European Commission
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DELIVERABLE

Project Acronym: **VERYSchool**

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Project Title: **Valuable EneRgY for a smart School**

D4.1 ICT business models for schools

Revision: V4.4

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Main Authors: Neuza Rosa (EPRO), João Salema (EPRO), Paola Laiolo (ISPE)

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Dissemination Level		
PU	**Public**	**√**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

REVISION HISTORY AND STATEMENT OF ORIGINALITY

D4.1 ICT business models for schools

WP4: **Energy Action Navigator** (*managing people & technologies*)

Document Control

Project Coordinator: **AESS** (*Alfio Galatà*)

Work Package Leader: **ENERIT** (Mike Brogan)

Task Leader 4.1: **EPRO** (*Neuza, Rosa*, *João Salema*)

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

Version Control Record

Rev.	Date	Description	Author
V4.4	26/06/2013	Final version re-submitted	AGa/AESS
V4.3	02/07/2013	Revision with recommendations provided at the 2nd project review	NRo/EPRO
V4.2	26/06/2013	Final version	AGa/AESS
V4.1	21/06/2013	Minor comments and review of the submitted deliverable	JSa/PLa/MBr
V4.0	17/12/2012	Final version	AGa/AESS
V3.0	03/12/2012	WP Leader: Minor amends to deliverables	MBr/ENERTI
V2.0	25/09/2012	Edit content with bilateral interviews	PLa/ISPE
V1.0	19/08/2012	Task Leader - Edit of content and assimilation of contributions Partners	JSa/EPro

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Revision of the project deliverable.

The current version considers the recommendation provided with Outcome Letter after the 2nd project review (*ARES(2013)3121536_VERYSchool*).

Action #1: D4.1 is accepted as-is but please re-submit an update during the next reporting period *with an additional section (ca. 20 pages) completing the canvasses of the BMO with qualitative information or, preferably, quantitative data - founded on estimates if necessary - clearly spelling out different value propositions (for different countries, respectively target markets). This resubmission ought to also include an improved description of the products' interplay as an introductory part.*

Relevant updates:

- **added Chap 3 with description of VERYSchool product as an introductory part;**
- **updated Chap 5 with Canvas business model for 4 different value propositions;**
- **updated Executive summary;**
- **updated Objectives and structure of the document.**

1 Executive Summary

Deliverable D4.1 describes and identifies business models to support the linkage between school stakeholders and ICT providers of VERYSchool products and services.

The aim of the document is to:

1) characterize and to describe business models for energy efficiency measures;
2) identify the financial barriers to develop a business model;
3) understand how schools currently finance their energy efficiency improvements, through targeted interviews that involve stakeholders, and to outline how the financing options can change according to the model adopted.

This deliverable has undergone a change to the last version submitted in accordance with the changes of the EC PO, which was added and improved description of VSchool product as an introductory part and detail the VSNavigator using Canvas Business Model tool in four different value propositions.

1.1 Working Group

EPRo leaded task T4.1 sharing the principal role for the development of this task with **ISPE**.

Other Partners provided the following contributions:

- **ENERIT, EAP, GENOA, UBFME, and AMEM**: best practises and case studies (made the interviews at their Country level on the template created by ISPE),
- **AESS** and **AMEM**: definition and objectives of the business model,
- **DAPP** and **AMEM**: barriers and opportunities to the development of the business model.

EAP, **GENOA** and **UBFME** have been involved although their involvement wasn't foreseen in the original DoW.

1.2 Acronyms and abbreviations

This section contains all the acronyms and abbreviations used in the writing of the present document.

BMS = Building Management System

EAN = Energy Action Navigator

EPC = Energy performance contract

ESC = Energy supply contracting

ESA = Energy services agreement

ESCO = Energy Service Company

HVAC = Heating, Ventilation and Air-Conditioning

ICT = Information and Communication Technology

IP = Intellectual property

IPMVP = International Performance Measurement and Verification Protocol

TPF =Third party funding

VC =Venture capital

VSNavigator = VERYSchool Energy Action Navigator

1.3 Objectives and structure of the document

The main purpose of the present deliverable is to describe the business models development for the Energy Action Navigators and to identify the barriers that could exist in financing energy efficiency and action management organization.

The report also describes several financial options that will be used in a later development of **VSNavigator** (i.e. deliverable D8.5 - Valuable Action Plan) as well several interviews which help to understand what are in a practical view the main difficulties found in the School context.

The content of the document is structured in several chapters, as follows:

Chapter 1:	It is an introduction to D4.2 and provides a general "picture" of the deliverable's contents, highlighting tasks providing inputs to this document
Chapter 2:	It introduces the business model scope and definition.
Chapter 3:[1]	Describes the innovative concept of VERYSchool project as well as VSNavigator as a product and service.
Chapter 4:	It describes what the main objectives are when designing a business model and what are the key answers a business model should address to have a successful implementation.
Chapter 5:[2]	Detailed description of the Business Model Canvas and how to develop, manage a business model based on the 9 building blocks theory and using Canvas Business Model tool in four different business scenarios. What is the key information to be addressed and discussed when developing a business model?
Chapter 6:	Identification of the existing barriers for the development of energy efficiency and energy management.
Chapter 7:	Identification of building requirements for the implementation of successful energy efficiency and management projects.
Chapter 8:	Existing finance options and barriers for financing energy efficiency projects
Chapter 9:	Best practice case studies in energy efficiency in schools and finance model options. Bilateral interviews with energy efficiency stakeholders.

The structure of this deliverable is adjusted according to the recommendations of EC PO in Chapter 3 and Chapter 5.

[1] Chapter 3 was added regarding the last Outocome Letter from EC PO asking to include description of Vschool product.

[2] Chapter 5 was updated of canvasses of BMO in four different business scnearios with different value propositions.

2 Definition and business model introduction

The business model describes the rationale how an Organization creates, delivers, and capture value.

Business development is today more and more focused on co-operation and networking activities, but internal development activities are still continuing.

Information and Communication Technologies (ICT) have made possible new business models and even new business structures. Learning and innovation concepts and perspectives have also emerged in discussions on enterprise networks and new business processes have arisen through these concepts and methods. There are a lot of opportunities in ICT business, and energy efficiency and energy management in one of them.

Technology innovations happen every day and ICT has had a big impact on product development. Nowadays, products are more and more intelligent. New emerging technologies like sensors, smart materials, Wi-Fi, wireless, data solutions, etc. have presented new opportunities to develop newer products and technical solutions with additional value-added services.

ICT have an important role in today building, but they can also have several applications in existing buildings. Energy management is for sure one of these applications. Some ICT technologies are developed with industrialized and commercial technology which needs to be integrated for operating as a unique solution.

Trendy business methods include real and effective ideas if they are developed and implemented correctly from an enterprise point of view. Core competence is one aspect of a company's business vision, which usually moves as customer requirements and business environment. It depends on the business as to how far ahead the vision is targeted.

Companies should have a vision of the future which serves as the starting point of the business strategy process. After that, companies should clarify what they are today.

3 The VSNavigator innovative concept

New technologies and innovations are changing the building landscape and making smart buildings more efficient. In particular, the adoption of sophisticated energy management systems in buildings has proven to reduce energy consumption and greenhouse gas emissions.

The ability of these systems to process and analyze huge volumes of energy-related data has shifted the way buildings are designed, built, and operated, but it has also proven challenging for the people who operate buildings on a daily basis. Recent economic conditions have caused building owners to cut back on both the numbers and types of personnel that they hire, shifting operational priorities from efficiency generating projects to those that are an absolute necessity for the daily maintenance of the building.

Under these conditions, Building Energy Management Systems become an afterthought, inhibiting their true value and limiting their potential return on investment. The VERYSchool project goes beyond supplying a simple Building Energy Management System (BEMS).

A comprehensive "Navigational System" on how schools can be more energy efficient through the use of ICT components and standardized action management will be developed.

Centred around the energy management environment, this new innovative concept will allow to implement “optimised energy management scenarios” rather than to simply act upon set-points of physical magnitudes only.

At the end of project, the key result will be VSNavigator, which the VERYSchool Consortium considers both as product and software as service.

VSNavigator offers solutions by offering:

- A consistent tool for replicating customisable energy management strategies in the school building segment to all the stakeholders along the school organization value chain, i.e. policy and decision-makers, managers, ICT professionals and technicians;
- A platform for sharing knowledge (e-learning process) which leads to embedding energy efficient actions in education.

VSNavigator could be called a web-based tool, which has four main functions:

- BEMS (Building Energy Management system) integration: allowing remote access to BEMS which is installed in the school for supporting energy (heating / cooling) and lighting management;
- Energy performance monitoring system: viewing both the measured data taken from the BEMS and the subsequent KPIs
- Simulation Optimization Scenarios (OSs): allowing access and exploration of a complete list of OSs. These are energy saving strategies, which cover both non-technical actions and technical actions that are related to BEMS (via operational OSs), building envelope, lighting system, HVAC system and Renewables.
- Energy Action management: managing energy saving actions for users.

Thus, the VERYSchool itself is an innovative concept which also has its own inherent marketing tool. The VSN offers user specific energy optimisation recommendations in it results which are based upon real marketable energy saving products. This is of benefit to the user as they are only marketed products which are suggested to have an energy saving and in turn cost saving for them. The product is also a benefit to the supplier, as they are marketed directly to a potential costumer who has a prospective need for their product.

The VERYSchool as a product

The VERYSchool platform, intended as a product, is a complex distributed architecture for energy optimization and management in schools, integrated so users can experience easy utilization and usability

of its functionality. The aim of the VERYSchool project is to drive behavioural changes in schools where, thanks also to the continuous monitoring of their Building Energy Management Systems data, the system identifies situations of non-optimized energy management (e.g. consumption, certification or audit area). An over-all illustration of VERYSchool Platform is illustrated in the figure below.

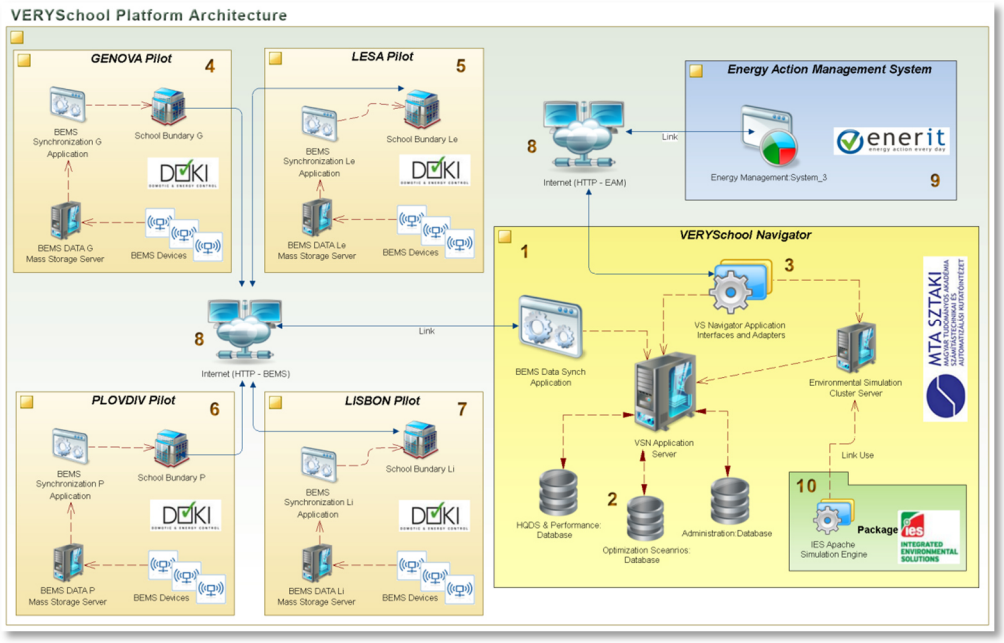


Figure 1- VERYSchool platform architecture

The VSNavigator end-product integrates over the Internet (components no. 8 in figure) Smart Lighting and LED technology, Smart Meters, Building Energy Management Systems (components from 4 to 7 in figure), Energy Simulation Software (component no. 10 in figure), and Energy Action Management Software (component no. 9 in figure). Each of these technologies is brought to the project from consortium partners with companies dedicated specifically to each hardware or software, and has been integrated under the governance and guidance of and intelligent web application layer (VSNavigator - components from 1 to 3 in figure), developed by the Consortium partner SZTAKI.

The main characteristics of the VERYSchool product can be summarized as follows:

1. Integration of the most recent technologies in software development (fully web-based);
2. Integration of the most recent technologies for BEMS monitoring, Energy Action Management and Environmental Simulations for Energy Optimization;
3. Easily deployable (all the application logics from integrated components is generated and driven on server side. Client is required only the installation of a relatively recent W3C-compliant browser for visualization of contents);
4. Easily customizable to and by user's requirements;
5. Multi-lingual ready platform;
6. Good-looking GUI;
7. Graphical representation of BEMS data, bills consumptions, energy actions and simulations.

The VERYSchool as a service

One of the main goals of the integration of VS involved technologies is the opportunity given to a school to certify the compliance of its energy management policies and behaviour with the guidelines and practices described by *ISO 50001* (energy programs) and *IPMVP* (measurement & verification), *leveraging a unique application product called the VERYSchool Navigator*. VSNavigator links all actors of the school value chain under a common platform dedicated to energy efficiency and provide "how to" information, enabling tools,

and cutting edge intelligent energy savings strategies through the execution of optimisation scenarios dedicated specifically to the needs of schools.

VERYSchool is an industry led and market driven project, whose Consortium members include Municipality, Educational Directorate, and Regional Energy Agencies, Bank Consultant, ESCO, ICT hardware and software Providers, Technology Integrators, and ICT Consultants. VSNavigator functionality is of fundamental importance because it provides the roadmap and platform services for the efficient use of energy and future investments in schools. The following illustration depicts the role-based, service-oriented nature of functionalities offered by the VSNavigator.

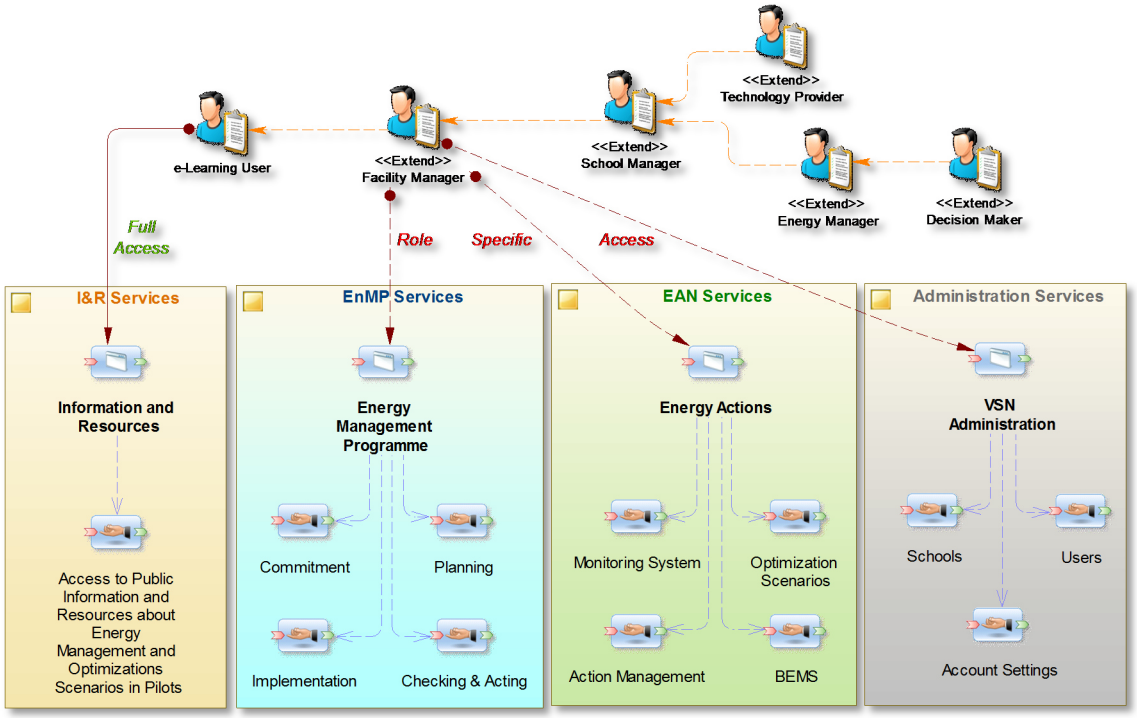


Figure 2- The VERYSchool Navigator functionalities

The aim of VERYSchool project is to generate (human) behavioural changes in schools (service), where the continuous monitoring and analysis of BEMS data (service) would lead to the identification and capture of non-optimized energetic situations (service). Thanks to the intelligence control of the application (service), one or more Optimization Scenarios will be automatically proposed to the specific user (service), after matching to well-determined monitoring set-rules (back-end service).

At this stage, the user can then leverage the powerful tool of the Environmental Simulator (service), so to acquire very realistic energy saving estimations (service) for the specific action is going to generate in the EnMS. This is the point where the automation outcome (machine driven) enables the generation and activation of human-oriented actions in the Energy Management System, whose aim is (among the others) to track the successful completion of the task required by the VSNavigator. This represents the necessary step in behavioural changes, towards the optimization of energy resources.

4 Objectives of the business model

The business model is the first "brochure" for the sale of energy efficiency and action management products, such as will be **VSNavigator**. The plan must include inception, start up, management, control of the business and, finally, the market.

Business model innovation results to satisfy existing but not yet answered market needs; to bring new solutions, services and products to the market; to improve and existing market but with newer and better business models; or to create and entirely new market. Understanding the process for business model design is very important for the success of the project.

In the next sections the foundations of a business model for **VSNavigator** are described and how a model, can be successfully delivered with the Navigator technically and financially considered.

To have a success the business model should have at least the following main objectives:

1. Secure financing for the start up or expansion of a new business venture.
2. Demonstrate the commercial viability of the product.
3. Develop the marketing plan.
4. Develop a commercial plan and strategies to help leaders of technology get their message to non-technologists and to sell a new product. Financially attractive with interesting payback periods.
5. Attractive to clients to acquire and invest in the new product.
6. To carry out a market research study.
7. Estimation of the production costs of the solution.
8. Understand competitor information regarding similar solutions.
9. Describe technically the product and provide technical information including data sheets.

The main economic objective of VERYSchool's business model is to promote the Navigator tool in the European market for energy savings in school buildings. The main non-economic objectives are to promote energy efficiency in school, energy policy and a correct energy management in public building.

The business model is an important tool for creating economic and social value to Society and to Organizations. It represents the core aspects of a business-like organization structure, strategy, policy as well operational management. Here it is described as the method on how VERYSchool project will generate revenues.

When designing a business model, it is necessary to clearly know and understand in detail all the factors involved in the process of generation revenues.

The digital economy and ICT have provided companies with the potential to develop new forms of value creation and value capture among suppliers, partners, distributions channels and coalitions that extend the company resources. One important role of VERYSchool's business model consist in capturing value from an mature stage technologies by unlocking the value potential embedded in technologies and converting it into market outcomes.

The companies involved in VERYSchool consortium diversify their knowledge and technological portfolios by introducing new technologies and concepts, and improved knowledge into existing products, exploiting the opportunities arising from the integration of different technologies.

The integration of these technologies and knowledge into one product technology base can open new opportunities in the existing technical performance and functionality space, which in turn requires new business models.

These new technological paradigms require appropriate business models to create value for customers and organizations.

VERYSchool business model can be viewed as a source of innovation and to create process for making innovation and improvements in the existing technology based products.

Within the technology and innovation management field, the business model is mainly seen as a mechanism that connects a company's (innovative) technology to customer needs, and/or to other company resources (e.g. technologies).

The market on technology alone is becoming massive and extremely difficult. The rising costs of R&D together with increasingly short product life cycles means that even great technologies can no longer be relied upon to earn a satisfactory profit before they become commoditized. A better business model will beat a better idea or technology.

To address a robust and reliable business model we need to have answered the following open questions, which will be discussed in more detail in this document.

Question: What business critical problems will VSNavigator solve for our customers*?*
The Energy Management Challenges in schools are:

- *How do you reduce energy cost at many buildings*?
- *How do you achieve energy savings quickly*?
- *How do you determine and prioritise energy saving measures*?
- *How do you reduce energy, year after year*?

The Energy Action Navigator (**VSNavigator**) will allow schools which normally don't have any kind of energy management, to have a system which will give technical and specialized support based on energy management best practices.

VERYSchool is relevant because schools are highly replicable and are a segment of the building stock to which energy efficient retrofit business will flow first as Europe determines how to meet 2020 and 2050 targets.

Question: Who will be a VSNavigator customers, and how do they make buying decisions*?*
VSNavigator will have at least two different kinds of customers. The end user which can see in the VSNavigator an opportunity to improve the energy management with a specialized system and technical decision support in energy management related-decisions, with no cost capital or without requiring long-term investments. Other VSNavigator customers can be the facilities management companies or Energy Service Companies (ESCOs), which can find in the VSNavigator a way to support and to add more value to their client's contracts.

Question: What trends and trigger events cause prospects to search solutions*?*
Energy prices have relevant weight in buildings operational costs, and schools are no exception. The increased energy prices and the cuts in the school budgets are a mixed combination for seeking additional options for improving the operational management costs.
VSNavigator due its programming tools, and because it is based on standard best practises, will allow the improvement of the energy usage.

Question: What are the most important features and capabilities of your solution*?*
VSNavigator will be customised for public and private school stakeholders and will provide the necessary features to develop and implement an Energy Savings Program at organisational and operational levels with respect to both policy and management. It will provide a methodology, approach and tool for school decision makers, technicians and ICT professionals to collectively address the issue of optimal energy management and energy savings.

***Question:* What are your prospect's alternative options**?

There are no real alternative options to **VSNavigator** with existing commercial products. It has been demonstrated in D2.1 [3], and for convenience repeated here, what are the ISO 50001 functions covered by **VSNavigator** in comparison with other existing techniques.

ISO 50001 functions	VSNavigator	M&T Techniques	BMS	Corporate Carbon and Energy reporting
Direct energy meter/sensors connections	Yes	Yes	Yes	
Reports - energy	Yes	Yes	Yes	Yes
Reports - actions	Yes			
Significant Energy Users (SEU)	Yes			
Energy Saving Opportunities (ESO)	Yes			
Planning	Yes			
Action Management	Yes			
Control of Systems/Devices	Yes		Yes	
Management of People	Yes			
Management review	Yes			
Document management	Yes			
Audit management	Yes			
Corrective Actions	Yes			
Integration with other systems	Yes			

The alternative option to **VSNavigator** for schools to implement effective energy management and energy savings would be a massive employment of "human actions" with highly specialised energy managers or energy consultants. Because schools are dispersed across a wide geographic area and vary in size, it is also expensive to have local energy expertise employed at each location or have energy consultants make on-site visits.

The real alternative option to **VSNavigator** could be Enerit's current software, nowadays used by energy managers or energy management consultants to run Energy Management Bureau and this could be used by school energy managers or energy consultants. However, the current Enerit software and energy management bureau service has not been fully exploited in the school environment.

The **VSNavigator** will provide the additional school sector added value to help make the service cost effective.

***Question: What category of problem and solution do you fall into*?**

Due the increase in energy prices, energy costs are becoming a large drain on school budgets. The energy management should gain more attention in the facilities management portfolio of services.
The **VSNavigator** will help to fill this existing gap in the actual way of managing schools.

***Question: What is your unique value proposition and unfair advantage*?**

The uniqueness of **VSNavigator** is the capability to provide "how to" information, enabling tools, and cutting edge intelligent energy savings strategies through the execution of optimisation scenarios dedicated specially to the needs of the schools.

***Question: What is your go to market strategy*?**

The most effective way to convert **VSNavigator** into customers and profits is with a well prepare and robust marketing and business plan. **VSNavigator** will provide stakeholders at all levels access to and a way to manage energy optimisation scenarios and energy conservation measures for their facility.

