	30,66	3 341,94		0	0,00	
8	H101	Cable rack sys 074120SP	X-piece	KSX-300		8	pcs	49,88	399,04		0	0,00	
9	H101	Cable rack sys 074130SP		Intermediate support bracket KS 20-300 (0.5m)		208	pcs	2,54	528,32		0	0,00	
10	H101	Cable rack sys 074170SP	KS 20-500	horizontal shelf (> 800 m),MEKA		2000	M	3,619	7 238,00		0,218	436,00	
11	H101	Cable rack sys 084172SP	KS 80-500	horizontal shelf (<800 m),MEKA		390	M	5,577	2 175,03		0,2458	95,86	
12	H101	Cable rack sys 074180SP	L-piece	KS 90-500		110	pcs	21,36	2 349,60		0	0,00	
13	H101	Cable rack sys 074190SP	T-piece	KST-500		67	pcs	35,43	2 373,81		0	0,00	
14	H101	Cable rack sys 084200SP	X-piece	KSX-500		3	pcs	55,49	166,47		0	0,00	
15	H101	Cable rack sys 084210SP		Intermediate support bracket KS 80-500 (0.5m)		200	pcs	4,192	838,40		0	0,00	
16	H101	Cable rack sys 074210SP		Intermediate support bracket KS 20-500 (0.5m)		570	pcs	3,68	2 097,60		0	0,00	
17	H101	Cable rack sys 074220SP		Supporting bracket KS 20-500		570	pcs	5,258	2 997,06		0	0,00	
18	H101	Cable rack sys 074240SP		Alteration of course KS 20-500		6	pcs	2,96	17,76		0,218	1,31	
19	H101	Cable rack sys 074260SP	KS 20-300	Vertical shelf (> 800 m), MEKA OY		210	M	6,287	1 320,27		0,218	45,78	
20	H101	Cable rack sys 074270SP	KS 20-500	Vertical shelf (> 800 m), MEKA OY		285	M	6,657	1 897,25		0,218	62,13	
21	H101	Cable rack sys 084251SP	KS 80-200	Vertical shelf (<200 m),MEKA		155	M	8,337	1 292,24		0,3138	48,64	
22													
23	<b>Raceway system</b>												
24	H102	Raceway syste 130070SP	TB 1312-1 (>800 m),	anodized trunking systems+1 cap, (Wide),NORDIC		55	M	10,36	569,80		0,2548	14,01	
25	H102	Raceway syste 131070SP	TB 2212-1 (>800 m),	anodized trunking systems+2 caps (Wide+Wide),N		67	M	17,527	1 174,31		0,2804	18,79	
26	H102	Raceway syste 131080SP		Internal corner TBS 22		10	pcs	18,09	180,90		0,218	2,18	
27	H102	Raceway syste 140010SP	TB 1012-3 (>800 m),	paint, trunking systems+1 cap, (Wide),NORDIC AL		55	M	9,285	510,68		0,2548	14,01	
28	H102	Raceway syste 140070SP	TB 1312-3 (>800 m),	paint, trunking systems+1 cap, (Wide),NORDIC AL		126	M	10,245	1 290,87		0,2548	32,10	
29	H102	Raceway syste 141010SP	TB 1722-3 (>800 m),	paint, trunking systems+2 caps (Wide+Narrow),NO		86	M	14,055	1 208,73		0,2804	24,11	
30	H102	Raceway syste 141020SP		Internal corner TBS 17-3		6	pcs	1,38	8,90		0,218	1,09	
31	H102	Raceway syste 141030SP		External corner TBU 17-3		6	pcs	1,38	8,90		0,218	1,09	

*Figure 18. Here is an example of Electricity-sheet. Only quantity of items need to be filled in.*

After filling in the quantities, the spreadsheet calculates the results by using its formulas. Then it is only choosing the approved gross margin and making the offer.

This accounting tool can be easily adjusted also for any other foreign country. Every country special characteristics need to be considered when full filling the specialties of object. This is planned for Russian and there are already fulfilled some specialties of Russian market as a starting information to tender calculation. All that information can be changed if they are not fitted to calculated project.

## 6. MAKING A TENDER OF SENSUS LOW ENERGY SYSTEM IN RUSSIAN MARKET

Russia has woken up to energy saving. Russian government has set the goal to cut down energy consumption. This has opened new markets for more energy efficient solutions. Are LTD has an answer to this. Sensus low energy HVAC- system is one answer to this demand. Both building and operating costs are lower than traditional HVAC-system.