We can see three different markets for this solution.

[3] Deliverable *D2.1 Building Requirements and User Specifications*, page. 53, approved at the 1st project review.

- The end user who can buy **VSNavigator** directly from a supplier,
- the ESCOs who can use **VSNavigator** in their contracts for the energy management, and
- the facilities companies which can use **VSNavigator** as an additional technical and management service to their clients.

VSNavigator can be disseminated by a product web page, in technical events and in customized presentations for particular market segments.

Question: What are your key costs of sale and sources of revenue*?*
We will need to understand the cost and effectiveness of every aspect of **VSNavigator** sales and marketing mix and have a clear strategy for maximising lifetime customer revenues.
To this end the project deliverable D8.5 "Valuable Action Plan", which acts also as detailed business plan, will be developed during the second half of the VERYSchool project life.

Question: What are the key metrics you use to manage the business*?*
In the business plan it should be defined and identified the leading indicators that will be used to determine the effectiveness of **VSNavigator** sales and marketing activities.
One of the main key metrics should be the number of units sold.

5 Background on Business Model Generation by Alexander Osterwalder

5.1 Background on Business Model Generation by Alexander Osterwalder

The aim of a business model is to define the manner by which the VERYSchool delivers value to customers, shareholders and clients, to pay for value and cover those payments to profit. Business models are used to describe and classify businesses and are used by managers to explore possibilities for future development of the VERYSchool Navigator.

Over the past years, business models are becoming more sophisticated and stronger, and depend mainly on the developed product. Nowadays, the type of business models might depend on how technologies are used. For example, entrepreneurs on the internet have also created entirely new models that depend entirely on existing or emergent technology. Using technology, businesses can reach a large number of customers with minimal costs.

More recently the business model generation have moved towards the simplification and recently an academic PhD, **Alexander Osterwalder**, develops a concept based in a commercial product by simplifying the business modelling into a 9 step process. Alexander Osterwalder has been working as an independent consultant in business model innovation, strategic management and management innovation. He is an entrepreneur and business model innovator who discusses dynamic, yet simple-to-use tools for visualizing, challenging and re-inventing business models. His role includes consulting activities in the private banking sector, wealth management industry and strategic consulting for non-profit organizations in the health sector. He has a Ph.D. in Management Information Systems from the University of Lausanne, Switzerland where he worked as a teaching and research assistant and published several papers.

The *Business Model Canvas* will provide innovative techniques for business model creation in an intensely competitive market. The market is the arena in which the plan of campaign is to be fought out and therefore is necessary to define the products market in terms of size, state of development, type of customers and competitors. Its size needs to be defined in terms of the scope of the business venture under consideration. The *Business Model Canvas* is the starting point for Customer Development and the process that monitors start-up business progress as they turn their hypotheses about what customers want into actionable facts. This action is crucial to understand the sustainability of the new product or service before start on large capital expenditure .

There is a natural pattern for the evolution of almost any market and the stage of the cycle at which the market is entered will significantly affect the business strategy which must be adopted. Understanding the geographical size of the market will be also very relevant to a particular business venture to segment the market by the end use customers. This segmentation will reflect the decision on who are to be the prime target clients and could be also interesting to segment the market by typology.

Although it may meet the needs of many customers, it is fundamental to concentrate on a smaller number, in order to focus the resources and the unique selling proposition for the product. For the development of its unique selling proposition will be needed an exploitation strategy, whether it will be lower manufacturing cost, better quality product, better service and technical support or lower price.

Although it could be difficult to establish a price for a new product or service, it's possible to have an estimation based on analysing the added value offered to the customer. In addition, all costs associated with the development of the product must be added. The sales process must be addressed once the marketing stage has been completed and the pricing strategy decided. Selling is the process of communication with the potential customers and converting their interest into firm orders and cash.

An integral role for the business plan will be the needed to demonstrate to the financiers that the business will be suitably controlled once commences trading. The financing package is one of the most important aspects for a successful business model. The details of financing sources can vary and it is thus essential that expert advice is sought on what options are open to a particular business venture.
The main alternatives available will be equity participation by a venture capital company, long and short

term loans, bank overdrafts, mortgages and debentures. In deciding on the financing package it will be necessary to specify the need for working capital and the need for capital for the purchase of plant and equipment. The timing of the financing must be specified and whether this will be required in phases or in a single lump. The funding by the proprietors must be specified since it will normally be a pre-condition that backers will commit a satisfactory level of their own resources before the financiers are willing to advance any money. The question of the availability of assets as security for loans must be considered.

5.2 Description of the Business Model Canvas

The Business Model Canvas is a strategic management template for developing new and innovative business models. It's a visual chart structured in nine basic building blocks (Figures 1 and 2), describing the company value preposition, infrastructure, customers and finance. It is like a blueprint for a strategy to be implemented through organizational structures, process and systems.

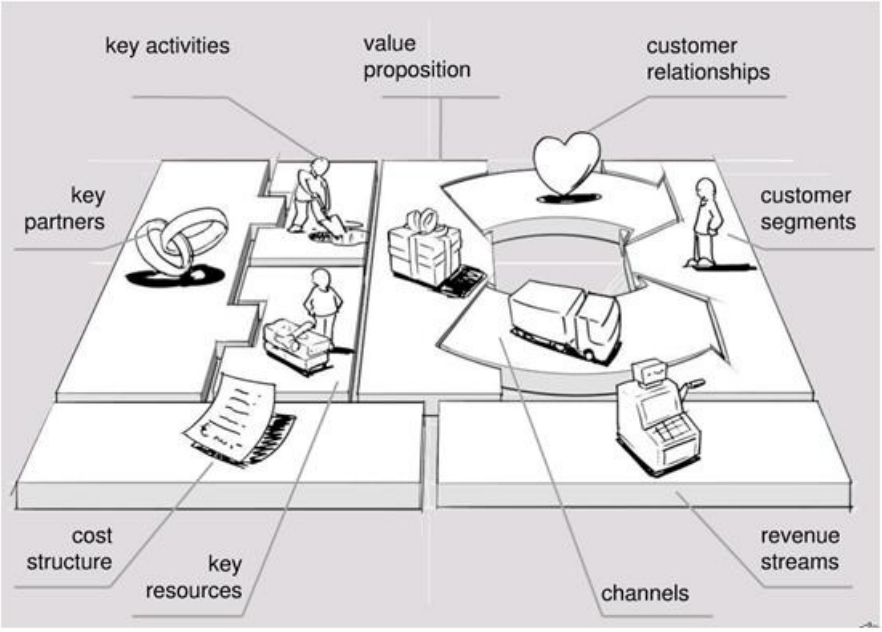


Figure 1 – Illustration of Canvas model

The business model canvas lets you look at all nine blocks of the business on one page. Each component of the business model contains a series of hypotheses that need to test.

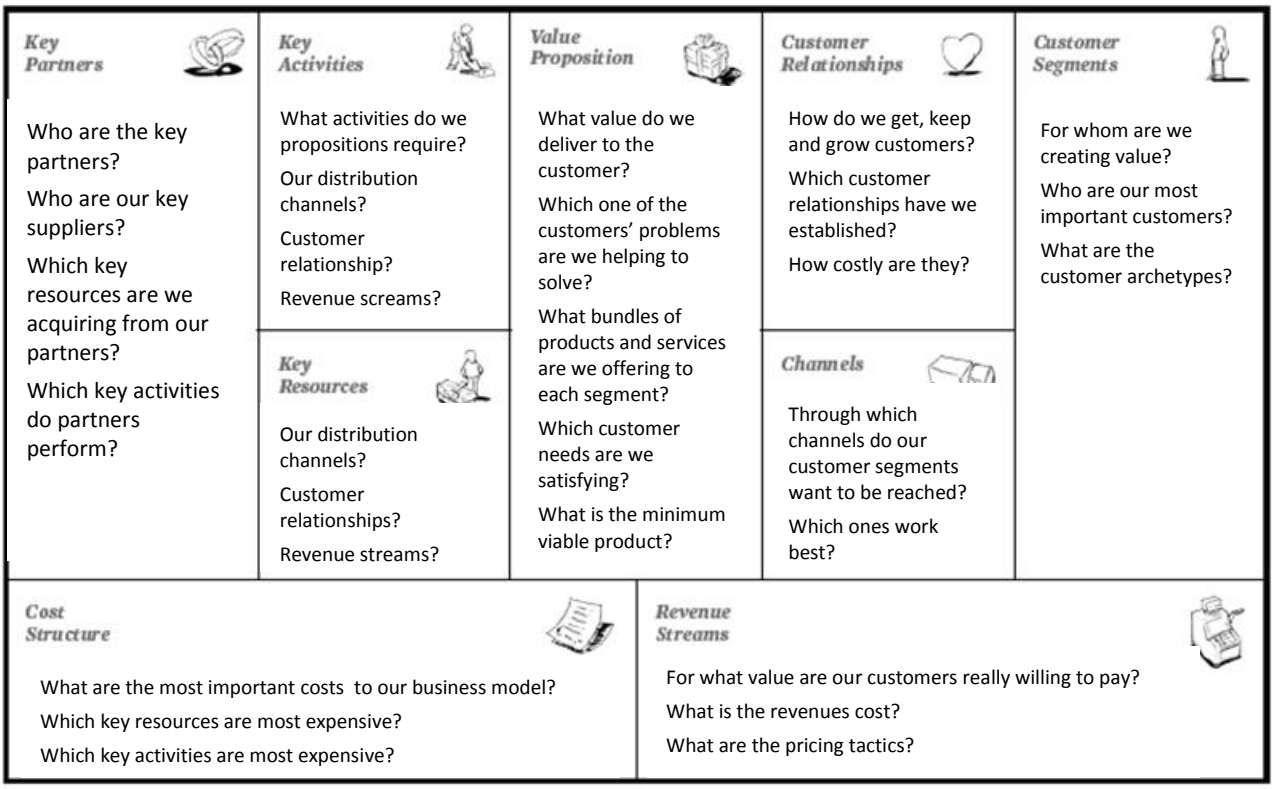


Figure 2 – The 9 building blocks of Canvas model

1. Customer Segments

In order to build an effective business model, a company must identify which customers it tries to serve. The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve.

Not always is easy to identify unique segments in customers. Unique segments can be created based on common needs, behaviours and other attributes. Customer groups represent different segments if their need require a distinct offering, they are reached through different distribution channels, require different types of relationships, have substantially different profitability and are keen to pay for different aspects of the offer.

There are also different types of customer segments, which we highlight the most relevant:

Mass market: In business models focused on mass markets there is no specific segmentation between Customer Segments. The Value Propositions, Distribution Channels, and Customer Relationships all focus on one large group of customers with similar needs and problems.
This type of business model is often found in the consumer electronics.

Niche market: Business models targeting niche market are based on specialized needs and characteristics of its clients.
The Value Propositions, Distribution Channels, and Customer Relationships are all tailored to the specific requirements of a niche market. This type of business can be found in supplier-buyer relationships, and where the supplier is heavily dependent on the buyer.

Segmented: In the segmented situation business models distinguish between market segments with slightly different needs and problems. In this situation, the business may further distinguish its clients based on gender, age or income.

Diversified: A diversified customer business model serves two unrelated Customer Segments with different needs and characteristics.

Multi-sided platform (or multi-side markets): A multi-sided business model serves two or more interdependent Customer Segments.

2. Value proposition

The value proposition is what distinguishes a company or a product from its competitors. It solves a customer problem or satisfies a customer need. The Value Preposition is an aggregation, or bundle, of benefits that a company or product offers to customers.

What value do we deliver to the customer?
Which customer needs are we satisfying?
Which are we offering to each customer segment?

It exist in quantitative and qualitative areas and provides value through various elements such as newness, performance, customization, "getting the job done", design, brand, price, cost reduction, risk reduction, accessibility and convenience

3. Channels

The Value Proposition can be delivered to its targeted customers through different channels. Communication, distribution and sales channels compromise a company's/product interface with customers. Channels serve several functions as, promotion of products and services; Value Proposition evaluation; offering specific products and services; delivering a Value Proposition to customers and provide post-purchase customer support.
Channels have five distinct phases. We can distinguish between direct and indirect Channels, as well between owned and partner Channels. Finding the right mix of Channels is crucial in bringing a Value Proposition to the market. An organization can reach its customers through its own Channels, through partner Channels, or through a mix of both.

4. Customer Relationships

For the development and success of the business, companies must identify the type of relationship they want to create with each Customer Segments. Customer relationships may be driven by the following motivations:

- Customer acquisition
- Customer retention
- Boosting sales

We can distinguish between several categories of Customer Relationships, as:

- Personal assistance: This relationship is based on human interaction. Assistance is performed either during sales, after sales.
- Dedicated personal assistance: This relationship involves dedicating a customer representative especially to an individual client. It represents the deepest and most intimate type of relationship and usually is developed during over a long period of time.
- Self-service: There is no direct relationship with customers, as the organization provides the tools needed for the customers to serve themselves easily and effectively.
- Automated services: More sophisticated form of customer self-service
- Communities: Allows for a direct interaction among different clients and the company.
- Co-creation: A close relationship is created through the customer's direct input in the final outcome of the company's products and services.

5. Revenue Streams

Revenue Streams represents the income a company generates from each Customer Segment. A business model can involve two different types of Revenues Streams:

i) Transaction revenues resulting from one-time customer

ii) Recurring revenues resulting from on-going payments to either deliver a Value Preposition to customers or to provide customer support.

There are several ways to generate Revenue Streams as:

- Asset Sale: Selling ownership rights to a physical product. This is the most common type.
- Usage fee: The Revenue Stream is generated by the use of a particular service.
- Subscription fees: Revenue generated by selling a continuous service.
- Lending/Leasing/Renting: Granting the exclusive right to use an asset for a particular period of time in return for a fee.
- Licensing: Revenue is generated by giving customers permission to use protected intellectual property in exchange of licensing fees.
- Brokerage fees: Revenues generated from intermediation services.
- Advertising: Revenue generated from charging fees.

Revenue stream opportunities require to ask several core questions:

- For what value are customers really willing to pay?
- For what do they currently pay?
- What is the market competitors price?
- How will this change in the future?

6. Key Resources

Key Resources describes the resources that are necessary to create value for the customer. These resources are considered and asset and allow an enterprise to create and offer Value Proposition. Key Resources can be physical, financial, intellectual, or human; and can be owned or leased by the company. Key resources can be categorized in the following types:

- Physical: category includes physical assets such as manufacturing facilities, buildings, vehicles, machines, etc.
- Intellectual: intellectual resources as brands, proprietary knowledge, patents and copyrights, partnerships and customer databases. These resources are difficult to develop but when created they will add value to the organizations.
- Human: Human resources are crucial in knowledge-intensive and creative industries.
- Financial: For de development of some core activities, in some cases there is the need to have some financial resources

Key resources can be owned or leased.

7. Key Activities

Describes the most important activities a company must take to reach a high standard of development. Like Key Resources, they are required to create and offer a Value Proposition, reach markets maintain Customer Relationships, and have profit. Key activities are:

- Production: These activities are related to the design, make and delivery of a product.
- Problem solving: Key Activities of this type relate to coming up with new solution to individual customer problems.
- Platform/network: business models designed with a platform as a Key Resource are dominated by platform or network-related Key Activities.

8. Key Partnerships

Key Partnerships describes the network of suppliers and partners that make the business model work. Business alliances can be considered through joint ventures, strategic alliances, buyer-supplier relationships and strategic partnerships between competitors (co-petition).

Some of the motivations for creating partnerships are the optimization and economy of scale; acquisition of particular resources and activities; and the reduction of risk and uncertainty.

9. Cost Structure

Describes the most important costs incurred to operate a business model. Depending of the business model, we can distinguish between two broad classes of business model cost structure (cost-driven and value-driven).

- *Cost-driven*: This business model focuses on minimizing all the possible costs. The goal is to create and maintain the leanest cost structure, using low price value prepositions, maximum automation and outsourcing.
- *Value-driven*: Less concerned with costs and focused on creating value for the products and services. High engagement of personalized services and premium value propositions usually characterize usually characterize this type of business models.

And within cost structure we can have Costs Structures with Fixed Costs, Variable Costs, Economies of Scale and Economies of Scope.

5.3 Application and description of Business Model Canvas in VERYSchool

In this section we will describe the five stages for business model implementation and will present an option for the **VSNavigator**. The following figure shows the five stages.

Figure 3 – The 5 stages of Business Model Canvas implementation

1. Mobilize

The mobilize stage is the reparation for a successful business model design project, i.e.:

- assembling all the elements for a successful business model design;
- creating awareness of the need for the business model;
- describing the motivation behind the project, and
- establishing a common language to describe, design, analyse and discuss business models.

The main activities of this phase are framing the project objectives, testing preliminary ideas, planning the project and assembling the team.

2. Understand

Research and analyse elements needed for the business model design effort. This phase develops a good understanding of the context in which the business model will be built.
This includes several activities such as market research, studying and involving customers, collecting information, interviewing experts, studying potential customers and identifying needs and problems.

3. Design

Generate and test viable business model options and select the best one. Transform the information and ideas from the previous phase into business model prototypes that can be explored and tested.
Expansive thinking is the critical success factor for this activity where there should be the ability to abandon the status quo from the current business models and patterns to create a completely new idea. After an intensive business model inquiry, the result should be the selection of the most satisfactory business model design.

4. Implement

Implement the business model prototype in the field. In this phase the final business model will be translated into an implementing design. This will include defining all related projects, specifying milestones, organizing legal structures and preparing a detail budget and project roadmap.

5. Manage

Adapt and modify the business model in response to the market reaction. In this activity the business model rethinking continues beyond business implementation. In this phase a continuous assessment of the model should be done in order to consider if it was affected by external factors over the long term. Set up the management structures to continuously monitor, evaluate, and adapt or transform your business model is a key factor for the success of each business model.

The Canvas model can be used as described in Figure 4, where one example of the business model brainstorming description using the 9 blocks methodology is presented.

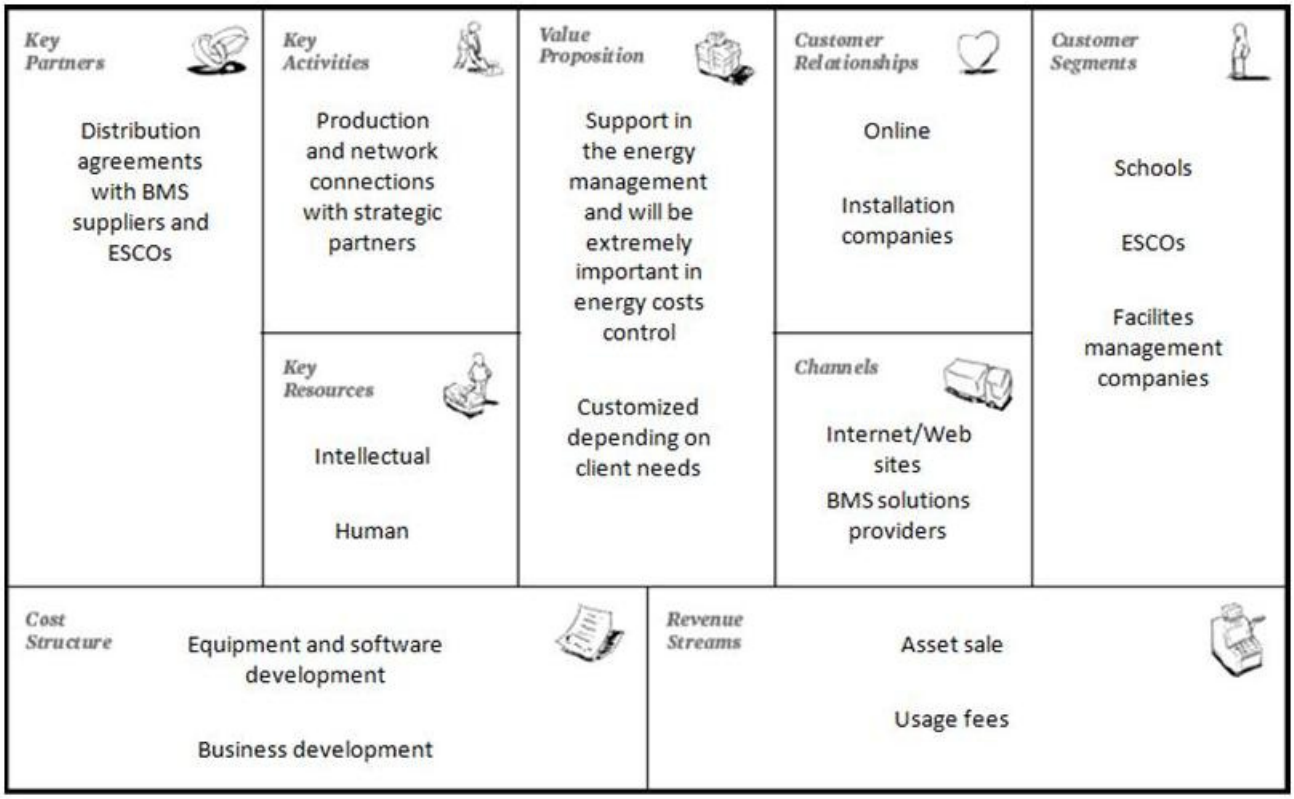


Figure 4 - Business model example for VSNavigator

The next aims to detail the VSN using Canvas Business Model tool in four different business scenarios.

ICT technologies provide a wide range of solutions for energy and resource use control, establishment of smart grids, cloud computing, as well as teleconferencing and online shopping. ICT solutions-based models generally can be of two types.

ICT service-based models, which includes companies ensuring the monitoring of the consumption or redistribution of resources; and **ICT products-based models**, which are centred on the ICT systems or software and hardware packages that are offered and sold to customers. Once the system is installed, customers learn to use it to monitor their resource use.

We will focus this improvement in a case description focusing on the companies' value proposition, cost structure, revenue stream, key partners, key resources, key activities, customer relations, customer

segments and benefits, impacts and drivers and barriers in relation to their green business model innovation.

Companies will experience financial, environmental and innovative benefits from working with Canvas business model innovation.

Canvas business model innovation can be seen as a way to counter growing competition and new market conditions that will arise from the new technology, the financial crisis, new global competitors, scarce resources, increased focus on corporate responsibility or changes in customer demands. Small ESCOs or companies are also drive by a value of "doing good" and in an efficient way.

New business innovation model companies will set forth processes to cut costs and create new revenue streams by changing or expanding their focus on how to source from surplus materials, design recyclable products, add services to products or create take-back mechanisms for reuse of products or components. This can all be seen as examples of circular and holistic business approaches, where waste is used as a resource and products are designed, sold and supported to be restorative.

Especially the case companies that are experienced in working a business model have combined different kinds of innovation in all of their value chain. There is therefore some way to go before solid statistics and sound evidence can be produced.

Key Drivers

There are several drivers of business models resulting in positive environmental, economic and innovation impacts.
We can identify five as the most important drivers for company's business models:

1. Increased consumer and media awareness and demand towards sustainability;
2. Market possibilities for sustainable products, now and in the future;
3. Increasing costs and decreasing availability of resources;
4. Government regulation in favour of sustainability;
5. Potential to create new and closer customer relationships as well as partnerships opportunities.

The business model canvas is defined as an analytical tool and consists of nine basic building blocks covering four main areas of a business: customers, offering, infrastructure and financial viability.

The overview is structured in nine different sections: each section encompasses the description of a business model canvas building block followed by the findings that match the nature of that certain block.

The findings are represented by the results extracted from all the studies and merged together in the context of the block.

In the following, tables with case applicable scenarios of Canvas Business Models to the VERYSchool project are considered.

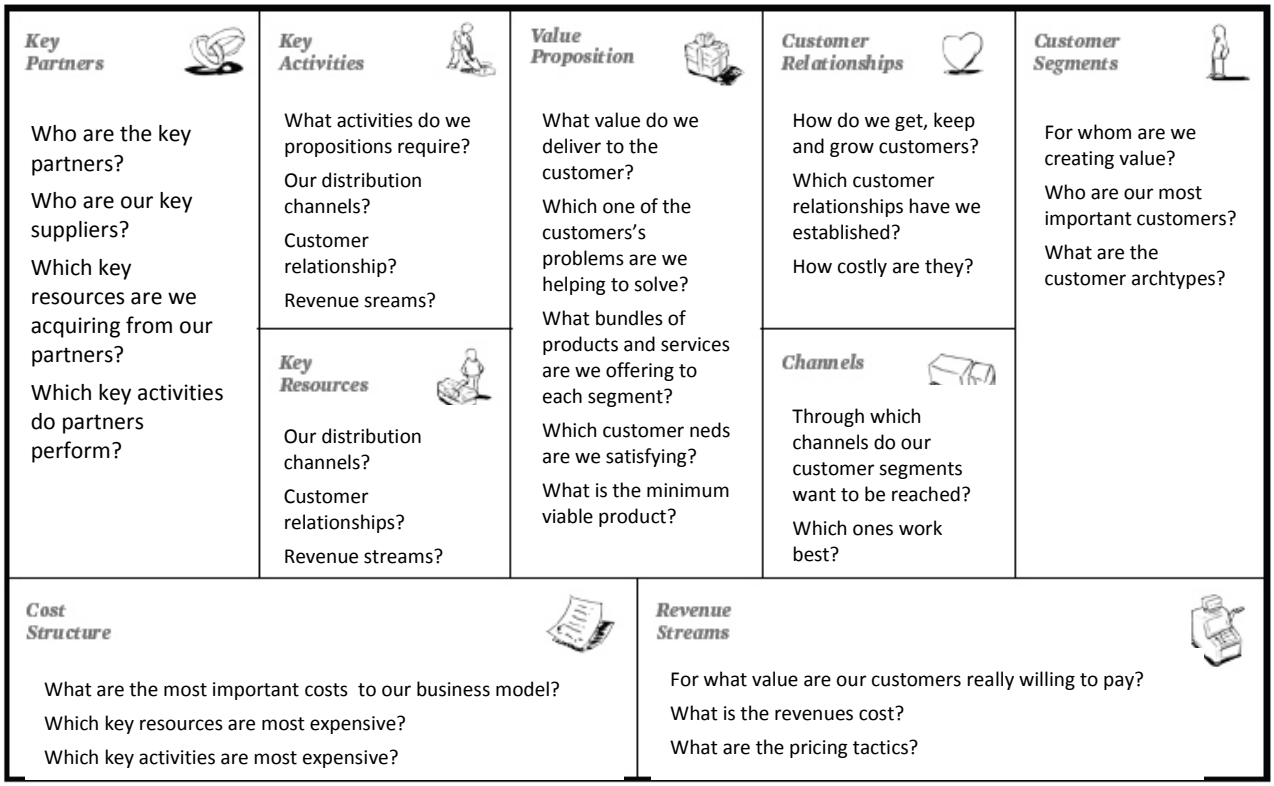
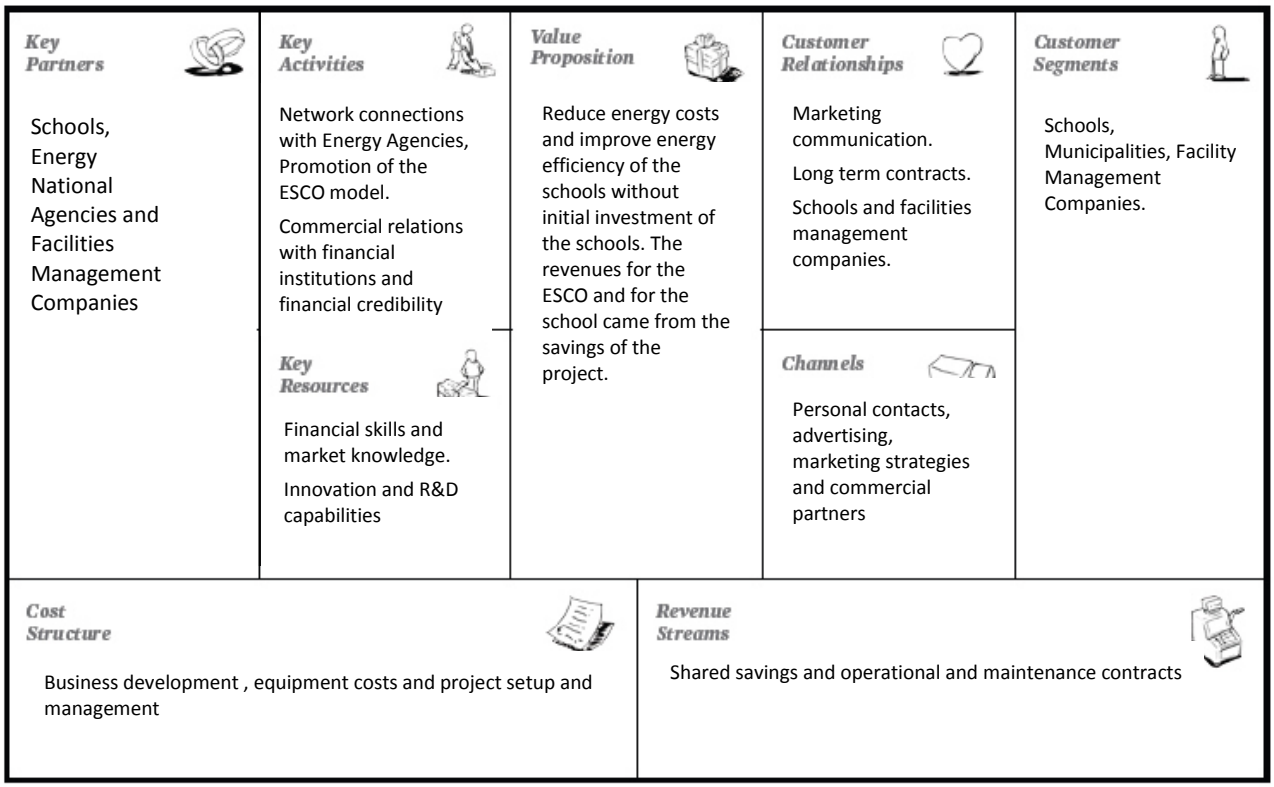


Figure 5- Main Canvas Business model for VERYSchool project

Scenario 1 : The ESCO will invest and develop the project

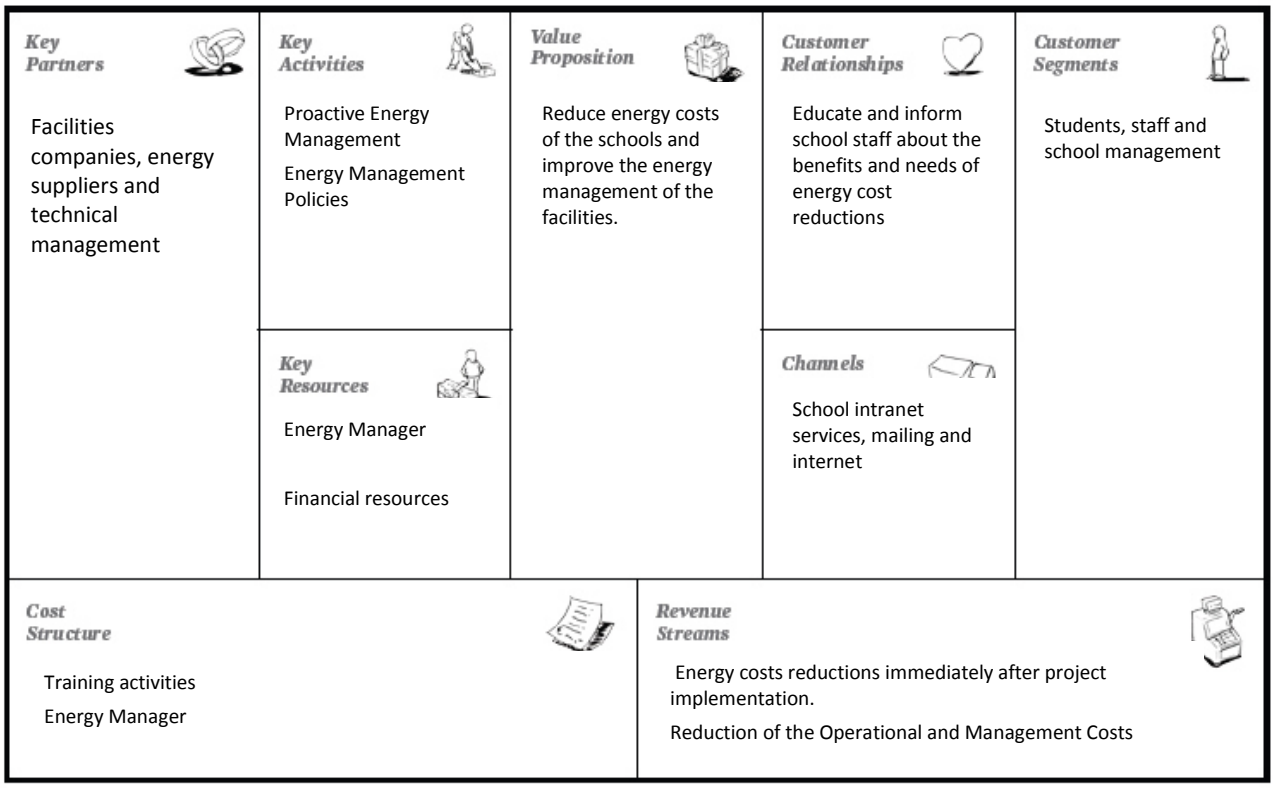


In this scenario, the ESCO will promote and develop the VSN in the facility. This will allow to the School owners or managers, a professional energy efficiency management.

It will allow the final Client to have the VSN tool without necessary investment. The consortium intends to reach at least one ESCOs per partner country in the 1st year of commercial operation; i.e. 9 ESCOs operating with VSN in the 1st year reaching each ESCO to 500 partners.

For this scenario is very important the financial skills that ESCOs could have in order to finance the solution during the contract. The partnership with technical installation companies is needed in order to transmit technical credibility to the facility owner.

Scenario 2 : The School will invest in the VSNavigator

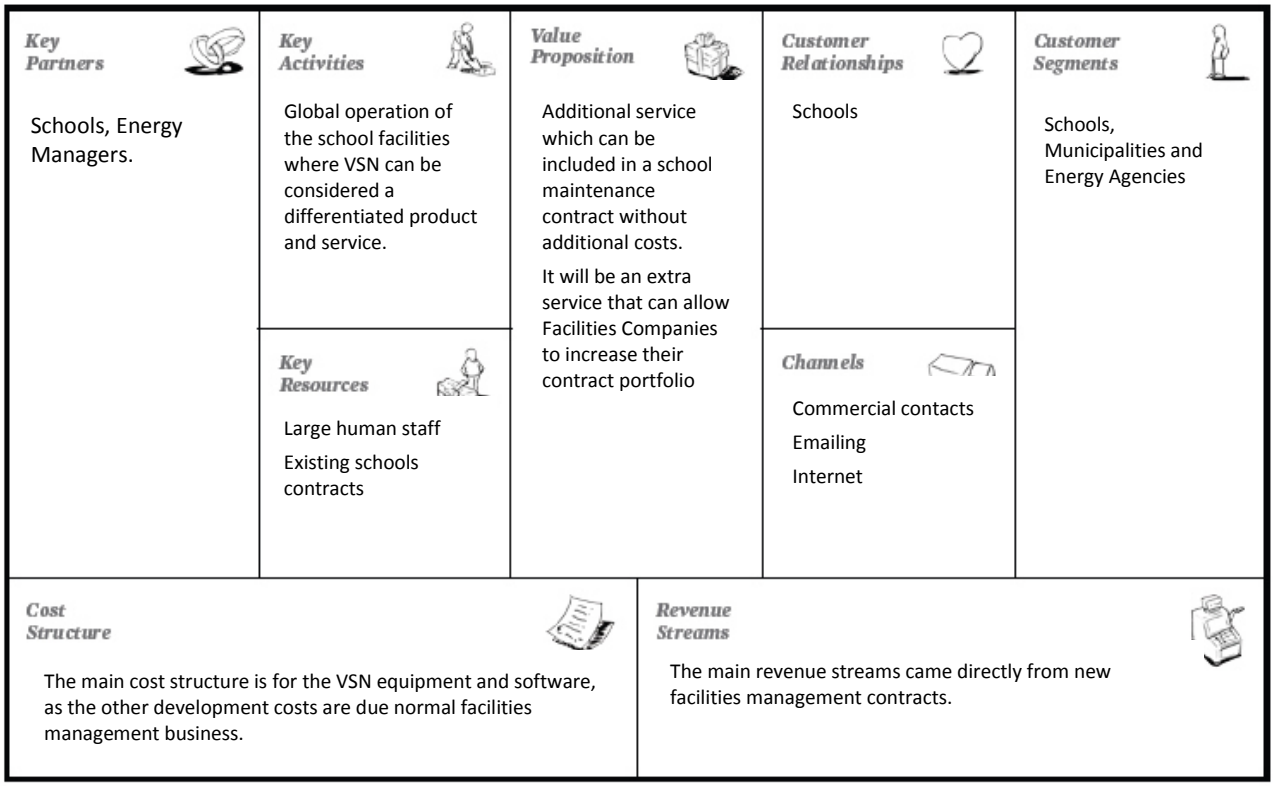


In this scenario the schools will buy directly from the Consortium, or from VSN distributors, the VERYSchool Navigator.

All the investment and management of the VSN will be done by the energy school manager which will need to have a training to use the system.

The Consortium intends to reach at least 3 schools per country partner in the 1st year of operation, which will allow disseminating the results among countries and collecting references for future exportation. The main difficulty or lack of probability of this scenario is due the need to have technical knowledge and capabilities in the school staff. This will add extra costs to the school investment budget. Otherwise, it could be the best way for managing the energy costs and consumptions instead of subcontracting the energy management.

Scenario 3 : The Facility Company will invest in the VSN Project



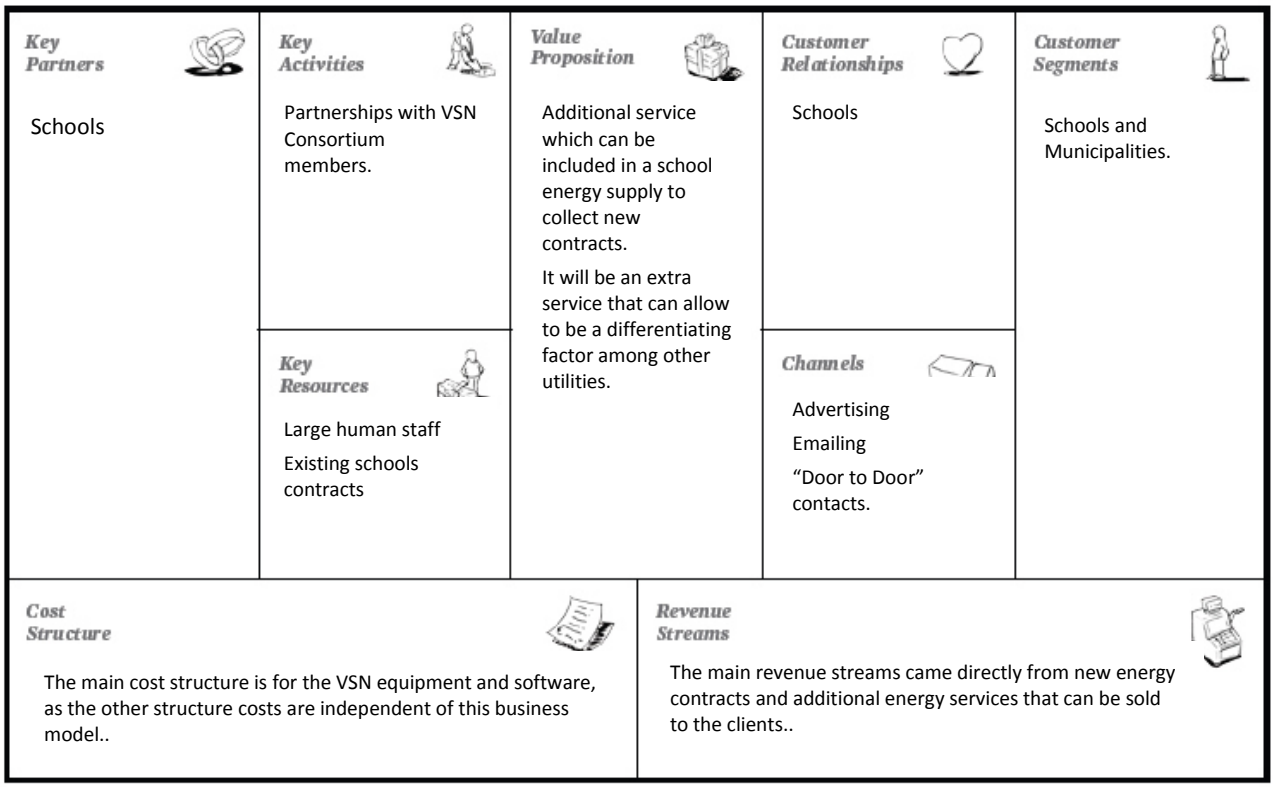
There is large competition in the facility management business. Maintenance contracts have actually a very short profit where the margins came directly from extra contract material and works.

The VSN can be a differentiated service which can be an additional tool for this competitive sector.

Companies which present VSN and use it as a tool for the facility and energy management can be seen as innovative companies in this sector.

In this scenario the Consortium intend to reach at least 5 facilities companies per partner country, which lead to 45 companies using VSN in the 1st year of commercial operation.

Scenario 4 : The utility will invest in the VSN Navigator



In this scenario the VSN is used as an additional service provided by the utility. Due energy market liberalization there are growing new companies in this sector which want to have niche energy markets. Margins in this sector are too competitive and VSN can be used as a tool to captivate the school sector.

Is intention of the consortium reach at least one independent energy provider per partner country.

The target that the Consortium intends to reach in the 1st year of commercial operation is to have 81 clients as detailed in the table below.

Scenarios	Client Target in the 1st Year
Scenario 1	9
Scenario 2	18
Scenario 3	45
Scenario 4	9

Environmental sustainability is rarely at the core of value propositions of business models. The business community has been increasingly recognising the challenges posed by climate change, resource scarcity and environmental degradation, but these are not always incorporated into the main building blocks of companies' strategy and operations.

"Green values" have been increasingly included in marketing strategies but they are not necessarily linked with a genuine integration of sustainability into the company's core operations. The main reason for this is that many businesses do not consider environmental sustainability as a key source of value creation. Companies often perceive sustainability as a challenge, or even an unnecessary cost.

Environmental concerns are primarily seen to be an external challenge to existing business models, leading to changes in the way business is done. Typically, the motivation behind such changes is pressure stemming from existing, or expected, regulation or an increase in the prices of energy and raw materials, which may put the company's cost structure and revenues at risk. In this context, sustainability can become an integral part of business model design if it is perceived as a potential generator of additional value to the company and its customers.

The business models examples presented confirm the high value of education and training to fostering green business models. According to compulsory schooling should provide all students with strong skills in core fields, including mathematics and science, while tertiary education should train quality graduates, who can contribute directly or indirectly to innovation in their workplace, and also foster research excellence and links to industry. As illustrated by several case studies, eco-innovations are the product of multidisciplinary approaches, drawing on a wide range of technical expertise and scientific (as well as non-scientific) skills.

There appear to be relatively few unique "green skills", and vocational skills that are required in "green jobs" typically overlap with those used in similar non-green occupations. Nonetheless, some green occupations do appear to require new educational or training pathways, e.g. research and engineering positions in the renewable energies sector or system analysts who develop ICT support for smart grids.

The case studies point to the existence of skills shortages in some countries and in specific occupations and business models, such as efficiency optimisation by ICT and innovative financing schemes (ESCO). Policy makers should ensure that the education and training system is well equipped to provide those skills, or support upgrading the skills of existing workers.

6 Barriers to the development of business models

In the development of energy efficiency and ESCO business models there are several challenges that need to be addressed.

Measurement and Verification (M&V)

Measurement and Verification Plan (M&V) is one of the most important procedures on any energy performance contract, which is the energy evaluation that will allow the identification of the energy savings and in most of the cases the remuneration of the ESCOs.

There are several options as discussed previously for M&V but sometimes clients and contractors couldn't reach an agreement on how to measure the project energy savings, mainly due the lack of measurement equipment, expertise and baseline agreement.

Because there isn't a standard for M&V in projects that rely heavily on energy management measures, it is sometimes difficult to agree on the level of energy savings if there isn't a relationship of trust between contractor and client. It is sometimes very difficult to measure the energy savings accurately. Energy consumption is impacted by many factors, such as working hours of equipment, weather, occupancy rate and others. Before starting any retrofit or energy efficiency project it is very important to identify the energy consumption baseline where all the saving will be related.

The M&V focusing on the IPMVP protocol is addressed in the VERYSchool project [4] to:

- establish a methodology and to specify the measurement and verification plan for each VERYSchool pilot activities.
- provide an overview of IPMVP to the unfamiliar reader: *what it is*, *when it is needed*, and *where to get more detailed information*.
- customize the 13-step IPMVP planning process to schools. This is appropriate because IPMVP was originally developed for large industry and large renewable energy investment projects.

The analysis to be conducted should result in a suggestion, best practice, or filtered analysis on how stakeholders involved with the energy management of schools can approach and employ the IPMVP process.

Awareness

Low awareness, lack of information and scepticism at the demand side of the market for energy services are other relevant aspects for development of businesses. There is a lack of information and understanding of the opportunities that energy efficiency offers and especially of how energy performance contracts work; the shortage of qualified personnel to develop these projects, the high risk perceived and concerns over the safety and reliability of equipment; limited understanding of energy use patterns and load profiles, as well as unavailability of such data; lack of culture for project financing and limited confidence in ESCOs due to short track record or poor performance are all important awareness barriers for the development of **VSNavigator** business models.

Some facilities have sufficient fund to implement energy efficiency upgrades by themselves, and they don't want to hire external consultants and be bound to running a multi-year service contract. In some projects, like large facilities, the investment needed in energy efficiency retrofit takes up a small part of the total operating costs, and clients don't give the necessary attention to energy related issues.

Operational risk

The operational risk of the facility is another important concern for the projects. If the business activity slows down and the operating hours of the existing equipment decreases, the future energy consumption

[4] Deliverable D2.3 Measurement & Verification Planning for Schools, submitted and approved at the 1st project review, July 2012, and WP7 - Validation (stamp of approval).

will be lower than in the baseline period. This will lead to a decrease in the energy savings and a lower return of the project which can condemn the project right from beginning.

Risk perception

High technical and business risk perception, conservative behaviour and lack of knowledge and experience in related projects from both financial institutions and private investors. End-use energy efficiency projects are often non asset based and hence collateral may be difficult to obtain. In addition investors and clients may be oriented towards short paybacks and with high returns.

Legislative

Legal and regulatory frameworks to agree in an energy efficient contract are usually heavy. Energy performance contract are generally new and complex to discuss. Measurement and verification protocols for assuring performance guarantees are not understood and sometimes use dubious procedures.

Motivation

Lack of motivation in energy consumption and costs, which in some cases are only a small fraction of total costs and hence treated as a low priority (or where it is large portion, then sometimes an in-house energy manager is justified). In small scale projects, energy efficiency projects compete for scarce capital with core business investments, or with investments with more visibility.

Governmental support

Limited government support for energy performance contracting, especially in residential sector where local banks and private investors are reluctant to participate. It's very important that government can support the development of energy efficiency business with the creation of legislative and financial support to mitigate the perceived risk existing in the finance sector and among small investors. Although there are some factors that can be considered as an opportunity for the development of ESCO business models.