Successful tender calculation is one of the key elements on aiming to Russian market or any market. The deal is off if you can't get the tender right on time and you can miss the contract if tender isn't good enough. If tender is calculated too low and you could get the contract, then there is a possibility that you won't get any profit. When calculating tenders to Sensus-projects to Russian market, it is important to remember to take into account specialties of Sensus system and Russian market. Purpose of this study was to create an accounting tool to speed up tender calculation after all quantity surveying is done.

Tender calculation starts by making a tender design. Main purpose of tender design is to determine the components for quantity surveying, the basis of tender calculation. A result of tender design, is a list of appliances and standard project drawing. Design development can be influenced by architectural design and construction plan, when some changes are needed for replacing traditional HVAC-system to Sensus low energy system. Source information that is needed in tender design are architectural drawing of building, floor plan, purpose of spaces and those modifiability, ADP(server)-rooms and the target value for internal thermal conditions. It is also necessary to know required spaces for engine room, shafts and false ceiling and important to know utility networks and services like district heating network, electricity network and water and sewer networks which are connected to site.

To ease up quantity calculation a typical room can be chosen. The size of panels, lighting, electricity supply and automation can be estimated as a sketch of typical room. Office spaces, air flows of Sensus, air supply unit and heating and cooling capacity are estimated and at the same time the regular air supply units are sized. The total heating capacity of the building and the size of heat distribution center are also scaled. After that it is possible to choose capacity of refrigerating machines.

When all the estimation is done, it is time to make quantity surveying. With the base of quantity surveying it can be started to work tender calculation. There are some specialties to remember while making tender calculation to Russian market instead of Finnish market. Biggest troubles in estimating costs can be set by cultural differences, increasing competition, custom clearance and legislation in Russia.

There is a huge difference in productivity of Russian employees compared to Finnish employee. To increase the productivity there has been Finnish employees as an instructor. Big problem in Russia is also staffs' low rate of engagement, that's why it is important to engage the key personnel. In Russia people are more person oriented than company oriented. If you can engage key personnel, you have more stable situation. One major problem of Russian employees is also chicanery as making sales. That's why most of western firms use western staff as sales manager. At the same time, it is very useful to have local expertise for example in law and marketing department.

Competition has been increasing in Russian market. It is important to do market settlement before entering to the market. It can be seen how Russian market looks like from companies' point of view from market settlement. First thing when entering to Russian market is to register trademark, so it is own by you. As starting a business in Russia or trying to enlarge business, it is good to remember that Finnish company named Finnvera offers export guarantee so that it is possible to give same paying time to Russian companies.

There is a lot of bureaucracy in Russia. Laws and regulations are also changing all the time, so it is not easy for foreign company to run business in Russia. Tax agreement between Finland and Russia is from year 2002, and it is not have been changed since. That means there is a lot of taxation in Russia. For Finnish companies, there comes more extra costs from social security costs, because Finnish company need to pay it for both countries. Building codes are similar to other countries as they consist of four parts.

Custom clearance is no longer the biggest trouble of importing to Russian market. After Russia become a member of WTO has the custom clearance become easier and more transparent. And now that electronic custom clearance is in use, it has decreased corruption.

All these specialties of Russian market can be taken into account in accounting tool. The lower productivity of employees can be take into account in accounting tool as a higher unit work time for each item. Without adding the extra time to working time the tender might end up being too low for contractor and it would mean that project is unprofitable to contractor. But easier way to take into account lower productivity of Russian employees is to add some extra costs to Work-sheet like efficiency factor, work without specified price, reserve for cost escalation, measurement and adjustment work, guarantee work etc. that will be added to total cost of work like it is shown in Figure 19. Like lower work efficiency can be take into account by adding a percentage of efficiency factor. Calculated sum -column is the same as Total cost -cell. Calculated sum -column is shown so it is easier to understand where extra costs are calculated from.