The rising costs of energy prices are the most important incentive for the adoption of energy efficiency and energy management good practices. The uncertainty of the energy costs are an important driver for the energy savings industry. The existing reforms in energy policies are important drivers for the growth of this market.

The liberalization of the electricity and gas markets can have a very positive impact in the growth of this market. Usually after liberalization process energy prices rise, and the market is more available to receive new business models, taking some share of the risk, and to incorporate new energy saving solutions.

7 Building requirements

When we try to specify the different business models that can be applied for the Energy Action Navigator, we need to understand what are the actual industry requirements in order to maximize the benefits of this system in the future.

To understand the right benefits and future savings due to energy management it is crucial to have a reference for the energy consumption of the facility. The baseline is the BAU (business as usual) consumption scenario of the school, where all future energy savings will be referenced to this "starting point". Savings due to energy management can't be measured directly, but need to be calculated from a comparison of the baseline energy consumption with the post implementation energy management measures. To accurately report the achieved savings, the baseline consumption should be done based on reliable data that needs to be analysed appropriately. If a real baseline is established it will provide a platform for the analysis of all aspects of energy consumption.

For schools buildings it's important to understand its energy behaviour and have an energy breakdown per type of usage, such as lighting, equipment, HVAC and domestic hot water. The identification of the factors that affect the energy performance and the ability to accurately track the building energy performance are key to develop an energy baseline and to determine the future savings due **VSNavigator**.

We can identify three different methodologies for establishing a baseline consumption.

1. Regression Analysis
2. Modelling or Simulation
3. Short term metering

We have chosen the modelling option as the simulation will be used not only for the baseline, but also to understand the impact which **VSNavigator** and the energy management actions will have in the baseline.

The modelling software is an energy analysis and thermal load simulation program, based on a user's description of the schools from the perspective of the building's physical make up, associated mechanical systems, etc. The software will calculate the heating and cooling loads necessary to maintain thermal control set points, conditions throughout a secondary HVAC system coil loads and the energy consumption of primary plant equipment as well as many other simulation details necessary to verify that the simulation is performing like the actual building.

VSNavigator will be implemented in a pilot study which will provide valuable guidance on process risk and savings opportunity where its results will be extrapolated to the whole building. A typical energy efficiency project needs a lot of requirements and before any kind of investment is done in energy efficiency and energy management, independently of the business model and the financial requirements, a typical project may include the following elements:

1. Site survey and preliminary evaluation, where a brief assessment to the energy consumption will be done;
2. Investment grade audit;
3. Financial presentation and client decision;
4. Guarantee of the results by proper contract clauses;
5. Project financing options;
6. Comprehensive engineering and project design and specifications;
7. Procurement and installation of equipment, final design and construction;
8. Project management, commissioning and acceptance;
9. Operation and maintenance for the equipment during the contract period;
10. Measurement and verification of the savings result.

From these ten elements, the investment grade audit (IGA) deserves a special attention. The traditional energy audit doesn't consider all related aspects such as measures implemented and financials aspects of energy savings and the return of the investment. The IGA attempts to more accurately predict a building's future energy use by adding the dimension of a "risk assessment component" which evaluates conditions in a specific building.

The IGA includes risk management, measurement and verification, financing issues, master planning strategies and management issues. The IGA will serve as a financial investment guide as to how **VSNavigator** will reduce the energy consumption and improve the energy management. Measurement and verification of savings result is other very important aspect when implementing and financing an energy efficiency project.

It is important to apply a consistent, verifiable approach to the determination of energy savings to ensure business confidence and credibility in the process. Energy savings due to **VSNavigator** cannot usually be measured directly by meters or equipment.

The M&V plan was already discussed in Deliverable 2.3 and there are several factors that need to be taken into consideration when determining these energy levels. As previously stated there are a number of factors which influence the energy consumption over time, such as weather, occupancy rate, and schedules.

In the post operation phase and for financing an energy efficiency project the main concerns are the existence of an IPVMP plan, a credible company carrying out all operation and maintenance activities to give the needed support to the savings achievable throughout **VSNavigator**.

8 Financing Energy Efficiency

Energy efficiency is a key factor to achieve progress towards a low carbon and more sustainable economy, and to contribute to social equity by reducing energy prices to final customers and increasing energy availability. Incentivizing the energy efficiency is probably one of the best options to create new jobs, to reduce energy expenditures and to encourage consumers and energy suppliers to adopt new technological solutions. Attracting public and private financing for the energy efficiency market is a priority in order to deliver viable and profitable projects and ventures to financial institutions.

We can identify three main areas related to energy efficiency that require financing:

1. *Technology Innovation*, where an energy efficiency innovative technology is extended from the R&D stage to full commercialization.
2. *Energy Efficiency Ventures,* the businesses that produce, market, distribute and sell energy efficiency products.
3. *Energy Efficiency Projects*, which are aimed to reduce energy consumption for the end users. These projects are usually directly financed by the end user recovering the costs from the energy savings generated.

The VERYSchool Navigator places itself in the middle of these three areas:

- It represents an innovative technology that is under validation and will require additional financial resources for the market uptake;
- It is developed and promoted by a pool of SMEs active in the energy efficiency field and by an ESCO which will be able to take care of distribution and selling;
- Once validated and available on the market, it will represent an energy efficiency solution to be sold to customers intending to reduce their energy consumption.

1. Technology Innovation

The transition from the R&D phase to the commercialization phase usually starts by drafting a business plan and constituting an enterprise start-up which will take care of industrialization and market uptake. This first stage is generally financed via:

- entrepreneur's own funds (its personal assets or from friends and family);
- public grants issued by Regional, National or European authorities
- seed capital, in exchange for an equity stake in the enterprise.

Seed investors are generally private individuals (technology, marketing, manufacturing and financial) who invest their own money (and intelligence) in businesses in which they believe. A financial gap can emerge in this start-up phase, since seed investors prefer to fund companies which already have a clear track record in sales and can perceive something at the concept stage as too risky.

As technology development moves into the pre-commercialization stage, new high-cost activities emerge such as:

- *Proof-of-concept.* The innovative technology is in its concept stage and exists only on a small scale: funding is needed to demonstrate the technical soundness of the concept, in order to be able to get additional private sector financing.
- *Prototype product development.* After the elaboration of a proof of concept, a prototype product embodying the technology needs to be developed. This can require a significant amount of cash, especially in the energy field, where products and technologies are often capital intensive. Developing prototypes is of the utmost importance to address product risk concerns, and customer acceptance, before finalizing the design of the commercial product.

- *Pilot and first plant project financing*. Once the prototype has been developed, a pilot plant needs to be established. A very large amount of financing is usually needed to this aim. For example a PV plant or a bio-fuels processing plant might represent such an investment project.
- *Commercial product development and demonstration.* Once completed the above steps, the commercial product design needs to be finalized, in order to manufacture it profitably and on a large scale. This is a costly and complex process, often requiring a collaborative process between the product engineers and the manufacturing engineers.
- *Market creation and development*. While waiting for full market acceptance, funding can be necessary simply for staying power, to continue to operate even at a loss. The business risk faced by this stage enterprise may seem relatively low compared to the earlier stages, but it is still higher in comparison to more traditional equity investments.

The skills and capital needed for large-scale demonstration and early commercialization are different from those required for R&D. During demonstration, financial concerns become a greater priority.

The financing needs described above can usually be addressed via venture capital investments, commercial loans and/or guarantees, which enable theearly-stage company to obtain a loan from a bank). Since the perceived risk is still high and the revenue stream is not yet steady, in these cases a strong and detailed business plan is crucial at start-up phase and for the development of the business.

Further alternative innovative forms of financial support can include:

- *Contingent grants:* grants that are 'loaned' without interest or repayment requirements until technologies and intellectual property have been successfully exploited. They can cover some of the costs during the highest-risk development stages and in some cases increase investor confidence.
- *Soft loans and convertible loans:* at the pre-commercial stage traditional loans from the banking sector are rarely accessible because of the high technology development risk, the lack of immediate revenue-generation capacity and of sufficient collateral. Thus, the public sector can provide soft and convertible loans that offer short-term interest deferral periods and payback grace periods. Innovative mechanism can be envisaged such combining grant support for a demonstration project with a soft loan that is repayable if the technology reaches commercialization.
- *Public-private venture capital*: public institutions can stimulate private investment in sustainable energy companies, by capitalizing venture funds with public resources leveraged by energy taxes or public national budgets earmarked for the Clean Energy sector. An example is provided by the UK Carbon Trust VC Fund[5] which has been capitalized by government funds, leveraging private sector VC funds.
- *Specialized support programmes*: public institution can also provide specialized support programs, such as business development services (preparation of business plan, market information, etc.), technology and business incubators/accelerators, and training/networking activities.

2. *Energy Efficiency Ventures*

The most common form of Energy Efficiency Ventures is represented by Energy Service Companies (ESCO) [6]. ESCOs offer a comprehensive energy service concept to execute energy efficiency projects in

[5] Further information is available at http://www.carbontrust.com/home/

[6] According to JRC 2007, an ESCO is a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria.

buildings or production facilities according to minimized project cycle cost. According to the definition of Bleyl and Schinnerl (2008),

"ESCO implements customized energy service packages, consisting of planning, building, operation & maintenance, optimization, fuel purchase, (co-)financing, user behaviour)".

The remuneration of ESCO is linked to the projects' performance, which means that the ESCO'spayment is directly linked to the amount of energy saved.
ESCO provide either energy (Energy Supply Contracting - ESC) or energy savings and services (Energy Performance Contracting - EPC) to the end user:

- *Energy Supply Contracting (ESC):* the focus is on the supply of energy such as heat, steam or compressed air. The business model usually includes purchasing of fuels and it is comparable to district heating or cogeneration supply contracts. Contractual issues are measured in Megawatt hours delivered (MWh).
- *Energy Performance Contracting (EPC):* it is a contractual arrangement [7] with the focus on reducing final energy consumption through demand side energy efficiency measures and a guaranteed level of energy savings. The scope is extended to the entire building or enterprise including measures such as technical equipment, user behaviour or building envelope renovation. The business model is based on delivering energy savings compared to a predefined baseline, and savings are used to reimburse the initial investments.

ESC is mentioned to consider the state-of-the-art. Indeed **EPC** is strictly linked with the objectives of the VERYSchool project and it is more in-depth described.

In an EPC:

- **the achievement of actual energy savings is the condition for the ESCO to be paid**. It should be noted that, considering the low energy prices with respect to large investment costs related to comprehensive retrofit, energy savings are usually not large enough to repay the investments within a reasonable contractual duration. In most cases, the owner/customer has to pay an additional fee to the ESCO; this additional fee is also justified by the value added to the property, both because of its energy performance ("green value") and because the building is refurbished and more attractive.
- **Financing for the investments can either be provided by the ESCO**, from its internal funds, **or by the owner/customer, or by a third party funding (TPF)**, in which a financial institution allows a credit either to the ESCO or directly to its client. The loan is then backed by a guarantee for the designed energy or cost savings given by the ESCO.
- **the possibility to turn intangible energy savings is converted into a secured (guaranteed) cash-flow**. As of today, energy savings in the building sector are not considered a secure source of income by the banking and financial sector in general. Banks require traditional guarantees to cover all the debt, so limiting the amount of investments a building owner can make. With a performance guarantee, investments in energy efficiency may be required a lower risk premium as income is guaranteed for the time of the contract, thus lowering financial costs. Energy saving measures can therefore become more attractive to the financial sector, opening the way for massive investments.

The EPC business model considers, anyway, the owner or the customer may benefit from a part of energy savings. The EPC ends after all investments have been reimbursed and the owner and/or the customer continue to benefit from all energy savings. Figure 5 below depicts the comprehensive EPC

[7] EPC's have been implemented in industry for many years, and to a lesser extent in buildings. The definition is mostly adapted to the specific perspective of comprehensive energy retrofitting of buildings. More complete descriptions of EPC's can be found in JRC 2007 and EUROCONTRACT 2008.

business model, where additional fees from the owner are also considered as energy savings are not sufficient.

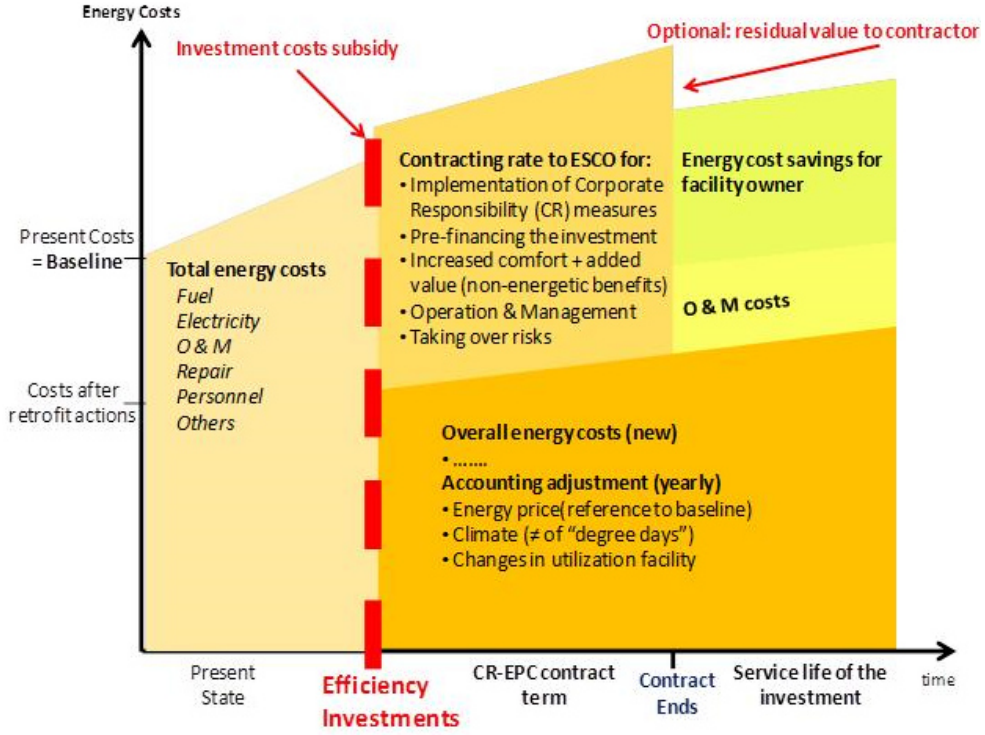


Figure 5 - Structure of Energy Performance Contract (EPC).

Anyhow, by considering a large-scale implementation of such EPCs the following results can be expected:

- energy savings guarantee a positive cash-flow, so that they can become a counterpart to investments in energy efficiency and secure debt repayment;
- Owners/Customers don't need to invest directly on energy efficiency: debt linked to energy retrofitting doesn't appear on their balance sheet and they maintain the capacity to invest; they can thus allocate their equity and debt to other investments, mainly in their core business, but also in other energy efficiency investments which would not be made through EPC's. Indeed it cannot be expected that all investments can be made through EPC's.
- EPCs open the way for private capitals to be invested in energy savings, providing an alternative to the insufficiency of available public funds.

Figure 6 below describes how an EPC can be finalized for a School Organization.

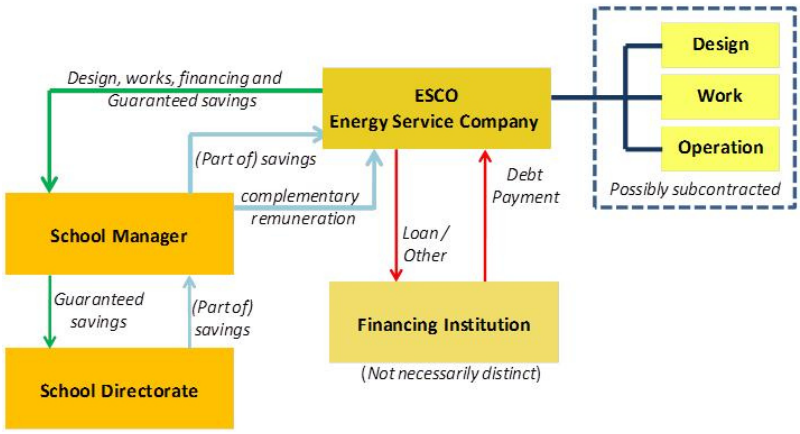


Figure 6 - The EPC model for a School Organization.

It should be noted that at the EU level, the EPC analysis is very general and has mostly a heuristic value, because of:

- costs depend largely on national and local labour costs;
- energy savings depend largely on climate and on the initial level of energy performance;
- payback period depends largely on local energy costs (and also on energy inflation, though it is usually not taken into account by financial experts due to its unpredictability).

Currently, EPCs are generally limited to the simplest operations with relatively short payback period (< 10 years). In particular, the majority of the EPC signed to date focus on the retrofit of energy production/distribution systems (e.g.: replacement of boiler, insulation of the distribution systems,…), without intervention in reducing the useful energy demand (e.g.: insulation of the frontages, replacement of the door frames, control of indoor comfort profiles, human behaviour, and so on.).

Since ESCOs are often of small size, with limited revenue generation capacity and scarce assets, it is usually difficult for traditional financial investors to finance them. Moreover numerous banks and financial institutions lack information about energy efficiency potential and especially experience in lending to ESCOs, and they often consider EPC as a risky business. This is further complicated by the fact that the banks need to evaluate their clients' credit-worthiness - either the ESCO's or the client's.
ESCO's equity investment is crucial to leverage money from financial investors, because it ensures them the company has enough capital to afford early development costs which can be repaid in a second stage through energy performance contracts.

To overcome these barriers (see section 7.1 below) it could be important to promote the **aggregation of small ESCOs**, in order to have larger and more structured entities, able to pool financial resources and leverage funds from commercial financial institutions. The **public sector intervention** may also take an important role with the application of public grants to subsidize the early stage of projects development.

Another possibility, already identified by the World Bank as a potential viable model, would consist in establishing a **'Super ESCO'**[8], an entity established by the Government serving as an ESCO for the large untapped public sector (hospitals, schools, municipalities, government buildings and other public facilities) and, at the same time, supporting capacity development and activities of other ESCOs. It could also act as a leasing or financing company to provide ESCOs and/or customers EE equipment on lease or on benefit-sharing terms.

3. ***Energy Efficiency Projects***

The development of energy efficiency projects usually follows three main stages:

1. Energy audit
2. Project planning/financing
3. Project implementation and generation of energy savings over time

A distinctive feature of energy efficiency projects is that in the long run the savings from the energy efficiency improvements will pay itself. Another distinctive feature consists in the fact that the service provider or ESCO provides a guarantee of the project's technical performance and satisfaction of contracted specifications with the consumer.

- The **Energy audit phase** is generally financed via ESCO or end-user's own capital, or via ad hoc public grants. The mix of these mechanisms with a good marketing and communication plan, and community education will be key factors for the development of the energy efficiency industry. An effective approach for the successful delivery of an energy efficiency project is

[8] http://www.esmap.org/sites/esmap.org/files/P112187_GBL_Public%20Procurement%20of%20Energy%20Efficiency%20Services_Lessons%20from%20International%20Experience_Singh.pdf

when the customer pays upfront the energy audit and assessment studies and, if the client wants to commit with the implementation phase, these initials costs will be deducted from the initial project capital expenditure. Otherwise, there will be an initial gap in the ESCO cashflow and a bottleneck that can affect the successful project delivery.

- The **Project planning and implementation phases** can usually rely on the following forms of financing.

  Debt financing. The main features of this model (shown in figure 7) are the following:

  - Energy end-user is borrower. This is typically a direct, full faith and credit payment obligation, on balance sheet.
  - ESCO provides turnkey project development, engineering, construction, commissioning, services and performance guarantees, as applicable.
  - Financing is arranged by ESCO with a financial institution partner. ESCO may arrange a multi-project finance facility where the financial institution partner agrees to look at a series of projects. ESCOs can establish programmatic relationships with financial institution partners who want to provide financing to the ESCO's target market (customers). The financial institution receives a flow of business with relatively lower transaction costs because the ESCO can perform many of the duties related to financing/loan origination.

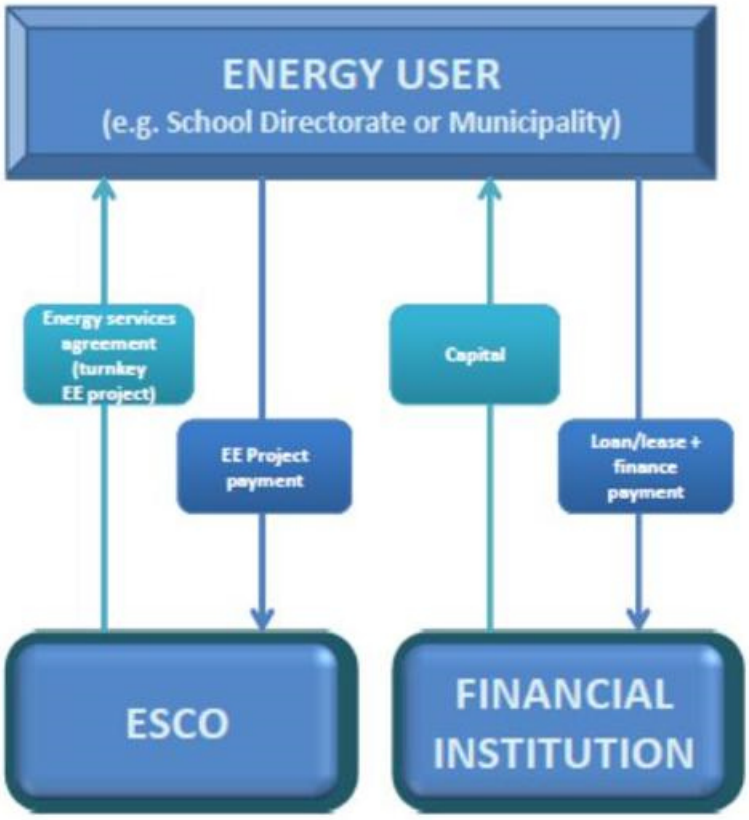


Figure 7 - Main features of "Debt financing" model.

In this case the loan goes on the client's balance sheet - usually known as the ***Guaranteed Savings model***. In this model ESCO carries only performance and design risk, whilst the end user carries credit risk. Value of energy saved is guaranteed to meet debt service obligations down to a floor price. If minimum savings targets are not met, the ESCO must pay the customer the difference, thus providing the customer with the funds necessary to repay its bank loan. If

the minimum savings are exceeded, then the customer transfers to the ESCO a percentage of these exceeding savings.
The energy savings guarantee reduces the risk perception of the bank, which has implications for the interest rates at which financing is acquired.

Third party financing. In the third party financing, ESCO borrows the money necessary for project implementation, as described and shown (Figure 8) below. Funds are provided by a third party, usually a financial institution. The financial institution may assume rights to the energy savings or take a security interest in the capital equipment used for the project.

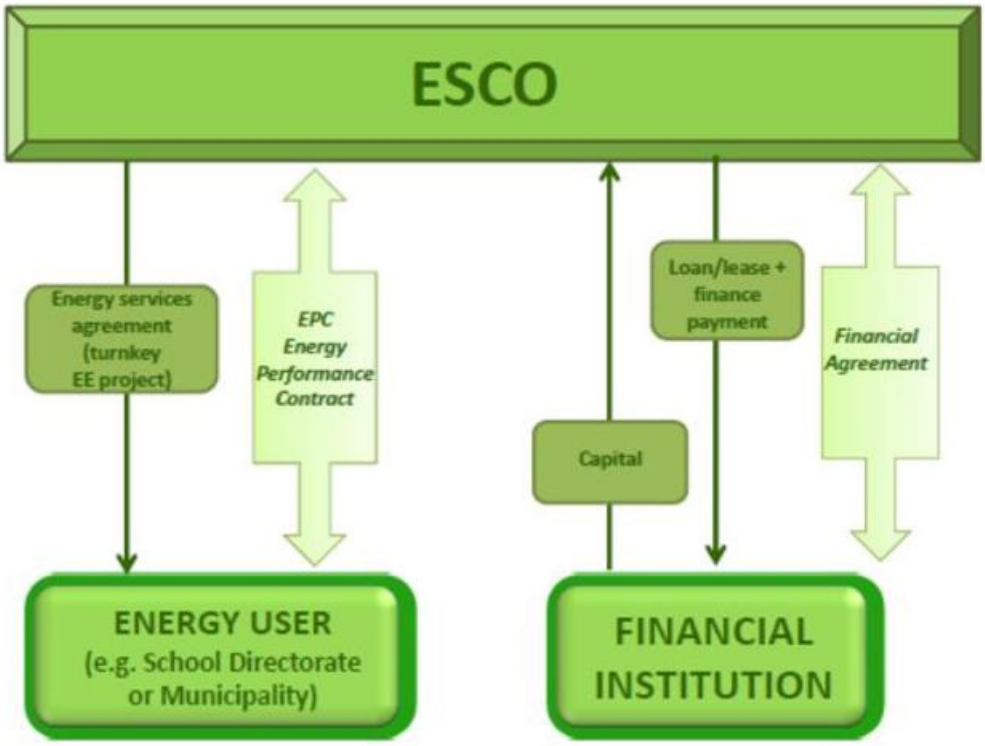


Figure 8 - Main features of "third party financing" model.

- ESCO enters into the energy services agreement (ESA) with customer. Several variations are possible. The energy end-user payment obligation is typically based on achieved savings, with many variations possible.
- ESCO provides turnkey project and services to the customer, as under the previous model.
- Financial institution must approve customer credit, ESA, project economics, etc.

In this second case, the loan goes on the ESCO's balance and it is usually known as the ***Shared Savings model***. The cost savings are shared by the ESCO and the client at a pre-determined percentage for a fixed number of years. The ESCO carries credit, design and performance risk. In lending to the ESCO, the financial institution is exposed to both:

(1) end-user credit risk (indirectly, because the ESCOs ability to repay its debt depends on the payment performance of the end-user), and

(2) the ESCO's performance.

The financial institution must, therefore, perform analysis and due diligence at both levels, the ESCO and the end-user.

Performance-based payments are often preferred by customers, as the payments are linked to savings. However, when payments are performance based, they can vary. This uncertainty introduces risk, which makes performance-based transactions more difficult to finance.

Loan guarantees / Revolving funds. Guarantee funds help cover the credit risks associated with financing energy efficiency projects. In such schemes, public funding is pledged (usually up to a ceiling level) to guarantee some of the risk of principal repayment for these loans. Typically, the loan recipient pays an annual fee to the guarantor in order to obtain a guarantee for the loan. As a consequence, guarantee funds can help alleviate the barriers to energy efficiency lending that are associated with collateral requirements, the higher risk nature of new technologies, and the risk of long-term lending.
Guarantee funds, by subsidizing risks, can be helpful in building the capacity and willingness of banks to offer energy efficiency loans until they become familiar with the market and can manage the risks on their own.
An alternative could be offered by Revolving Energy Funds (REF) schemes, which are already widely implemented in the Unites States but still to be exploited in the EU. They represent an interesting experience to be replicated and adapted to local needs. REFs rely on identifying energy cost savings and, in future budgets, allocating these savings to a revolving fund so that the money can be reinvested in future energy efficiency projects. Through this process a REF can grow and allow the Public Administration to pursue energy saving projects that might not be funded through standard budget processes. REFs usually do not have to start with a big amount of resources to be effective: a small revolving fund will continue to grow as financial savings from reduced energy use are added to the original capital.

Creation of a special purpose enterprise (SPE) created specifically for the project. If the objective is to keep the project off the client's balance sheet, and to place the performance risk on the ESCO, another approach would be to create a Special Purpose Entity (SPE). In this case, financing is given to a special purpose enterprise specifically set up for the project. This SPE serves as the focal point of the financial structure:

- The SPE borrows funds from domestic or international lenders and uses the loan proceeds to purchase energy savings contracts from local ESCOs or engineering firms. The SPE will acquire the collection rights of each ESCO project through a purchase/assignment agreement.
- To provide lenders to the SPE with additional assurance that payments from each project acquired by the SPE will be used to repay loans, a trust is established to hold all contracts purchased by the SPE.
- The SPE, through an assignment agreement with the trustee, transfers all contracts, insurance policies, warranties and other assets to the trust. The trust will collect payments under the various contracts, and pay the lenders directly. The trustee will make payments for operation and maintenance expenses, contributions to a debt service reserve fund and other contractual obligations, before paying the SPE.

The SPE will conduct initial project intake evaluations and assess the technical and financial viability of each project proposed for financing.

8.1 Barriers to financing energy efficiency

We can classify the barriers for energy efficiency financing in at least 4 categories.

1. Market: In some countries the governments are financing the energy costs. The price distortions are one of the principal barriers for a successful market uptake of energy efficiency projects and technologies, since they negatively affect the demand of these kinds of solutions

In this way, energy efficiency must compete with investment opportunities in other industries. In the markets where capital is scarce and there isn´t enough experience in assessing the potential of energy efficiency investments, often the available capital will be addressed to finance large power plants, even when they do not offer the best business case.

2. Financial: Financing energy efficiency and management is generally difficult. Often there is a lack of experience and technical knowledge for assessing these kind of investments, and there is a tendency to overrate the underlying project risk. This generally leads to very high costs of debt and equity and entails disproportionately high transaction costs, which make these projects unattractive to financial institutions. Moreover, many energy efficiency projects are too small to attract the attention of large financial institutions. This creates a perceived small market size by the banking industry and lack of interest on their part to invest the time and resources to learn how to finance energy efficiency projects.

Another barrier is represented by the fact that guaranteed revenues streams relying upon energy savings are still an unusual concept to banks, and as these are often non-asset based projects, there is no collateral to serve as security.

SMEs working on sustainable energy, including ESCOs, are often thinly capitalised and usually don't have sufficient collaterals to secure the capital needed for start-up, operation and expansion. On the other hand and when the building owner is not the end user, there is a difficulty in splitting the incentive among those who make energy decisions and those who bear the costs. Typically, developers and landlords who don't pay the energy bills, save cost in the initial investment by purchasing the simplest and least efficient equipment without considering the life-cycle of energy efficiency investments.

3. Technical: Even if there are in the market several energy efficiency consultants and energy services companies, there is still a lack of affordable energy efficiency technologies and know how suitable to local conditions. If there are sufficient capacities to identify and design the energy efficiency investments, there is little experience in developing, implementing and maintaining these projects.

   There is also a lack of firms that can aggregate multiple projects and deliver a cost-optimal energy efficiency project. Management and technical expertise is vital for the success of energy efficient projects and the post implementation phase is crucial.

4. Awareness: There is lack of sufficient information and understanding to make investment and rational consumption decisions. Decision makers are often reluctant to invest in energy efficiency for fear of hidden costs associated with retrofits and equipment conversion, and usually tend to minimize these decisions due the reduced visibility of these actions. Another important barrier is the lack of information about the performance of the buildings. In older buildings these information is almost inexistent or it is not updated.

   A misjudgement can often be observed regarding the fact that energy efficiency measures make buildings more expensive, but this usually does not correspond to reality: even if the initial investment can be slightly higher, the generated savings will contribute to cover it and the operational costs, as maintenance and repairs, will often be lower.

9 Best practise & Case Studies

We present in this section best practices and case studies from extensive partner experience and information gathered with Task 4.1 activities. Information is divided into three sections:

1. Energy management best practices on how to deliver energy management to owners of many buildings;
2. ESCO best practices in different types of buildings, and
3. Case studies based on bilateral interviews with school stakeholders to assess how schools make their decisions from an administrative and economic perspective.

9.1 Energy Management Best Practice

Enerit: Udaras na Gaeltachta Energy Management Bureau

Today, Enerit develops and delivers software for systematic energy management based on ISO 50001 for large energy-using organizations. In the past, Enerit has used similar software as part of a combined software-service offering to run energy management bureaus on behalf of customers. The following describes a highly successful energy management bureau service delivered by Enerit to Udaras na Gaeltachta which has many buildings dispersed over a wide geographic region in Ireland.

Udaras na Gaeltachta is a regional development agency (RDA) which combines an economic development role with community, cultural and Language-development activities. This RDA sponsors hundreds of companies that employ approximately 9,000 people. RDA building stock is of approximately 300 buildings, comprising 300,000 m^2 of floor area, has CO2 emissions of 44,089 tonnes/yr and energy costs of €12.5 million/yr. The buildings are mostly on the Atlantic seaboard and are occupied by RDA staff, community organisations or companies.

In 2008, a three-year energy management bureau pilot project using Enerit software and services was implemented. This project involved five buildings occupied by agency staff, and 10 buildings occupied by community organisations or SMEs. The project targets aimed to reduce energy consumption and carbon dioxide emissions for these 15 buildings by 4% consecutively each year, i.e. 12% by Year 3.

The unique challenges in dealing with the RDA are:

- The Buildings are widely dispersed across a wide geographic area.
- Many buildings and units are small, and it is not economically justifiable to have local energy expertise employed at each location.
- Expensive to have energy consultants make on-site visits due to the location of sites.
- Problems in converting obsolete factory buildings to comfortable and energy-efficient offices.

The team set out to overcome these challenges by demonstrating how a systematic energy management approach combined with advanced web based IT systems can be used. The properties were built between 1970 and 2008. All the office buildings are a combination of open plan areas, private offices, training facilities and meeting rooms. Based on 2007 costs electricity comprised 63% of total costs.

In setting up the energy management system for each building, a systemised set of actions were taken, involving the following steps:

- Identified the lead manager, local energy champion and key energy staff at the building.
- Local energy champion and key energy staff completed energy consultant's pre-audit questionnaire.
- Energy bills were collated for previous three years to identify energy consumption trends.
- Energy Bureau Portal configured with the building details and usernames and passwords set up for the energy champion and key staff.
- Energy audit conducted and energy awareness training provided for all staff by energy consultant – customised to energy requirements and operation of each building.

- Energy consultant initiation meeting with energy champion and key staff, initial action list based on feedback from audit and from energy awareness training.
- Energy analysis, energy audit report and action plan completed by energy consultant.
- Follow-up meeting with energy consultant to agree further actions, responsibilities and target dates.
- Training on use of system, during which gathered data is also entered.
- Use of the action management tracking system to drive actions and workflow through email alerts, automated reminders and alarms, management.
- Using the Energy Bureau Portal reports are displayed on the intranet.

A good systematic energy management approach required actions involving technology, operation and organisation and people behaviour must be addressed. The following are examples of actions across all 3 aspects:

- Technical Matters - sample energy-saving actions:
  - Removing or disabling light fittings in areas with excessive lighting
  - Replacing incandescent and halogen lights with more energy-efficient CFLs
  - Installing 7-day timers on office equipment(photocopiers, printers)
  - Installing 7 day time clocks on water boilers
  - Installing motion sensors or daylight sensors in toilets and other appropriate areas
  - Modifying settings on hot water heating immersion coil controls
  - Ground source heat pumps for under-floor heating system: adjusting time clock settings
  - Switching off immersion electric heating to allow the oil heating to take over domestic water heating
  - Reducing heating in unoccupied offices.
- Human Behaviour Change- Sample energy saving actions:
  - Awareness training for all staff
  - Access to Enerit system's energy-saving reports for staff motivation League tables on intranet showing energy performance of buildings
  - Eliminating electric space heaters which were informally introduced to the building
  - Switching lights off in areas at times when sunlight is sufficient
  - Switching off banks of light in zones of open space areas as each zone empties
  - Switching lights off when employees depart, i.e. not leaving them on for the cleaners
  - Audit checks of PCs and monitors left on at night and weekends
  - Follow-up instruction to staff groupings who are "switching off" less
  - Labelling light switches to encourage staff to only switch on lights that are required
  - Staff competition, automated suggestion scheme on intranet, energy saving posters and other motivational information
  - Email reminders to staff to switch off computers, monitors and other equipment.
  - Organisational Improvement and Action management

In the first 2.5 years of the project, 487 energy saving actions were identified. 450 actions were already completed across all 15 sites with 54 people involved in taking energy saving actions. Between 2007 and 2009, electricity consumption for the entire building stock had dropped by 18%. This was well beyond expectations: the original target was to achieve this reduction over four years. Electrical energy reduction across individual buildings ranged from 10% to 29%. The energy management bureau approach using Enerit software helped this agency meet its energy saving targets. Using the above model, Enerit then went on to run the NUI Galway (educational sector) Energy Management Bureau.

With regard to the marketing and exploitation of **VSNavigator**, the key points from the above case study and business experiences of Enerit are that:

- this is an example of an organisation that could not afford to have a full-time energy manager;

- the buildings were a combination of offices, light industrial and training/educational buildings not unlike the range of schools that could potentially use **VSNavigator**;
- they outsourced the energy management function to Enerit which we called an Energy Management Bureau;
- the service was paid for with a monthly fee;
- Enerit delivered this service through a combination of remote support, consulting activity and an early version of the Enerit software;
- this was very successful approach and reduced the energy consumption substantially;
- this is a partial ESCO model (it's only partial because we leave out capital investment and delivery of equipment within the function of the energy management bureau.).

Towards the end of the project, Udaras carried out one of the recommendations that had been identified and discussed and installed a pellet boiler through a separate ESCO contract. Because of this positive experience, Enerit decided to further develop this software and offer it to other energy management consultants to run similar Energy Management Bureau. This business model has yet to "take off".

With regard to a business model for schools, here are some key points:

- It is not practical for Enerit to sell its software directly to individual schools for two reasons: the value of the sale would be too small to justify; there may not be strong enough technical and management expertise on a single site.
- Therefore, there are two ways that the Enerit software could be used in schools:
  1. sold at our school board or school district level and then used by a central energy manager or energy team (these personnel could be permanent employees or the operation could be outsourced to a consultant or facility management team);
  2. sold as an integrated part of an ESCO service:
     a. the ESCO would contract with the school
     b. Enerit would sell the software to the ESCO
     c. the benefits to the ESCO are that, because many ISO 50001 related savings are no cost and low cost, the return on investment to the ESCO would be much greater
- in both case, the software would be sold under a SaaS (Software as a Service) model with subscriptions paid monthly

Cardiff Metropolitan University

With an annual budget rising to £2.1m in 2008, effective energy management had become a key priority to the University. Half-hourly energy data from more than 200 meters was collected and transmitted via the University's own data network and stored on an on-site server. This data was used to generate monthly reports for key managers who are responsible for meeting the reduction targets. Regular monitoring of the data was essential to highlight the opportunities for improvement and to suggest practical ways to address energy reductions. With plans to achieve £1m in savings over 5 years, it has already achieved savings of £330k through a 12% reduction in electricity, 5% reduction in gas and 18% in water in the last three years.

Gloucestershire university, UK

This college is the largest college in Gloucestershire with 15000 students and over 1.300 staff and with energy costs of approximately £500k per year**.** The college has identified savings through a range of energy efficiency, alternative energy and carbon management projects. One of its key projects was the implementation of a building management system (BMS) across the college sites.

With a most efficient way of managing consumption and a better understanding where the energy is used, the college reached savings up to £200k over the first three years.

The initial investment was £29k to implement the BMS upgrade project and the payback of this investment was 0,5 years. It was found to be more efficient and cost effective process of controlling the energy use remotely on a computer than with labour intensive checks.

The savings achieved where nearly 642 MWh per year, corresponding to £56k savings in electricity costs and 337 tCO2 emissions savings per year.

St Edward's College, UK

St Edward's College is a voluntary aided schools in Liverpool, with 1150 students from 11 to 18 year old. With several restrictions in the budget and with an annual energy cost of £55,600 , it was mandatory to reduce the energy costs.

After a detailed survey of the site it was produced a list of recommendations, which detailed how St Edward's could save energy costs by 20%. These recommendations included the installation of presence sensors into large areas and awareness of the staff college for energy management and energy efficiency procedures.

King Edward VI School, UK

King Edward VI School is over 450 years old and have around 560 students and 90 staff. The total annual energy cost was around £80k with a carbon footprint of 410 tonnes CO2 per year.

The School performed an energy survey to identify a number of areas for savings with recommendations ranging from raising awareness around energy consumption and management issues, through to technical improvements to the schools energy consumptions system.

Energy management, awareness actions and drafting an energy policy for the school were taken with a focus on energy management, where an energy awareness campaign was initiated with the aim of helping staff and students to understand the importance of these related issues. Energy saving actions included energy intensive lighting replaced with energy efficient high frequency T5 fluorescent luminaires. Other low cost measures included installing heating controls such as thermostatic radiator valves and rooms thermostats.

With the implementation of these measures King Edward VI School has reduced its carbon footprint by over 12% and its costs by over 15%. The investment was £20k and reduced 50 tonnes of carbon and £12.300 annual savings.

9.2 ESCO Project Best Practice

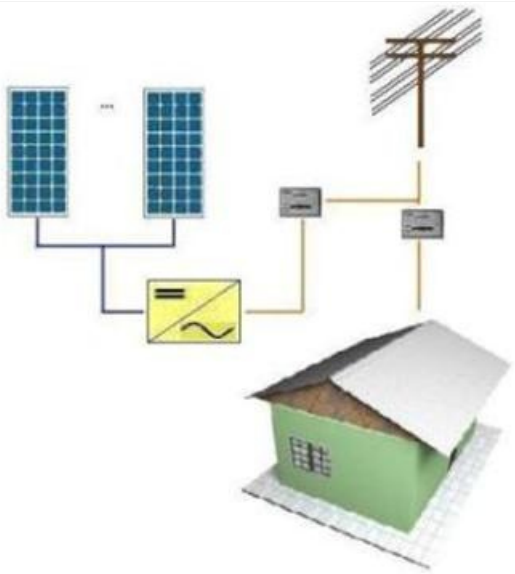
Energia Própria - A real Business Case in ESCO Industry

Within more than 6 years of energy market, Energia Própria, an Energy Service Company,has developed several ESCO projects nationally and worldwide.

The following describes a project [9] related to an installation of fourteen photovoltaic plants and solar thermal units in a hotel complex. This project was developed in a very well-known hotel chain in Algarve, Portugal, with a total investment of around 280.000 €.

The solution adopted was the installation of 4kWp photovoltaic plant and a solar thermal system in fourteen villas of the hotel.

The 4kWp and solar thermal installation



Schematic of a 4kWp photovoltaic

Due the existing feed in tariff scheme in Portugal this project will allow to receive an income during 15 years of the energy generated. After this period the electricity will be sold at market price or if the client intends it can be use it to feed the installation. The contract length signed was for 15 years, where the ESCO is responsible for the design, development, construction, operation and maintenance, as well for part of the investment of the system.

The business model proposed was the shared savings agreement where both the ESCO and hotel share the investment and the savings. In this particular case the ESCO was responsible for 85% of the investment, which was done with a leasing agreement with a financial entity. The 15% of the remaining investment was supported by the client through direct equity. The annual revenue generated by the project is around 40.000€.

The savings are shared on 85% of the feed in tariff revenue to the ESCO and 15% plus the thermal energy generated by the solar thermal equipment to the hotel.

This project is very interesting for both parties, where the ESCO collect some of the revenues of the feed in tariff and the hotel with a small investment have hot water and a revenues from de feed in tariff. After the contract period the client can use the electricity produced in the villas and with less dependency of the electricity market.

Measurement and verification of the project is done based on kWh of electricity and thermal generated with the support of web monitoring systems. Periodic reports are sent to the client with the reading of each unit, which will support financially the project.

[9] http://www.senso.pt/nm_quemsomos.php?id=44

Energy efficiency finance is still an unknown market for the main Portuguese financial entities. Because the income was guaranteed by a governmental feed in tariff during 15 years, it was simple to assess the risk of the project, which led us with interesting interest rates and without the necessity to provide any kind of collateral guarantee.
This is not usual when we are discussing energy efficiency finance where the risk of operation of the project is too high and the income expected in the initial analysis could be slightly different. For this case the financial entities generally asked a collateral warranty of the same value of the investment which leads to difficulties in the development of these projects by small and medium size companies.

Intesa Sanpaolo Group. An example of scheme to finance EE projects

Intesa Sanpaolo S.p.A., one of the largest Italian banking groups, is implementing a specific financial scheme to finance energy efficiency interventions in buildings in Italy. This typology of scheme could be further improved and replicated at a larger scale, and adapted to different technologies such as those proposed within the VERYSchool project.
Intesa Sanpaolo started in 2010 to apply innovative schemes to finance energy efficiency in public buildings based on third party financing. Typically the deal structure involves four categories of stakeholders: an ESCO, a public Local Authority, a National Energy Agency which grants incentives for renewables energies generation and distribution, and a financial institution.

- The ESCO signs a multiannual contract with the Local Authority for installing and maintaining the energy efficiency equipment and obtains from the Bank a loan covering max. 70% of the total investment cost (the remaining 30% must be provided by the ESCO via equity). The ESCO is also entitled to receive the feed in tariffs granted by the National Energy Agency for the whole period covered by the contract with the Local Municipality.
- The Local Authority signs a covenant with the National Energy Agency (in Italy GSE - Gestore Servizi Energetici) that states the eligibility of the installed equipment to feed in tariffs or to other public incentives. It also signs a credit transfer agreement to remise this public incentive to the Bank if the ESCO is insolvent in reimbursing the loan to the Bank. At the end of the contract, the Local Authority becomes owner of the equipment/plant.
- The financial institution gives to the ESCO the loan covering up to a certain percentage of the total investment cost and is guaranteed by the credit transfer agreement signed with the Local Authority. It evaluates the economic sustainability of the project by analysing: the track record of the key players; the service contract between ESCO and Local Authority; the credit risk of the ESCO and/or of the local municipality; the amount of equity invested in the project by the ESCO or by the local authority.

Concerning the mobilisation of more private financing from institutional investors for energy efficiency projects, according to the experience of Intesa Sanpaolo, a number of barriers still exist and need to be addressed:

- Regarding the bankability assessment, energy efficiency solutions, and more in general the overall clean-tech sector, still suffer a scarce predictability in future cash flows, except for some technologies such as photovoltaic cells where returns are totally predictable and risk is nearly zero. The traditional investment analysis is based on expected cash flows and normally performed without a risk management model able to take into account the implications derived by new energy / construction approaches. Financiers are available to support projects where risk management is transparent and credible, no unproven concepts.
- Since the majority of energy efficiency investment projects are of small or medium size, transaction costs to assess their technical reliability and performance (such as costs associated to due diligence, legal and engineering advisory, feasibility studies) are disproportionately high to be borne by investors.
- Energy efficiency technologies and solutions are very much diversified and many of them are not yet standardized. Therefore, investors intending to assess their technical viability and reliability need an ad-hoc evaluation, which entails additional costs and technical skills not internally available.
- Traditional financial intermediaries often lack specialized internal skills to understand and properly evaluate the market potential of innovative technical solutions in the energy efficiency field.
- Since companies providing energy efficiency technologies are often young and under-capitalized, investors perceive them as high risk counterparts and assign low credit ratings.

The possibility of achieving returns in the field of energy efficiency is strictly dependent on the presence of public incentives. If these public incentives are not enough stable and long term oriented, private investments are discouraged. Public support in terms of incentives must not necessarily be huge, but stable, accurately quantifiable and with a long term perspective. Uncertainty is the antithesis of bankability.

Lievensberg Hospitals, The Netherlands

Lievensberg Hospital comprises 367 beds along with a day care facility. It employs over 100 medical specialists and 1600 co-workers and provides a wide range of primary and specialist healthcare services. The hospital had a previous renovation several years ago and felt that there was scope for improvement in energy efficiency. They were looking for a solution that would enable them to streamline costs and at the same time enhance facility management. One of the main challenges was the lack of resources and budgetary constraints needed for necessary improvements.