1							
2	Tender no:	at0036					
3	Cost of standard hour €:	14,69					
4	Working hours (hours):	372 766,68					
5	Length of working day (hours):	8,00					
6	Handicap supplement %						
7	Total cost (h*€):	5 475 942,59					
8	Total cost (nh inst. method):						
9							
10	<b>Work &amp; Fitters</b>						
11	Type of cost	Description	Calculated sum	Percentage	Price	Unit	Total
12	Work	Efficiency factor	5 475 942,59	1,70	0,00	0,00	93 091,02
13	Work	Work without specified price	5 475 942,59	0,00	0,00	0,00	0,00
14	Work	Increments, foreman etc.	5 475 942,59	0,00	0,00	0,00	0,00
15	Work	Reserve for cost escalation	5 475 942,59	0,00	0,00	0,00	0,00
16	Work	Travelling time	5 475 942,59	0,00	0,00	0,00	0,00
17	Work	Measurement and adjustment work	5 475 942,59	10,00	0,00	0,00	547 594,26
18	Work	Guarantee work	5 475 942,59	1,00	0,00	0,00	54 759,43
19	Work	Social security costs	5 475 942,59	0,00	0,00	0,00	0,00
20	Work	Food allowance	5 475 942,59	0,00	8,75	500,00	4 375,00
21	Work	Daily allowance	5 475 942,59	0,00	0,00	0,00	0,00
22	Work	Travelling expenses	5 475 942,59	0,00	0,00	0,00	0,00
23	Work	Accommodation allowance	5 475 942,59	0,00	0,00	0,00	0,00
24	Work	Other accommodation	5 475 942,59	0,00	0,00	0,00	0,00
25							
26							
27		<b>Total cost of work</b>	<b>6 175 762,30</b>			<b>Percentage</b>	<b>65,22</b>
28		<b>Gross margin %</b>	<b>13,00</b>				
29		<b>Calculated offer</b>	<b>7 098 577,36</b>				
~							

*Figure 19. Example of some extra work costs that can be evaluated in making the offer.*

Extra social security costs that come also from foreign people working in Russian market can also be considered and added into special costs. Because there is still very much taxation it needs to be reassessed for every project all over again. And there can be added some reserve for it so that it will not be unprofitable.

After performing all research of project in question, you have a quantity surveying ready and a knowledge or approximation of labor and other costs connected to building project in Russia. When you have all this information, you can start completing spreadsheet of tender calculation. Filling the quantities of needed components and estimated extra costs to spreadsheet is easy after background information is done correctly. Spreadsheet calculates the total costs and after that you fill in the wanted gross margin, so that company gets some profit of completing project.

## 7. CONCLUSION

Russian markets are growing from the energy efficient solutions point of view. There are demand for solutions like Are Sensus low energy system. Finnish quality and know-how is highly appreciated in Russia. This creates a good basis importing Are Sensus low energy system to Russian market.

Aim target of this study was to help company to import low energy technical building services to Russian market. One of the key things to entering market is to have a winning tender in competitive tendering. That's why one main subject was to create an accounting tool to help tender calculation.

Tender calculation starts when contractors get invitation for tender. Invitation for tender includes all basic information of project that is needed to make a tender. Project costs can be started by calculating based on technical documentation. Estimating summary of expenses needs a good quantity surveying so that estimation of cost is accurate enough. In tender calculation there need to take into account many other variables in addition to cost estimate. Company has some demand for coverage that needs to be added to cost estimate. There are also some other risks that need to be considered in making a tender and those are evaluated and reservation is added to the tender. It is also important to remember that tender can't be too high because there can be other contractors that have also made an offer. And from the other hand it can't be too low so that it won't be unprofitable to contractor. Making a tender need to be fluent and quite fast because usually there is not that long time for calculating tender and also every hour that is spent for calculating offer costs to contractor even though the contractor doesn't get the project.

Are Sensus is a low energy technical building system. Are Sensus is more energy efficient and more economical choice than traditional technical building system. Are Sensus has lower building costs and operating costs than traditional HVAC-system. Studies also have proven that working environment is more pleasant and appropriate for users.

There is still lot of differences between Finnish and Russian market, but with a good preparation it is not too risky to enter Russian market. It is important to be conscious of Russian culture. It highly affects to Russian market. There is a lot of bureaucracy in Russia, but can be managed with the help of good nerves and skillful employees. These specialties of how Russian market works affects to tender calculation and these need to take into account when finishing tender.

Although Russian markets are in constant change and political situation around the world is a bit unstable at the moment. European Union has set some exporting limits to Russian

market, but those consider mostly defense equipment not HVAC-systems or building materials. Russia has also set as a reply some products to an import prohibition but those are mainly consisted of food industry. There is nothing preventing to import low energy system in Russian market.

There is huge market for energy efficiency products in Russia. After being well prepared it will be worth of importing low energy technical building system to Russian market.

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