The energy implementation project was developed in 2 phases. In the 1st phase the focus was at reducing the bottom-line impact associated with energy consumption, energy costs and improving the energy efficiency of the facilities through the design, implementation and financing energy efficiency measures. This phase was important to understanding the use of energy in the facilities and the areas where this can be improved.

In the 2nd phase a heat pump was installed that provided cooling during summer and in winter provided heat to the air handling units. A, CHP unit was considered to help recover waste heat for electricity generation. All the installed solutions were integrated with other building applications using an energy manager system.

With the energy management system, the Lievensberg Hospital was allowed to view and control the energy use in the facilities across hospitals with an improved process for monitoring, validating and optimizing the energy consumption. In the phase 2 some air handling units (AHU) were renovated and optimized.

The flexible finance option offered by the Contractor enabled the hospital to transfer the savings made from phase 1 to be invested in phase 2, and with a third party finance through the Contractor it was possible to provide the cash flow for project implementation without the need for upfront capital.

UniCredit Group, Milano

UniCredit Group headquarters in Milan houses 1250 employees and a data canter serving all UniCredit companies, where the data canters cooling systems are vital to on-going business operations. To reduce the energy costs several improvements were made to the cooling system, with the replacement of four aged cooling units, motor pumps, reengineered cooling and heating systems and refurbishment of the air conditioning and ventilation systems.
The implementation was done with an energy saving performance contract with guaranteed savings without any upfront payment from UniCredit Group.
The results were an annual reduction of 2.800 tons of CO2 and 460.000€ annual energy savings while improving air quality and increasing comfort.

Brigittenau Swimming Pool, Vienna

Brigitenau indoor swimming pool, in Vienna is a 25 year old city swimming pool with rising energy costs to heat water, run the ventilation and dehumidification systems. In order to decrease the energy costs, several improvement in the technical side of the pool were performed. These improvements included the installation of a new condensing boiler, a building management system, solar collectors for pre-heating the pool water were installed and the waste heat from pool water was recovered. Additional measures were taken to improve water flow and improving the water treatment system.
The results with these improvements were a decrease in the energy used to heat the pool by 66% and a water consumption reduction by 45%**.** The annual energy savings were 200000 €, while improving comfort.

University of Sheffield, UK

The University of Sheffield had made huge investments in developing its estate, primarily channelled into new buildings which led to significant underinvestment in the existing estate. Due to rising energy prices substantial investment was need in energy efficiency, and budgets were under huge pressure.
Several improvements were adopted to minimize the on-going energy costs. These included the replacement of the largest chilled water systems, installing water temperature monitoring, improving lighting efficiency and control, installing metering and providing automatic M&T, refurbishing the existing air handling units, heating distribution circuits and district heat stations. An awareness campaign of energy efficiency throughout the University was also developed.
All the €4.4m investment needed was totally self-financed by the University and will allow a 20% annual energy savings, during a implementation phase of 2 years.

The Retzhof of LIG, Austria

The Retzhof of LIG (Landesimmobiliengesellschaft Steiermark – State Real Estate Company Styria) is a complex of buildings consisting of a castle from the 16th century as well as two conference rooms and guest houses from 1960 and 2009 with an overall useful area of approx. 4000 m^2, which is used as a hotel and conference venue.
The energy costs were high, the natural gas boiler was inefficient and there was lack of insulation in the buildings. The annual consumption was approximately 750.000 kWh.

To reduce this consumption the following goals were identified:

1. Replacing the old boiler installation
2. Outsourcing of energy supply and financing of the investments
3. Reduction of energy demand and cost through demand side savings measures as well as CO2 reductions

An energy service contract was implemented with a combination of energy efficiency measures and supply of useful energy with specific measureable quality assurance instruments.
The business model was an energy performance contract with guaranteed savings, where the ESCO provide all the finance, nearly €150.000, to implement the project which achieved around 30% of thermal savings.

9.3 Case Study: Bilateral Interviews

In order to assess the market exploitation potential of **VSNavigator** it will be essential to understand how Schools' stakeholders make their decisions from an administrative and economic perspective. The adoption of innovative energy efficiency technologies (such as **VSNavigator** developed in VERYSchool) is subject to authorization procedures, investment decisions, choice of the best financing mix and existing legislative ties.

These aspects are studied by analysing some real cases through ad hoc bilateral interviews. A common framework to conduct interviews in a consistent way was established, and it is shown in the template in Annex 1.

"Energy management in schools in a small Italian town: the case of LESA"

Interview with:

- Mrs. Marina Rizzato - Head of Technical Office, Municipality of Lesa

Ownership and features of the school buildings

The Municipality of Lesa owns and manages two school buildings**:**

- the first one has an area of about 600 square meters and was built in 2009. In this building a nursery (hosting 30 children) and a kindergarten (hosting 60 children) are located.
- the second building extends for about 700 square meters plus 1.000 square meters devoted to services such as a gym and cafeteria. It hosts a primary and a secondary school (1st level, until age 13), with a total of about 250 pupils. The building was constructed in the '70s.

Management procedures and administrative organization

The *City Council* has the power to decide on the purchase of new energy efficiency technologies, while the *Technical Office* is responsible for the ordinary maintenance activities (management of heating and lighting installations) and extraordinary maintenance (painting, door and windows substitution, installing and renovation of thermal and electrical plants).
The *School administration* is informed of the maintenance activities and new investments in energy efficiency technologies which the Municipality intends to perform and can report problems and needs to the Municipality, but has no decision-making powers.

Economic and financial management

The running energy expenditures for ordinary and extraordinary maintenance are included in the annual budget, as well as the new investments are recorded in a three-year financial plan (only when it comes to significant interventions). Both the annual budget and the multiannual financial plan are subject to approval by the City Council. The City Council is therefore the sole entity responsible for the adoption and approval of investments in the school buildings owned by the Municipality of Lesa.
The **choice between alternative energy efficiency investments** is made mainly on the basis of cost criteria. The Technical Office is in charge of preparing a report on the technical features of the proposed energy efficiency solutions to support the City Council in its decisions. Only when the proposed interventions are of considerable size, the technical report is associated with a financial plan detailing costs and payback period.
The **most frequently used forms of financing** include own resources, public subsidies (e.g. Provincial grants for small-scale interventions and Regional grants for larger interventions), loans (for which provision is not

necessary to pay the guarantee being sufficient debt limit maximum allowed). Currently the municipality of Lesa is not subject to the Stability Pact (being a municipality with less than 5000 inhabitants) and therefore has no constraints on spending.
With regard to the **barriers** encountered in accessing financial resources, one of the most relevant is the slowness in the procedure of earmarking public funds.
Regarding the **tender procedures and criteria** for the selection of energy services and installations suppliers, the legislative framework of reference is the "*Codice dei Contratti*" , together with its specific implementing regulation. Further technical regulations and standards on energy consumption reduction established at regional level are also applied.

Interventions in the energy sector

Currently the Municipality of Lesa **does not use an automated system for monitoring energy consumption**. Meter reading is periodically done in manual mode. The schools owned by the Municipality do not avail themselves **neither of an Energy manager nor of the services provided by an ESCO**. The main interventions to reduce energy consumption in school buildings conducted by the Municipality in its properties include **the windows and doors substitution and the replacement of heating and lighting installations**. Insulation measures for the external envelope are in the design phase, but not yet implemented.
In the past the Municipality of Lesa launched a **programme of energy audits on public buildings**, which helped identify a series of energy efficiency measures (insulation, renovation internal heating system) that were submitted to the Region for its approval and co-financing. The plan has already been approved by the Region, but financial resources have not yet been earmarked for the implementation phase. The **main obstacles** to the adoption of more energy-saving technologies, such as the VERYSchool navigator, are the difficulty in finding financial resources and the lack of specialized skills among the staff that should take care of the management of new technologies.

"Energy management in schools in a large Italian City: the case of GENOA"

Interview with

- Mr. Fortunato Billè - Head of Technical Equipment Office, Properties and Sport Department, Municipality of Genoa
- Mr. Mario Merello - Head of Energy Sector, Municipality of Genoa

Ownership and features of the school buildings

The Municipality of Genoa owns 204 school buildings, which host nurseries, primary and secondary schools. They are classified in 5 categories according to their period of construction:

Number of Schools	Built
36	Before 1867
48	Between 1868 and 1926
79	Between 1926 and 1975
8	Light prefabricated buildings built in the 60's
33	Built after 1975

Regarding the management of the school buildings:

- The Municipality of Genoa manages and administers the buildings where nurseries, kindergartens and primary schools are located;
- The Province of Genoa manages the buildings where secondary schools and Universities are located.

Management procedures and administrative organization

The management of the energy installations and equipment in the school buildings stock falls under the responsibility of different entities, both internal and external to the Municipality.

Regarding the ordinary and extraordinary maintenance of the **thermal energy installations**, it is in charge of the **Property Management and Sport Directorate of the Municipality** through the Heat Management Office.
For the **extraordinary maintenance interventions** the **Heat Management Office** conducts a screening of the thermal installations via the energy services provider and then decides the priority measures to be carried out.
As to **the ordinary maintenance of the electrical installations,** it falls under the responsibility of ASTER S.p.A**.** (*Azienda Servizi Territoriali Genova SpA*), an '**in house' company** of the Municipality of Genoa which, on the basis of a Service Contract', manages all the electrical and technological installations and equipment (included fire alarm installations, antitheft alarms, etc.) located in the municipal buildings.
The **extraordinary maintenance of the electrical installations** is usually under the responsibility of the **Property Management and Sport Directorate** which can commission the execution of the more complex works to the **New and Large Public Works Directorate.**
The decisions regarding the **new investments in energy services and technologies** are generally under the scope of the **Environment, Health and Energy Department of the Municipality**. This Department is also responsible for the adoption of new policies and plans in the field of energy efficiency, such as the Sustainable Energy Action Plan of the Municipality of Genoa that was approved in August 2010.

Economic and financial management

The different Municipal Departments propose the **decisions about new investments** and enter them in a 3-year Investments Plan, which is subject to the approbation of the City Council. The City Council is the sole entity responsible for the adoption and approbation of new investments concerning the school buildings owned by the Municipality of Genoa. The responsibility for the implementation of the investments/interventions approved by the City Council lies with the City Committee ("*Giunta*") and the City Managers.
The Accounting and Finance Department is in charge of the investment planning and of finding and managing financial resources.
The **running energy expenditures** are estimated according to available historical data by the competent office ("*Ufficio Gestione Utenze*"), within the Property Management and Sport Department.
The most frequently used sources of funding are **debt** and **public grants,** both at regional, national and European level. Among the national public funding opportunities, the Municipality participated to specific calls for proposals for energy retrofitting in schools and in public buildings ("*Il Sole a scuola*" [10] e "*Il Sole per gli edifici pubblici*") issued by the Italian Ministry for Environment.
Similarly, the Municipality also draws heavily on **Structural Funds** at regional level. Moreover, it is under evaluation the possibility of submitting a request for funding to the European Investment Bank under the **European Local Energy Assistance (ELENA)**, even if the complex access requirements and procedure could represent a barrier in this context.

Energy management

Over the last years, the interventions on the school buildings' envelopes and the maintenance of the energy installations are put into action on the basis of warnings and contingent requests made mainly by the educational institutions, which are under the supervision of the Directorate of Educational Policies. Currently, due to a lack of financial resources, **there is not a long term planning for interventions on the school building stock** owned by the Municipality (except for the adaptation to the fire prevention rules).
The **thermal energy consumption** monitoring is performed through an remote control system, whilst the **electric energy consumption** monitoring is not automated and is based on the electricity bill reading.

[10] http://www.minambiente.it/home_it/showitem.html?lang=&item=/documenti/bandi/bando_0061.html
http://www.minambiente.it/export/sites/default/archivio/allegati/vari/bando_sole_enti_pubblici.pdf

There are **no energy managers** employed in schools acting as an interface with the Technical Equipment Office, and the Municipality has not yet established **any service contract with ESCOs** for the energy management of schools.
Until now, the main energy efficiency interventions carried out on school buildings by the Municipality are the **door and windows substitution** and the retrofitting of heating systems (conversion from heating oil to natural gas), which is expected to be concluded by the first quarter of 2014.
Regarding the **tender procedures and criteria for the selection of energy services and installations suppliers**, the legislative framework of reference is the "*Codice dei Contratti*" [11], together with its specific implementing regulation [12]. Further technical regulations and standards on energy consumption reduction established at regional level are also applied.

Sustainable Energy Action Plan (SEAP)

The Municipality of Genoa adopted in 2010 its Sustainable Energy Action Plan (SEAP), an ambitious and comprehensive plan that is intended to lead to a 23% reduction of CO2 emissions in 2020 compared to 2005. The SEAP of Genoa contains specific provisions for the school building sector:

1. Energy audits in school buildings: the Municipality will perform them in order to identify the priority interventions to reduce energy consumption and CO2 emissions.
2. Implementation of the priority interventions identified through the energy audits. A public tender process will be applied to select the works and equipment suppliers.
3. Installation of photovoltaic plants in schools. The Municipality has already conducted feasibility studies for installing 20 kW solar PV systems on the roofs of 13 schools. This first tranche of intervention will be realized by using Regional funds. Once the Regional funds are officially approved and earmarked, the Municipality will proceed with the installation. The photovoltaic plants will be equipped with a display visible outside the building, allowing real time performance monitoring.
4. Use of Energy Certification as a means of ensuring that the necessary measures are actually and properly implemented. The Municipality will organize the energy certification of school buildings after the conclusion of the energy efficiency improvements. Each school building will display the Energy certification to give visibility to the actions taken.
5. Use of the Record of Assessment for school buildings.
6. Monitoring of energy consumption.

One of the main actions under implementation within the SEAP, is a public tender procedure for assigning a 3-years contract for heating/cooling and related services provision to the 267 public buildings owned by the Municipality of Genoa (including the school buildings). Among the requirements of selection, the public tender also sets out the retrofitting of heating systems (conversion from heating oil to natural gas of about 120 thermal power stations) and the **execution of comprehensive energy audits** for the overall building stock owned by the Municipality.
Another on-going action within the SEAP is the inventory of the school buildings' surfaces aimed at the installation of the PV plants.

In the future, the Municipality **envisages a structured involvement of ESCOs** in the energy management of public buildings, even if some barriers exist like the high fragmentation, undercapitalization and lack of organization of this typology of companies in Italy.

Barriers and opportunities

The economic and market barriers reported by the Municipality of Genoa for the commercial adoption of VERYSchool navigator are the following:

[11] D.Lgs. n. 163/2006, http://www.camera.it/parlam/leggi/deleghe/06163dl.htm
[12] DPR 207/2012

- **Technical difficulties** in using the Energy Navigator;
- To be really useful to the City, the Energy Navigator should be characterized by a **centralized management**: the school administration should use the tool for monitoring consumption and influencing behaviour, but the power of intervention on the heating and electrical installations must be exclusive jurisdiction of the municipal technicians in charge of these tasks.
- **The cost of installation compared to the savings generated is still not enough convenient, especially for small size buildings** , as they are often those hosting schools. For this reason the use of VERYSchool navigator would seem more appropriate for larger buildings.

In terms of opportunities, one of the most interesting aspects of the project according to the Municipality of Genoa consists in the **possibility of changing human behaviour and of educating school buildings' users to energy efficiency**.

"The Turin Smart School project"

Interview with:

- Mrs. Mariagrazia Pellerino - Alderman for Education and University, Municipality of Turin
- Mrs. Laura Rinaldi - Head of Education Services Department, Municipality of Turin
- Mrs. Elisa Rosso - Head of the European Funds, Innovation and Economic Development Department, Municipality of Turin

The Municipality of Turin is at the leading edge in promoting energy efficiency and achieving better environmental conditions, to maximize connectivity and to enhance opportunities for all, putting the city user – citizens, institutions, enterprises, and organizations of all kind – at the centre of development policies.

In this context, in 2007 a first urban integrated action plan in the field of energy ("Sustainable energy as local competitiveness factor: a plan for Turin"), aimed at supporting both the demand and the offer of smart and clean products/services/technologies was developed. In 2010, the Turin Action Plan for Energy (TAPE) was approved: it includes an inventory of the major sources of energy consumption at city level and defines a set of interventions in the building and transport sector (public and private) with the final objective to decrease CO2 emissions of up to 41,9% by 2020.

The "Smart School" project

Within the Turin Action Plan for Energy (TAPE), a specific "*Smart School*" project was launched, targeted to the reduction of the energy consumption and environmental footprint of the school buildings owned by the Municipality of Turin.

The existing school building stock (total volume 3,981,617 cubic meters) owned and administered by the Municipality of Turin represents 52,61% of the overall public building stock of the city and hosts about 71,500 [13] pupils in the age range 0-13.

According to an assessment performed in 2005, the energy consumption of the school building stock belonging to the Municipality of Turin amounts to about 164,789 MWh/year, equal to 52.64% of the energy consumption of the overall public building stock.

The "*Smart School*" project will be implemented following three main courses of action:

1. Smart Carbon: strategic planning to reduce the carbon emissions and improve the environmental sustainability of the public school ecosystem in Turin;
2. Smart Retrofit: according to the concept of *Eco Educational Building*, actions and measures to support the energy retrofitting of school buildings;

[13] Data referred to the year 2011.

3. Smart Community: development of *Community School* actions, a set of partnerships between the school and other community resources. They integrate focus on academics, health and social services, youth and community development and community engagement promoting students' learning, stronger families and healthier communities.

Main actions

Within these three macro-fields, 26 specific actions were identified and branched in 11 different areas. Further actions can be added in the future, in order to respond to new and emerging needs.

Currently, the 26 actions are under the feasibility study phase and they will be implemented in the next months.

Regarding the 'Smart Retrofit' strand, six actions are envisaged:

- Audits of the energy-maintenance-management efficiency of the existing school building stock;
- Identification of design models and innovative procedures for the retrofitting of the existing school building stock;
- Application of comfort solutions to buildings: acoustics, furniture, colours, indoor and outdoor space management;
- Ad hoc training modules for building design and retrofitting;
- Retrofitting of school playgrounds and implanting school vegetable gardens;
- New sustainable mobility network to the service of the school ecosystem and expansion of green areas around the school buildings.

A pilot project focused on the energy retrofitting of 6 school buildings and of Turin Conservatory, which will lead to a total decrease in energy demand of about 70%, is on-going. It is co-funded within the Region Piedmont ROP ERDF 2007-2013 (total amount: 13 Mio €).

Main stakeholders involved

The "*Smart School*" project will involve a multitude of actors, due to its cross-disciplinary and collaborative approach.

Promoters

- Municipality of Turin (Department for Educational Policies and Culture and Education Management Office)

Implementing entities

- Municipality of Turin (School Buildings Service, School Management Service)
- ITER, Istituzione Torinese per un'Educazione Responsabile (Turin's Institute for Responsible Education)
- Consorzio Pracatinat (private company developing initiatives for environmental sustainability and awareness)

Main partners

- Torino Smart City Foundation
- Turin Foundation of Architects

Main barriers

Among the main potential barriers in the implementation of the actions envisaged in the "Smart School" project are the difficulties associated with accessing private funds (especially loans), the delays in the procedures for accessing and obtaining regionally administered Structural Funds and a very rigid regulatory framework at school administration level.

"Energy management in a Serbian Electro-traffic Technical school"

Interview with:

- Mr. Branislav Mićović, School manager (director).
- Mrs. Dušica Đuričić, School secretary

Ownership and features of the school buildings

The Elektro saobraćajna tehnička škola (Electro-traffic Technical school) ''Nikola Tesla'' is a Secondary school (Vocational School) located in Kraljevo, Serbia. It was built in 1974, has a size of 3266 m2 (heated 2533 m2) and hosts a total of 731 pupils + 83 employees.
The school is State-owned and under the Responsibility of the Serbian Ministry of education.

Management procedures and administrative organization

Regarding the administrative organisation, the **school is managed by the School principal (director)**, who is assisted in his tasks by a School board, an Assistant and a secretary. Other employees are teachers, associates and non-teaching staff.
The school director is elected on a competitive basis, by School Board, following the opinion of the teachers' council. He **reports to the School Board and to the Ministry of education** and he has the following duties:

- Plans and organizes the implementation of educational programs and all institution activities;
- Cooperates with local governments, organizations and associations;
- Makes decisions on the use of funds determined by the financial plan;
- Responsible for the approval and appropriate use of these funds in accordance with the law;
- Decides on the rights, obligations and responsibilities of pupils and employees.

Regarding the role of the Public Administration, it:

- performs the professional and pedagogical supervision in schools;
- controls the appropriate use of funds in school;
- participates in the preparation of development plans of education and monitors its implementation.

Economic and financial management

Regarding the general financial obligations, the School is subject to the Law on Budget and Law on Budget System. It is not obliged to adopt a multiannual strategic financial plan, or to submit a complete annual school budget plan. The main types of expenses borne by the school are for heating, electricity, water.
The responsibility for investments / borrowing / leasing decisions lies with the School director in coordination with the Ministry of education.

Energy management

The Elektro saobraćajna tehnička škola (Electro-traffic Technical school) ''Nikola Tesla'' monitors consumption of electricity and energy for heating. Monthly electricity bill is about €600. For heating, heat consumption is monitored through the calorimeter by the supplier of heat. In spite of measuring, heat consumption is charged per square meter of heated space. The monthly bills for heating are €7.500 (only in heating season - 6 months yearly).
Regarding the energy efficiency measures/technologies already adopted, the old heating substation with direct connection was replaced by a new one of indirect type with automatic control. The heating substation and equipment in it is the responsibility of the distributor-supplier of heating energy (Heat plant Kraljevo). To install the new heating substation, the heating supplier (Toplana Kraljevo) considered all the economic criteria demanded by t**he credit program KfW (a German government-owned development bank**), which was used to finance the project.

Other energy efficiency interventions implemented by the school are the replacement of windows and construction (walls and roof) insulation on the façade. For these kind of interventions, the authorization is issued by Department of Urban Planning of the City of Kraljevo.
Energy technology providers are chosen in accordance with the **Law on Public Procurement of the Republic of Serbia**. Currently, **the school does not avail itself of the cooperation with ESCOs**.
The **School board and Department of the social affairs of the City of Kraljevo** are responsible for deciding and approving investments in energy efficiency.
One of the main barriers in the adoption of further energy efficiency measures is the **lack of funding**.

"Energy management in the fifth Belgrade's gymnasium"

Interview with:

- Mrs. Svetlana Šekularac, Head of Accounting - PETA BEOGRADSKA GIMNAZIJA

Ownership and features of the school buildings

The PETA BEOGRADSKA GIMNAZIJA is the fifth Belgrade's gymnasium, it is a secondary school and was built in 1932. The building's size is 6105 m2 and it hosts 1090 pupils. The school is State-owned and under the Responsibility of the Ministry of education and Secretariat for Education of the City of Belgrade.

Management procedures and administrative organization

The school has the following organisation: School principal (General manager – director), Assistant director, School secretary, Head of Accounting, 2 administrative employees, 99 teachers (professors), superintendent, 12 maids. Director is elected by school board with the suggestion of the collective. The Ministry of education makes final decision and approval. Director has full authority in terms of teaching process, and limited authority regarding investments and procurements.
School administration is responsible for small maintenance and repairs (in cooperation with School secretary and Head of Accounting). Funding for larger investments is provided by the Secretariat for Education of the City of Belgrade.

Economic and financial management

Regarding the general financial obligations, the school applies the Law on Budget and Law on Budget System. There is no obligation to adopt a multiannual strategic financial plan, whilst the School must submit a complete annual school budget plan.
The main categories of expenditures borne by the school include running costs for maintenance and teaching, costs for electricity, heating, water, training of employees, and pupils' extracurricular activities.
There are no official restrictions on the school's expenses, even if the available funds are limited.
The Secretariat for Education of the City of Belgrade is responsible for investments / borrowing / leasing decisions.

Energy management

The School does not directly monitor the energy consumption and related costs. From the bills it can be noticed that annual costs for heat are app. 65000 Euro and for electricity 8000 Euro. The only intervention to improve energy efficiency was the windows' replacement carried out in 2001.
Secretariat for Education of the City of Belgrade is the subject responsible for deciding and approving the new investments in energy efficiency, as well as to ensure their installation.
Currently, the School do not outsource energy services to specialized companies like ESCOs. One of the main barriers in the adoption of further energy efficiency measures is the **lack of funding**.

"Energy management at Belgrade University"

Interview with:

- Dragan Živić, Head of Technical Department, University of Belgrade, Faculty of Mechanical Engineering

Ownership and features of the school buildings

The University of Belgrade (Faculty of Mechanical Engineering) was built in 1960. The building's size is 37000 m2 and it hosts 2,840 pupils (+ 420 employees: teachers 189, associates 60 and non-teaching staff 171). The school is State-owned and under the Responsibility of the Ministry of Education.

Management procedures and administrative organization

Faculty of Mechanical Engineering has 24 Departments, which perform Teaching & Education and Scientific & Research activities. Each Department may establish Department Center as organizational unit for Research and Development activities, for teaching purposes and collaboration with industry. The Centres are associated in the Faculty Institutes. Head of the Department manages the work of the Department and Centre. The managing authorities of the Faculty are the following:

- Dean,
- Vice Dean for education,
- Vice Dean for R&D,
- Vice Dean for finances,
- Vice Dean for accreditation and organization,
- Heads of Departments (mostly for topics related to education)

The Dean is elected in a convergent procedure without competition, for three years, from the ranks of full professors. Members of Academic Scientific Council propose the candidate for the Dean by secret vote. Scientific Council submit its proposal to the Faculty Council for the final choice. The Dean has main duties:

- represents the Faculty;
- organize and manage all business operations of the Faculty;
- organizes and controls the educational, scientific and research activities;
- is responsible for law enforcement;
- proposes annual work program and development plan;
- designates the members of committees and other subsidiary bodies for the implementation and development matters within its jurisdiction;
- decides on the rights and obligations of the employer;
- perform other duties in accordance with the law, collective agreement and statute.

Department council proposes the Head of Department also by secret vote, among full professors. He is appointed by the Dean for the period of three years.

The Public Administration:

- performs the professional and pedagogical supervision at the Faculty;
- controls the appropriate use of funds;
- participates in the preparation of development plans of education and monitors its implementation.

Economic and financial management

Regarding the general financial obligations, the University applies the Law on Budget and Law on Budget System. There is no obligation to adopt a multiannual strategic financial plan, whilst the University must submit a complete annual budget plan.

The main categories of expenditures borne by the school include salaries, travelling costs, building maintenance, heating, electricity, tap water, telephone, and garbage removal.

There are no official restrictions on the school's expenses, even if the available funds are limited.
The Dean is responsible for investments / borrowing / leasing decisions.

Energy management

The University monitors the energy consumption and related costs. With reference to the year 2011, the energy costs are the following:

- Heating: 350,000 €
- Electricity: 95,000 €
- Water: 28,000 €
- Garbage removal: 45,000 €

Regarding the energy efficiency measures, the following interventions were performed: **balancing valves in hydronic heating system, thermostatic radiator valves for local heat output control, rotary wheel heat exchangers in ventilation systems**. The Dean is the subject responsible for deciding and approving the new investments in energy efficiency, as well as to ensure their installation. The maintenance of energy efficiency measures is under the responsibility of the **Head of Technical Department.**
For upgrading the existing building it is necessary to obtain a Building permit, and for the reconstruction, refurbishment and restoration in order to increase energy efficiency, the Faculty, as Investor, must obtain the approval for the works. Both documents are issued **by the Secretariat of Urban planning and construction of the City of Belgrade**.
Concerning the procurement procedures, small purchasing organized by the Faculty take into account energy efficiency criteria. Middle-size investments organized by the Faculty under public tender procedure, pay more attention to minimizing costs than to energy efficiency criteria. For large investments, carried out by the Ministry of education, or by City of Belgrade (as in the case of reconstruction of HVAC systems in 2006 at the Faculty of Mechanical Engineering) the prevailing influence in choosing technology providers is **minimization of costs**.
When deciding to adopt new energy efficiency measures, the main economic criteria considered are the payback period, the potential savings in bills, installation and maintenance costs (IRR is applied only for very big and long term investments).
Currently, the University **do not outsource energy services to specialized companies like ESCOs**.

Barriers

One of the main barriers in the adoption of further energy efficiency measures is the **difficulty in accessing funding**. At legislative level, a barrier consists in **the dominant influence of price** (and limited influence of energy efficiency criteria) in public tender procedures.

"Energy management in the schools of Hissarya, Bulgaria"

Interview with

- Mrs. Ivanka Bogunska - Head of Education Department of the Municipality of Hissarya

Ownership and features of the school buildings

The Municipality of Hissarya is owner of five schools:

- "Hristo Smirnenski" High School (Town of Hissarya);
- "Vasil Levski" Secondary School (Town of Hissarya);
- "Kliment Ohridski " Secondary School (Town of Hissarya);
- "Hristo Botev" Primary School (Village of Panicheri);
- "Hristo Botev" Primary School (Village of Krasnovo).

The type of ownership of schools is municipal property, with legal entity status under the Law of Public Education.

Management procedures and administrative organization

School boards are registered under the Act for Non-profit Purposes. The powers and responsibilities of school boards are regulated by **Law of Public Education and Implementing Regulations of the Law on Public Education**.

The **School trustees** are independent voluntary associations to support the development and provision of substantive school, kindergarten and service units. Each school, kindergarten or servicing can create only one board of trustees. The trustees can be established for a group of schools, kindergartens and servicing units. The boards of trustees were created as non-profit organizations to perform a community service and organise activities in accordance with the law under the terms and procedures of the non-profit purposes and in accordance with the provisions of this act, the statutes or founding act.

In order to achieve its goals, trustees:

- discuss and make proposals to the relevant authorities for the development or resolution of current problems in a school, kindergarten or servicing unit;
- help provide additional financial and material resources for a school, kindergarten or servicing unit and monitor their proper spending;
- support the establishment and maintenance of the equipment of the school, kindergarten or servicing unit;
- participate in the selection of textbooks by a teachers' council, which will train students in school and be offered for purchase;
- assist in the organisation of student nutrition, providing transportation and solving other social problems of children, students, school teachers, kindergarten or servicing unit;
- support the development and implementation of educational programs devoted to children and students;
- assist schools and local authorities in the implementation of compulsory education;
- facilitate the implementation of extra-curricular forms, organized recreation, tourism and sport with children and students;
- promote the involvement of parents in organising leisure time for children and students;
- propose measures to improve the operation of the kindergarten, school or service unit;
- organize the public to support the kindergarten, school or service unit;
- alert authorities to violations in the public education system;
- organise and help educate parents on the upbringing and development of their children;
- support the school in its efforts to counter drugs and other harmful influences on children and students; and assist disadvantaged children and students; and assist committees to combat antisocial behaviour in juveniles.

The Board of Trustees will be established on the initiative of the directors of the kindergartens, the schools or service unit or the parents, teachers or public. The directors of the kindergarten, the schools or service unit provide free use of the boardroom suitable for carrying out its activities.

Economic and financial management

Municipal schools have **their own budget, which is prepared mainly on the basis of uniform national standards**: the number of students multiplied by the relevant factor. The distribution of budget funds is determined by the Director and Chief Accountant. Municipal schools **may be additionally funded by the Municipality**, which is a decision of the municipal council. School buildings are municipal property and in accordance with the Municipal Property Act, the municipality is responsible for basic repairs. Each school is obliged to prepare a budget for each calendar year. The main categories of expenditures borne by the Schools of Hissarya are:

- Wages and salaries;
- Insurance payments;

- Materials and external services;
- Repair;
- Electricity, water, telephone, electricity;
- Heating costs;
- Training costs;
- Costs of consumables and supplies;
- Work clothes;
- Qualification costs;
- Social and cultural services.

Existing restrictions on the expenses of municipal schools are established within the annual budget plan. Delegated budgets of small schools usually do not allow earmarking for large investments. Control on the running energy costs of a municipal school is not a common practice; most monitoring is done on payment documents. The selection of alternative investments in energy efficiency is made mainly on the basis of **cost criteria**. The Department "Territory Planning" coordinates project documentation including expenses analyses in relation to the payback period.

Energy management

Energy renovation (**windows replacement** and **thermo-modernization**) is the most common energy efficiency measure already adopted in most municipal schools. Replacement of existing boilers with RES installations, energy management systems introduction are rare events.

The Principal is responsible for approving decisions on investments in energy efficiency measures that are not associated with major repairs and are not associated with large investments; otherwise the **municipality is responsible for the approval of investments**. According to the Energy Efficiency Law, four school buildings, mentioned above, **have had energy audits** with recommended energy efficiency-measures for implementation over a three-year period.

"Hristo Smirnenski" Secondary School (Town of Hissarya) is included in the *Social Investment Fund (CIF) program*. Some of Hissarya's schools are included in the **Operational Program for Energy Efficiency of the Ministry of Regional Development and Public Works.**

Some of energy efficiency and RES technologies implementation might require construction and/or environmental permits. The **technology providers are chosen based on the size of the intervention**: for large interventions the reference framework is the Public Procurement Act, whilst for the award of small contracts other regulations apply. Municipal schools typically follow regulations for the award of small contracts.

Schools can sign contracts **after collecting at least three bids** containing technical and financial specifications, in the following cases:

1. for construction activities - from 45k to 200k BGN (23.008 ÷ 102.258 EUR) (excluding VAT),
2. for provision of services - from 15,000 to 50,000 BGN (7.669 ÷ 25.565 EUR) (excluding VAT)

Schools can sign contracts **without collecting three bids** when they are below the following thresholds (without VAT):

- for construction - less than 45,000 BGN, (23.008 EUR) - excluding VAT
- for provision of services - less than 15,000 BGN (7.669 EUR) - excluding VAT

Currently, Hissarya municipal schools **do not have contracts with ESCOs**.

Main barriers

The main barriers to the adoption of more energy-efficient technologies are the budgets of schools as a secondary administrator, the difficulty in finding financial resources and the lack of tradition and skills for fund-raising activities, including project development both by school management and the school trustees. The legislative framework is not considered a barrier to the introduction of alternative/innovative technologies in municipal schools.

"Energy management at Professional School for Electrical Technology and Electronics (PSETE), Plovdiv"

Interview with:

- Ms. Stoynaka Anastasova, Principal and Ms. Katya Ivanova, Chief Accountant - Professional School for Electrical Technology and Electronics (PSETE), Plovdiv

Ownership and features of the school buildings

The Professional School for Electrical Technology and Electronics (PSETE) is located in Plovdiv (Bulgaria) and it is **owned by the Ministry of Education, Youth and Science** (MEYS). The School is housed in two buildings: a 4-floor building and a 3-floor building; total buildings area is 2 900 m^2. By 2012, the school had 847 students, with staff and employee members numbering over 85. The number of visitors of the school is more than 30 people per day.

Management procedures and administrative organization

The **Principal** of the Professional School for Electrical Technology and Electronics is responsible, takes decisions and **approves any investment** in energy-efficiency measures implementation that do not exceed the allowable funds of the school budget. **The decisions for larger investments are adopted by the MEYS**.
The organisational and administrative structure of the school include the following roles: Principal, assistant principal, chief teachers, senior teachers, teachers, junior teachers, employees, workers.
The school is state-owned, and the **role of Public Administration** (Ministry of Education, Youth and Science) **is to monitor the spending of funds**. The Ministry also **monitors compliance with the state educational requirements**, including:

- minimum requirements for admission qualification and level of education for students and adults;
- qualification requirements – practical educational activities, responsibilities, working condition requirements, requirements for equipment and tools;
- provision of opportunities for professional development under the National Classification of Occupations and Positions (NCOP);
- objectives for the training activities– skills and knowledge;
- requirements for equipment for training in theory and practice.

State educational requirements for acquiring professions qualification provide the necessary information relating to individual career planning and the development of human resources in enterprises, developing curricula, training and assessment of competence of staff, and the development of proposals for changes in the content of training.
The **school's board of trustees** is a non-profit organization, with members selected on a voluntary basis. The purpose of the board of trustees is to support school activities. Trustees elect the Board of Trustees and Monitoring Committee.

Economic and financial management

The budget assigned to the school is **based on the number of students**. PSETE is not obliged to submit a long-term financial plan, but is required to submit a comprehensive annual budget plan.
The school has the following main categories of expenses:

- Wages and insurance payments;
- Materials and external services;
- Electricity, water, heating costs and communication costs;
- Training costs;
- Consumables and supplies;
- Work clothes;
- Social and cultural services.

The restrictions on the school expenses are established within its budget. **The allocation of the budget funds is determined by the principal and the chief accountant, who are also responsible for investments and/or loans**.
School buildings are state property, and **the MEYS approve the funds for major repairs and costs that are above the school budget**. The school participated in a few European and national projects and operative programs organised by the MEYS.

Energy management

The energy consumption in the school is monitored and evaluated regularly. It includes **monthly monitoring of electricity consumption and comparison with historical data**. In addition to the heat supplier measurements of heat, **an external firm helps the school to analyse energy consumption**. The school buildings have been **energy audited** with recommended energy-efficiency measures that have to be implemented within a period of three years: **replacement of the coal boilers with district heating supply, radiators replacement, windows replacement, and the replacement of old fluorescent lamps with new energy-efficient ones**.
At this moment, most of these energy-efficiency measures have been implemented. In addition, **electronic control of thermal energy distribution was implemented**.
As a principal, Ms. Stoynaka Anastasova **is responsible for approval of the smaller energy-efficiency investment** and the implementation of energy-efficiency measures, as well as for the maintenance activities. Some of the EE measure implementation requires construction permits, and the school has to organise the preparation of the necessary documentation.
The procedure for small public procurement is organised according to the following steps:

1. taking decision for small public procurement, including terms for execution;
2. publishing of the announcement;
3. conditions and size of the procurement guarantee;
4. the school defines the technical specifications;
5. examination, evaluation and classification of the bids;
6. signature of a procurement contract with the selected provider;
7. information provision to the public about the bid selected

The school currently **does not have contracts with ESCOs in place**. It has developed a draft contract to be used in contracting with a company for the electronic control of heat.
Regarding the adoption of new/alternative EE technologies, the **payback period and reduced energy consumption** are the main criteria for decision.

Main barriers

The main problems in terms of interaction with investors and obtaining private and public funding are: an absence of guarantees, a lack of capital, a lack of financial basics in terms of liquidity, and the absence of the possibility to apply for bank and other financing.
The need to obtain the approval from the Ministry of Education, Youth and Science for new large investments is the main legislative barrier to the introduction of new energy-efficiency technologies in schools.

“Energy management in a Turkish primary school”

Interview with:

- Mrs. Banu Özkaya - ANADOLU PRİMARY SCHOOL

Ownership and features of the school buildings

The ANADOLU Primary School located in Ankara was built in 1969. The building’s size is 3040 m2 and it hosts 1010 pupils. The school is public-owned and under the responsibility of the Ministry of Education.

Management procedures and administrative organization

Management of the school is carried out by a **School Manager and a Deputy Manager**. Two officers and three servants are supporting them. Under this management, there are three groups of teachers: Kindergarten, classroom and branch teachers. One Special Education Teacher and one Counsellor are supporting teachers. Manager and Deputy Managers are **appointed centrally by Ministry of Education** every five years. Ministry takes in to account their scores and choices when appointing. Both managers are responsible for everything in the school, education, building maintenance, cleaning etc.
Public Administration is responsible for providing finance, curriculum, appointing School Manager and Deputy Managers, supervising training materials.

Economic and financial management

Regarding the general financial organisation, for primary schools fuel, electricity, water, telephone costs **are directly paid by local public authority**. Cleaning, and other **daily maintenance costs are paid by School Parents Associations**. Staff salaries are paid centrally by the Ministry.
There is no obligation for Primary Schools to submit a multiannual strategic financial plan nor a complete annual school budget plan. There are no official restrictions on the school's expenses. The Local Public Authority is responsible for investments / borrowing / leasing decisions.

Energy management

Currently, there are not in place systems for monitoring energy consumption in ANADOLU Primary School. There are no energy efficiency measures implemented in the school.
Regarding the selection of technology suppliers, the Technical Office of the Local Public Authority define the technical requirements, according to needs of the schools. After then, Technical Specifications are prepared and a tender is issued. The school currently **does not have contracts with ESCOs**. Regarding the adoption of new/alternative EE technologies, the **payback period and the installation/maintenance costs** are the main criteria for decision.

Main barriers

Since the School manager has not the decision making power to adopt new energy efficiency technology, the main barrier consists in convincing the Local authority to put the energy efficiency investments in schools among their priority list of the year.

"Energy management in a Turkish vocational High School"

Interview with

- Mr. Şeref Kantoğlu - ANKARA TOURISM AND HOTEL MANAGEMENT VOC. HIGH SCHOOL

Ownership and features of the school buildings

The Tourism and Hotel Management Voc. High School is a secondary school located in Ankara and built in 1961. The building's size is 8563 m2 and it hosts 585 pupils. The school is public-owned and under the responsibility of the Ministry of Education.

Management procedures and administrative organization

The school is being managed by one **School Manager, one Coordinating Deputy Manager, three Deputy Managers and one Technical Deputy Manager**. Under this management, there are three vocational departments, managed by Department Chiefs. Teachers are classified in two groups: Vocational teachers and General Subjects teachers.
As a general rule, Manager and Deputy Managers **are appointed centrally by Ministry very five years**. There are one manager and six deputies, one of the deputies are coordinating deputy and one of them is

responsible for technical issues. Other deputies are responsible for management of one class level, for example: class 1, class 2, etc.
Department chiefs are responsible for maintenance of training, workshops, equipment and materials.
Public Administration is responsible for providing finance, curriculum, appointing School Manager and Deputy Managers, supervising training materials.

Economic and financial management

Regarding the general financial organisation, Secondary schools receive **public grants from the Ministry of Education**. Fuel, electricity, water, telephone costs and workshop consumables are covered by this central public grant, whilst cleaning and other daily maintenance costs are generally covered by **School Parent Association**. Staff salaries are paid centrally by the Ministry.
There is no obligation for Secondary Schools to submit a multiannual strategic financial plan nor a complete annual school budget plan (the amount of central public grant is decided according to grant of previous year). There are no official restrictions on the school's expenses.
The **Local Public Authority** is responsible for investments / borrowing / leasing decisions.

Energy management

Currently, there are not in place systems for monitoring energy consumption in Ankara Tourism and Hotel Management Voc. High School, nor energy efficiency measures already implemented.
Regarding the selection of technology suppliers, the Technical Office of the Local Public Authority define the technical requirements, according to needs of the schools. After then, Technical Specifications are prepared and a tender is issued.
The school currently **does not have contracts with ESCOs**. Regarding the adoption of new/alternative EE technologies, the **payback period and the installation/maintenance costs** are the main criteria for decision.

Main barriers

As in the case of Primary Schools, since the School manager has not the decision making power to adopt new energy efficiency technology, the main barrier consists in convincing the Local authority to put the energy efficiency investments in schools among their priority list of the year.

"Energy management in a Portuguese combined Primary and Secondary School"

Interview with

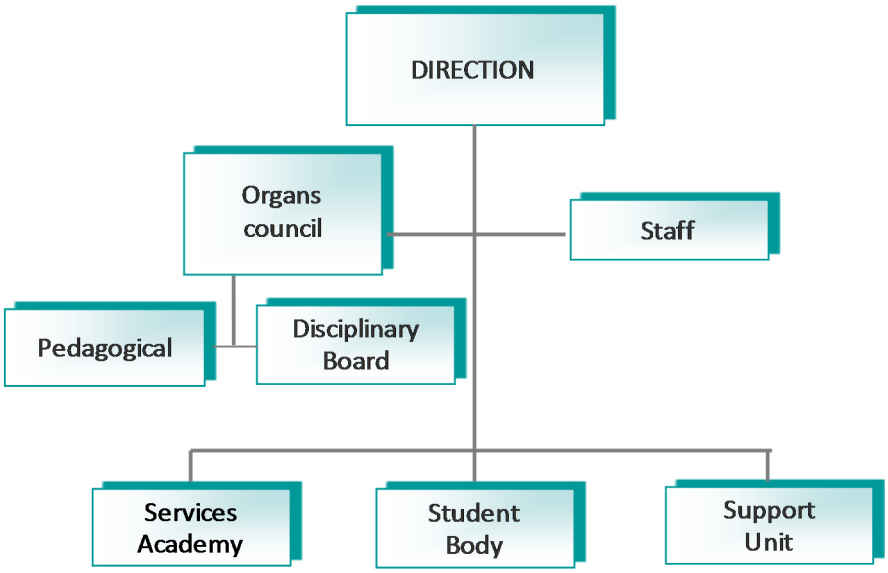
- Mr. Miranda Soares (Coronel) - Institudo dos Pupilos do Exército - Lisboa, Portugal

Ownership and features of the school buildings

The school is owned by the Ministry of Defense / Army. The school provides both primary and secondary education. The school was built in 1911 and is 1000m2.There are 207 pupils.

Management procedures and administrative organization

The Director is appointed by the Chief of Staff of the Army. The responsibilities and powers derive from the military legislation and legislation in force in public education. The school as such is publically owned but does not provide public education. The guardians pay fees for the students to attend the school. The following is you're the school's organization chart.



Economic and financial management

The school depends on the financial system and the Army's own revenue from the fees paid by the Guardian according to their income status and frequency of Students (External / Internal).
There are no official restrictions on the school's expenses.
The types of expenses in the school are to:

- Repairs
- Transport
- Training
- Costs of health
- Cleaning and hygiene
- Fuels and lubricants
- Food
- Office
- Communications
- Clothing and personal items
- Charge facilities
- Conservation of goods
- Technical assistance

The School Director with support from parent organization is responsible for investments / borrowing / leasing decisions. The Chief of Staff of the Army on a proposal from the Director of School is responsible for deciding and approving investments in EE measures.
The Commander of the Support Unit is responsible for installing and maintaining EE measures.
The following tender procedure is used to select technology providers:

1st. Technical opinion manifestation of needs
2nd. Select multiple suppliers
3rd. Budget request to all
4th. Selection of the most economically advantageous budgets
5th. adjudication

There are no contractual arrangements with technology providers and the school does not avail of ESCOs. The funding of EE measures comes from the school budget and no payback criteria have been used when for implementing the EE measures.

Energy management

The school monitors its energy consumption with daily readings of consumption (water, electricity and gas.). The energy efficiency measures/technologies already adopted include:

- Daily monitoring of consumption;
- Continued placement Electronic Ballasts;
- Replacement Projector Lamps and by traditional light bulbs;
- Using equipment in periods of lower tariff;
- Optimization of energy tariffs;
- Improved Thermal Insulation (double glazing);
- Placement of light sensors.

Main barriers

There are no known legislative barriers that could prevent the school from adopting new EE technologies.

"Energy management in Scoil Eanna – A small primary school in Ireland"

Interview with

- Mr. Fergal Connaire – School Principal

Ownership and features of the school buildings

The vast majority of primary schools are owned by the religious denominations and run by a board of management. Scoil Éanna is a Catholic school and is under the patronage of the Bishop of Clonfert. There are deeds of trust signed by the owners, which ensure that the school will continue to be used as such. The Education Act 1998 clarifies and restates the fact that the board of management does not acquire any right over or interest in the land or buildings of the school for which it has responsibility. The school building is owned by the Department of Education & Skills. The land is on a 99 year lease from a local farming family.
There are currently 178 pupils. The school consists of a school building with 3 classrooms, an office, kitchen and storage space. The main school building was built in 1967. There are 4 prefabricated buildings which have been added over the past 8 years as the school pupils numbers has risen dramatically. Two of the newest prefabricated buildings installed in the past 2 years are now located on adjoining land donated to the school by a local farming family. The school has lodged an application for a new school building to be built on land nearby. The land has already been acquired but so far funding has not been made available from the department of Education & Skills to build the new school. 2 of the prefabricated buildings are leased and the other 2 have been purchased outright by the school themselves through their own fundraising.
The main school building is heated by oil boiler with radiators. The prefabricated building as are electrically heated using various types of storage heaters. No options other than electricity were provided for heating the prefabricated buildings.
Scoil Éanna is staffed by a teaching principal, four assistant mainstream teachers, two support teachers, three special needs assistants, a part-time secretary and a part-time caretaker.

Management procedures and administrative organization

Scoil Eanna, like most primary schools are run by a board of management.

The composition of the board of management is:

- two direct nominees of the patron
- two parents of children enrolled in the school (one mother and one father) elected by the parents
- the principal
- one other teacher elected by the teaching staff.
- two extra members agreed by the representatives of the patron, teachers and parents.

The members of the board may not hold any interest in the school property or get paid for serving on the board. The Education Act 1998 explicitly clarifies that being on the board does not confer any property interest on a board member. Employees, other than the teacher representatives, may not be on the board.

Essentially, the board manages the school. Among other things:

- It has responsibility for drawing up the school plan and for ensuring that it is implemented.
- It appoints the principal, the teachers and other staff.
- It must ensure that the school fulfils its functions as set out in the Education Act 1998.
- It must promote contact between the school, the parents and the community and must facilitate and give all reasonable help to a parents' association in its formation and its activities.
- It has overall responsibility for the school's finances. The school is registered for VAT. It is obliged to have comprehensive insurance cover for the school. It must keep proper accounts, which may be audited by the Department of Education and Skills and/or the Comptroller and Auditor General. Its annual accounts must be available to the patron and the school community.

The Education Act 1998 clarifies and restates the fact that the board of management does not acquire any right over or interest in the land or buildings of the school for which it has responsibility.
The board of management has identified priorities for future attention including the acquisition of appropriate accommodation, the promotion of greater use of information and communication technologies (ICT) as a strategy for teaching and learning, and revision of the learning-support and resource provision.

Economic and financial management

Traditionally, the site for primary schools was provided locally - either directly by the patron or as a result of local fundraising.
There is significant local contribution to the building costs and the running costs.
The State pays a direct capitation grant of per student to each primary school. The State pays the teachers' salaries. Enhanced capitation grants are paid for children with special educational needs in special schools or who attend special classes in mainstream schools. Capitation grants are used for the day-to-day running of schools and for teaching materials and resources.
Primary schools also receive a grant for caretaking and secretarial services (called the Ancillary Services Grant Scheme) and this is based on student numbers and depending on whether the school gets the full-rate or half-rate grant. The school also receives a book grant based on number of students.
Significant renovation projects are the responsibility of the Department of Education and Skills. A summer works grant is available from the Department of Education & Skills. The conditions for applying for these grants can change each year and depends heavily on the economic climate. In recent years, one of the criteria for applying for a grant is that the school must get a Display Energy Certificate (DEC) label.
The school is responsible for energy expenditure and day-to-day maintenance. Each school gets a grant towards the cost of minor works. Emergency funding is also available if above a certain threshold. For any building and services related projects, the school employs the services of local engineers to help with managing any projects including applying for government grants and liaising with contractors and the government department.
Alternative energy efficiency investments have not been considered for the current school facilities because they are applying for a new school building. The only alternative technology considered is a ground source heat pump but there is no room for this investment in current school facilities.
The **most frequently used forms of financing** for supplementing the government funding for day-to-day costs and also any extraordinary expenditure is local fund raising through and an annual Christmas concert and other similar events.
Regarding the **tender procedures and criteria** for the selection of energy services and installations suppliers, the school follows the public procurement guidelines based on EU and national rules. For small projects, the school get quotes from 3 different suppliers.

Interventions in the energy sector

Electricity meters are manually read by the students as part of the Green Flag programme. The school does not avail an Energy manager nor of the services provided by an ESCO.

The main interventions to reduce energy consumption in the main school building has been the installation of roof and cavity wall insulation, replacement of windows with PVC double glazed windows and the a new boiler. These works were carried out in 2004/2005 under the summer works grant scheme.

The main obstacles to the adoption of more energy-saving technologies are the difficulty in finding financial resources and the lack of specialized skills among the staff that should take care of the management of new technologies.

Barriers

With regard to the barriers encountered in accessing financial resources, the school relies heavily on the government for funding of significant projects. The school can raise investment but the responsibility of servicing and repaying these investments is with the board of management and ultimately with the patron of the school. The board of management is recognised as a corporate entity and expected to act in a responsible manner.

"Energy management in an Irish Secondary School"

Interview with:

- Retired School Principal (retired in 2012)

Ownership and features of the school buildings

This secondary school is a catholic school operated under the patronage of the bishop of the diocese. The school building is located on a large area of land and has approximately 440 students. The school was built 100 year ago. Heating is provided by natural gas. The school has approximately 50 teaching staff.

The school facilities also used extensively by external organisations such as sports clubs. This provides a much needed supplementary income.

Management procedures and administrative organization

This secondary school is run by a board of management with 8 members, 4 appointed by the patron, 2 staff members and 2 parent representatives.

Economic and financial management

The State pays a direct capitation grant for each student. State funding is supplemented by hiring out school facilities such as the gym to sports clubs and teaching halls for night classes. The car park is also used for fund raising.

The school has overall responsibility for the school's finances. The school is registered for VAT. It must keep proper accounts, which may be audited by the Department of Education and Skills and/or the Comptroller and Auditor General. Its annual accounts must be available to the patron and the school community. The JMB provide support in preparing annual financial statements.

Financial planning is mainly based around annual budgets and estimates.

The school is responsible for energy expenditure and day-to-day maintenance. The main expenses are heating, electricity and insurance. The total energy bill is approximately €80.000 per annum.

Because of the significant land available around the school, investment in wind energy has been discussed but no plans have yet been developed.

The **most frequently used forms of financing** for supplementing the government funding for day-to-day costs and also any extraordinary expenditure is through local fund raising and hiring out the school facilities to sports clubs and other organisations.

Interventions in the energy sector

All the windows were replaced between 1997 and 2000 to double glazing windows.
An energy audit was carried out by Sustainable Energy Authority of Ireland (SEAI) over 2 year ago. One of the main recommendations was to change from oil heating to natural gas heating with the replacement of a more efficient boiler. This has resulted in significant energy savings with an expected payback of less than 3 years.
The energy audit carried out by SEAI has been the driver for many other energy saving initiatives. Not only did energy savings but also included information on costs and payback to help with decisions making to implement these changes. Other recommendations include the installation of motion sensors, on-going replacement of light fixtures and fittings with more energy efficient options. The school is also currently implementing a zoned heating infrastructure.
Electricity, gas and water meters are manually read on a regular basis by students. The school **does not have an Energy manager nor are any energy services provided by an ESCO**. A big issue is implementing changes in the lack of personnel. The investigation of different projects is usually always the responsibility of the Principal.
The main obstacles to the adoption of more energy-saving technologies are the difficulty in finding financial resources and the lack of specialized skills among the staff that should take care of the management of new technologies.

Barriers

With regard to the barriers encountered in accessing financial resources, the school relies heavily on the government for funding of significant projects. The school has been able to raise investment for other projects and the responsibility for repaying these investments is with the board of management and ultimately with the patron of the school.

The following table summarized the results and collected information from the interviews.

Interviewed												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
Schools owned by Municipality of Lesa	Schools owned by Municipality of Genoa	Schools owned by Municipality of Turin	Electro-Traffic Technical School (Kraljevo)	Peta Beogradaska Gimnazija (Belgrade)	University of Belgrade	Schools owned by Municipality of Hissarya	Professional School for Electrical Technology and Electronics (Plovdiv)	Anadolu Primary School	Ankara Tourism and Hotel Management High School	Institudo dos Pupilos do Exército	Scoil Éanna Primary School	Secondary School

School Building' Ownership												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU

School Building' Features												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
Building hosting a nursery + kindergarten (600m^2) + 1 Building hosting Primary and Secondary school (1700 m^2)	204 school buildings, which host nurseries, primary and secondary schools.	School buildings (volume 3,982 m^3) are 53% of the overall public building stock owned by the City of Turin	1 School building (3266 m^2 - heated 2533 m^2)	1 School building (6105 m^2)	1 School building (37000 m^2)	5 School buildings hosting Primary and Secondary schools	2 School buildings (total area 2900 m^2)	1 School building (3040 m^2)	1 School building (8563 m^2)	Primary and Secondary Education Professional. Year of construction 1911. 1.000 m^2. Number of pupils 207.	Primary school built in 1967 with 187 pupils housed in one main permanent building and 4 prefabricated buildings.	Secondary School built 100 years ago with 440 pupils on 30 acres of land.

Main Stakeholders and their role												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
City Council: adopts and approves new EE investments. **Municipality Technical Office**: performs ordinary & extraordinary maintenance in schools. **School administration**: is informed about maintenance and new EE investments, but has no decision-making powers.	**City Council:** adopts and approves new EE investments, following plans proposed by the **Environment Health and Energy Dpt.** **Property Management and Sport Dpt.**: performs ordinary and extra maintenance of thermal energy installations. **ASTER**: manages electrical installations. **Accounting and Finance Dpt.**: is in charge of finding and managing financial resources	The 'Smart Schools' project was promoted by **Municipality of Turin** (**Educational Policies Dpt.**) and deployed by their offices **School Buildings Service** and **School Mgt Services** in cooperation with Torino Smart Cities Foundation, ITER, Consorzio Pracatinat and other stakeholders	The liability for new EE investments lies with the **School Director**, and the **School Board.** Permits for EE measures are issued by Municipality of Kraljevo (Urban Planning Dpt.).	**School director and School Board** are responsible for small service and repairs. Larger investments must be approved by the **Secretariat for Education of the City of Belgrade**.	**The Dean** is responsible for deciding and approving new investment in EE. **The Head of Technical Dpt.** is in charge of ordinary service activities. Approvals for EE measures are issued by the Secretariat of Urban Planning of **the City of Belgrade.**	The **School principal** is responsible for small repairs; larger investments in EE must be approved by the **Municipality.** The **School Board of Trustees** are independent voluntary associations to support schools' innovations.	The **School principal** is responsible for adopting EE measures; larger investments in EE must be approved by the **Ministry of Education, Youth and Science**.	The **Municipality of Ankara** manages investment decisions. Daily service costs are covered by **School Parents' Association**.	The Municipality of Ankara is responsible for investment decisions. Daily maintenance costs are covered by **School Parents' Association**.	School of the Ministry of Defense / Army. Director is appointed by the Chief of Staff of the Army. The liability and powers derive from the military legislation and legislation in force in public education	School building owned by Government but **run by local Board of Magt** which includes chairperson appointed by patron and Principal	School **run by local Board of Mgt** which includes chairperson appointed by patron and Principal

Main EE investments adopted												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
Program of energy audits on public buildings. Windows' and doors' substitution. Replacement of heating and lighting installations	Heating systems' retrofitting (from heating oil to natural gas). Windows' and doors' substitution. A SEAP was adopted in 2010, containing specific plans for school buildings: energy audits, installing PV plants, use of Energy certification, monitoring energy consumption	The 'Smart Schools' project envisages the following actions: energy audits of existing building stock; innovative retrofitting models; application of indoor comfort solutions; training modules for school buildings design; retrofitting school playgrounds; sustainable mobility network to the service of schools	Substitution of old heating substation with new one with automatic control; Windows' substitution; Walls and roof insulation	Windows' substitution	Balancing valves in hydronic system; Thermostatic radiator valves for local heat output control; Rotary wheel heat exchangers in ventilation systems	Energy audits; Windows' replacement; Thermo-modernization	Replacement of the coal boilers with district heating supply; Radiators' and windows' replacement; Replacement of old fluorescent lamps	NO	NO	Daily monitoring of consumption; Continued placement Electronic Ballasts; Replacement Projector Lamps and by traditional light bulbs; Using equipment in periods of lower tariff; Optimization of energy tariffs; Improved Thermal Insulation (double glazing); Placement of light sensors.	Roof and cavity wall insulation and new windows in main school building in 2004/2005.	Windows replaced 20 year ago. Oil replaced by gas 2 years ago with expected 3 year payback. Others include motion sensors and replacement of light fittings.

Automated system for monitoring Energy consumption												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Contracts with ESCOs												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
NO	NO	NO	NO	NO	NO	NO	NO (but an external firm helps the School analyze energy consumption)	NO	NO	NO	No	No

Forms of financing for EE Investments												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
Own resources (Municipal budget). **Grants** at local level. **Loans**	**Own resources** (Municipal budget). Grants at regional, national and EU level (ad hoc grants for energy retrofitting in schools issued by Ministry of Environment). **Loans**. Under evaluation the submission a request of funding under ELENA (European Local Energy Assistance Facility)	The pilot phase (energy retrofitting of 6 schools) of the project was funded via **Structural Funds (ERDF)**	**Own resources** (from Ministry of Education/Municipal budget) **KfW Credit Program** (German development bank)	**Own resources** (from Ministry of Education/ Municipal budget)	**Own resources** (from Ministry of Education)	Municipal schools have **their own budget**, calculated according to uniform national standards. Some schools benefit of **Structural Funds** (O.P. for Energy Efficiency of the Ministry of Regional Development)	**Own resources**	**Own resources** (form Municipal budget)	**Own resources** (from Ministry of Education)	**Own resources** (School budget) The school depends on the financial system and the Army's own revenue from the fees paid by the Guardian according to their income status and frequency of Students (External / Internal).	Own resources (from department of Education and local fund raising). Summer works grants available for small individual projects.	Own resources

Barriers												
1	2	3	4	5	6	7	8	9	10	11	12	13
IT	IT	IT	SR	SR	SR	BG	BG	TR	TR	PT	IRL	IRL
Lack of funds. Slowness in the procedure of earmarking public grants. Lack of specialized skills to manage EE technologies	Lack of technical skills to manage VSNavigator. Cost of installation compared to the savings generated by VSNavigator must be enough convenient. VSNavigator should by centrally managed to be effective.	Difficulties in accessing loans. Slowness in the procedure of earmarking regional public funds. Rigid regulatory framework at school administration level	Lack of funds	Lack of funds	Lack of funds Dominant influence of cost criteria (and scarce influence of energy efficiency criteria) in public tender procedures.	Difficulties in accessing loans - Lack of skills for fundraising activities	Difficulties in accessing loans; Lack of guarantees; Need to obtain approval from Ministry of Education, Youth and Science.	Difficulty of convincing Local Authority to put EE investments in schools among their main priorities.	Difficulty of convincing Local Authority to put EE investments in schools among their main priorities.	Not Applicable	Lack of funding. Board of Management can raise finance but are ultimately responsible for repayment of financing etc.	Lack of funding. Lack of personnel. Board of Management can raise finance but are ultimately responsible for repayment of financing etc.

Case Studies: summary of key findings

- Thirteen interviews were conducted in the following Countries: Italy, Serbia, Bulgaria, Turkey, Portugal and Ireland. Among the interviewed there are both Schools administrators and Public Authorities representatives. In all cases analyzed schools are **publicly-owned**.
- Regarding the **administrative procedures and management** generally the Municipality, through the City Council, has the power to adopt and approve new energy efficiency investments. The measures to be adopted are usually suggested by the School Administration and/or by the Departments of the Municipality in charge. Ordinary and extraordinary energy and electrical installations' maintenance is performed by the municipal Technical Office in charge. The School administration is generally responsible only for small repairs, but do not have decision-making powers on new energy investments.
- Concerning **the already implemented investments in energy efficiency**, the most common types of interventions are the windows' and door's replacement, thermo-modernization (radiators' replacement, substitution of old heating substations), lighting installations' substitution. More advanced interventions are planned in large cities like Turin and Genoa, in the framework of their Sustainable Energy Action Plans. For example, the Municipality of Turin launched a 'Smart Schools' project which will include energy audits of the whole school building stock, study of innovative retrofitting models, application of indoor comfort solutions, training modules for school buildings design, sustainable mobility network to the service of school.
- **Automated systems for monitoring energy consumption** (as the Energy Action Navigator developed under VERYSchool) are generally not applied. Energy service **contracts with ESCO** are not yet widespread.
- As to the **criteria for selecting among alternative new investments**, the payback period and the installation/maintenance costs are the most used in the considered cases. Selection criteria based on energy efficiency and generated energy savings are usually not applied.
- **The most typical forms of financing** used to cover running expensed and new investments are the following: own resources (from Municipal budget or from Ministry of Education) / public grants at regional, national and EU level / Structural Funds / loans from commercial banks. In the case of Genoa, it is under evaluation the submission a request of funding under ELENA (European Local Energy Assistance Facility), an EIB facility to support Public Authorities in implementing their Sustainable Energy Action Plans. It is also interesting to note that in Italy ad hoc grants for energy retrofitting in schools were issued by the Ministry of Environment ('*Il sole a scuola*').
- As to the **main barriers in adopting new investments in energy efficiency**, most of the interviewed mentioned: lack of funds, difficulties in accessing loans, slowness in the procedure of earmarking regional public funds, lack of specialized skills to manage energy efficiency technologies, difficulty of convincing Local Authorities to put energy efficiency interventions in schools among their main priorities.

10 Next Steps and Future Work

Outputs from Task 4.1 and Contents of project deliverable D4.1 “ICT business model for schools” will be used in WP8 for project deliverable D8.5 “Valuable Action Plan” and the Exploitation strategy as well.

11 Implications for other Work packages

The upcoming process will be oriented towards the development of a commercial business model in order to prepare a future integration of **VSNavigator** in the real market.

12 Conclusions

Innovative business models and energy financing methods are being developed to face new energy market challenges.

High and volatile oil and energy prices, as well as severe power shortages are key drivers for the development of energy efficiency and energy management.

The business model is the first “brochure” for the sale of the Navigator and is an important tool for creating economic and social value to the society and to the organizations.

ICT have provided companies with the potential to develop new forms of creating value from mature stage technologies converting it into new market outcomes.

The business model description is based on Canvas business model generation by Alexander Osterwalder. The business model Canvas is a strategic management template for developing new and innovative business models.

Measurement and Verification, awareness, operational risk, size of the projects, risk perception and governmental support are some the barriers and challenges that we need to address when discussing energy efficiency projects.

There are several business models that can be applied to the Energy Action Navigator and promote the energy management and energy efficiency. The procedures to create and develop a new business models are described in a detailed way.

Finance is a key factor to achieve progress towards a low carbon and more sustainable economy where we can identify **technology innovation**, **energy efficiency ventures** and **energy efficiency projects** as the **three main areas related to energy efficiency that will require financing**.

In the **bilateral interviews** done to assess the market exploitation of **VSNavigator** it was understood that **energy efficiency and energy management are of relevant interest**, but often **the energy management take a secondary role in schools management**.

The **main obstacles** to the adoption of more energy-saving technologies in schools are the **lack of financial resources** and the lack of **existing skills among the schools staff**.

A **deeper involvement of ESCOs** in the energy management in the public buildings can contribute to a wider dissemination of good energy management and energy efficiency procedures within school buildings.

13 References

[1]	http://en.wikipedia.org/wiki/Business_model
[2]	http://www.businessmodelgeneration.com/canvas
[3]	http://pt.wikipedia.org/wiki/Business_Model_Canvas
[4]	http://suaideiavale1milhao.com.br/saiba-tudo-sobre-business-model-canvas-parte-1/
[5]	A Handbook for Visionaries, Game Changers, and Challengers ,Alexander Osterwalder
[6]	http://sloanreview.mit.edu/the-magazine/2012-winter/53214/how-to-identify-new-business-models/
[7]	http://www.adb.org/site/funds/funds/clean-energy-financing-partnership-facility
[8]	http://www.iese.edu/research/pdfs/DI-0862-E.pdf
[9]	http://www.ictworks.org/sites/default/files/uploaded_pics/2011/Business_Models_to_Increase_Rural_Internet_Access_in_Mali.pdf
[10]	http://virtual.vtt.fi/virtual/proj3/cobtec/files/poms2004_hemila.pdf
[11]	http://www.bdi.eu/bdi_english/download_content/Marketing/Brochure_Internet_of_Energy.pdf
[12]	http://www.worldenergy.org%e2%80%99/
[13]	http://www.worldenergy.org/publications/energy_policy_scenarios_to_2050/appendices/appendix_b_specialist_perspectives/925.asp
[14]	Public finance mechanisms to catalyse sustainable energy sector growth, UNEP, 2005
[15]	Public Procurement of Energy Efficiency Services. Lessons from International Experience. World Bank, 2010
[16]	http://iet.jrc.ec.europa.eu/energyefficiency/european-energy-service-companies/energy-performance-contracting
[17]	Guide to financing energy smart schools, US Department of Energy,

14 Annex : Template for bilateral interviews

Background information

In order to assess the market exploitation potential of **VSNavigator** it will be essential to understand how Schools' stakeholders make their decisions from an administrative and economic perspective. The adoption of innovative energy efficiency technologies (such as **VSNavigator** developed in VERYSchool) is subject to authorization procedures, investment decisions, choice of the best financing mix, existing legislative ties.

These aspects will be studied by analysing some real cases (4 project's pilot cases + potential others if available) through ad hoc bilateral interviews. A common framework to conduct interviews in a consistent way has been established, and it is shown in the following template.

Template for bilateral interviews on management/economic/financial aspects

CASE STUDY XXX
GENERAL INFORMATION ○ *Name of the school* ○ *Name of the respondent* ○ *Address* ○ *Category of school (Nursery/Primary/Secondary/University)* ○ *Year of construction* ○ *Building's size* ○ *Number of pupils*
ADMINISTRATIVE ORGANISATION ○ *Type of ownership (private or public)* ○ *Legal status* ○ *Please describe your school's organization chart.* ○ *School board governance: how it is appointed or elected? How it is organized? Which are its responsibilities and powers?* ○ *If public school, what is the role of the Public Administration (duties and powers, means of surveillance)?*
GENERAL FINANCIAL MANAGEMENT ○ *Describe the general financial regulations* ○ *Is your school obliged to adopt a multiannual strategic financial plan?* ○ *Is your school obliged to submit a complete annual school budget plan?* ○ *List the types of expenses in your school* ○ *Are there any restrictions on the school's expenses* [14]*?* ○ *Who is responsible for investments / borrowing / leasing decisions?*
ADOPTION OF ENERGY EFFICIENCY (EE) MEASURES/TECHNOLOGIES

[14] For instance, in Italy the Stability and Growth Pact places restrictions on the expenses of Local Authorities.

CASE STUDY XXX
○ *Does your school monitor its energy consumption? If yes, please explain how and provide some details about your school's current energy costs.* ○ *List the EE measures/technologies already adopted.* ○ *Who is responsible for deciding and approving investments in EE measures?* ○ *Who is responsible for installing and maintaining EE measures?* ○ *Which kinds of authorizations are needed? Who can provide them?* ○ *How the technology providers are chosen? Please describe how the tender procedure is organized.* ○ *Which kind of contractual arrangements does your school establish with technology providers? Are there penalties / incentives if guaranteed energy savings are not / over achieved?* ○ *Does your school already avail itself of ESCOs? Please describe which services are offered and the contractual arrangements adopted.* ○ *Which financing source / financing mix was adopted to fund the adoption of these EE measures?* ○ *Which kind of economic criteria are considered when deciding to adopt a new EE technology (e.g. payback time, savings in bills, installation + maintenance costs, minimum Internal Rate of Return…)?* ○ *Describe the main problems you observed regarding the interaction with investors and the obtainment of private and public funding (e.g. lack of guarantees, undercapitalization and lack of financial basics in terms of liquidity, cash leverage, excessive length of selection procedure…).* ○ *Describe the main legislative barriers that could prevent the schools from the adopting new EE technologies.*