Sustainable Business Models for the Adoption of Energy Management Cloud Platforms within Enterprises

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***Abstract*—Nowadays, in order to adapt to increasingly dynamic market changes and ensure market competitiveness while enhancing energy efficiency, comfort and security in working environments, enterprises concern themselves with the adoption of novel business models, technologies and methodologies. The main purpose of this paper is to present author's conceptual model of a Cloud energy management system and to propose adaptations of EPC business models which can accelerate the market penetration of similar solutions. This paper provides an overview on the benefits and downsides that EPC (energy performance contracting) can provide to the business sector and financial institutions. It also presents marketing aspects associated with energy management solutions that aim to enhance energetic performance, comfort and security within enterprises from various domains.**

Keywords—Business Model, Energy Performance Contracting, Energy Management Cloud Platform, ESCO

I. INTRODUCTION

Within enterprises of all sizes and activity fields, monitoring the energy demand became one of the most important decision-making tools since companies use consumption data to stay competitive without neglecting the environment [1].

In the context of highly demanding environmental policies and growing energy costs, many enterprises tried to find more convenient financing sources for their investments and to adapt their business models in order gain competitive advantages [2].

Based on this, this paper briefly presents authors' conceptual model of an energy management Cloud platform and proposes business models based on "Shared Savings", "Guaranteed Savings" and „Chauffage" energy performance contracting [3]. These business models come to overcome existing barriers caused by the lack of financing options and technical expertise in adopting energy efficiency measures.

The rest of the paper is organized as follows: Section II presents the principles of energy performance contracting, analyzing functional and marketing aspects of energy management solutions, Section III describes authors' conceptual model of a Cloud energy management platform, Section IV proposes the business models which can be used to enhance the market penetration of solutions similar to the proposed one, while Section V concludes the paper.

II. RELATED WORK

In this section, we present funding methods used within EPCs, business models associated with energy performance contracting and energy management systems available on the global market.

A) Funding and models of energy performance contracting

When energy performance contracting first came to the market, ESCO (Energy Service Company) entities were performing both technical and financing activities since financial institutions were reticent when it came to EPC projects. Nowadays, ESCOs do no need to struggle with project financing, because there is a competitive marketplace with financial institutions willing to provide support for new investments.

Financing can either be ensured by the ESCO itself or by the customer, ESCO being responsible for providing a savings guarantee. To finance the investment, ESCOs or their customers can either use personal capital or involve a third party as a credit source [4].

Energy performance contracting can rely on various models, "Shared Savings" and "Guaranteed Savings" being the most common [5].

A "Shared Savings" model implies that the energy savings are shared between the ESCO and the customer in accordance with a pre-arranged percentage over the term of the contract. The ESCO uses the savings to repay the loan to the financing institution and, in return, guarantees a certain level of energy efficiency. Since the client takes over some of the performance risk, it is likely that it won't be willing to assume any credit risk. This contract model usually involves financing from a third-party institution, ESCO being responsible for repaying the loan and taking over the credit risk [6]. This model provides a great advantage to the customer in developing markets since the customer doesn't support any financial risk. According to Bertoldi et al. [7], the model tends

to create barriers for small ESCO companies in obtaining financing.

Within a "Shared Savings" business model, the compensation is achieved through fixed fees, unit pricing and/or gainsharing.

Under the "Guaranteed Savings" performance contract, the ESCO guarantees a certain level of energy savings in a way that exempts the customer of any performance risk. Even if the ESCO arranges the funding, the client is directly financed by a financial institution and is responsible for the repayment of the loan. According to Parviainen [8], this model is less appropriate for economies where the ESCO concept is relatively new, due to the fact that customers are usually not willing to support the financing and the associated risks and due to the lack of familiarity with project financing for energy efficiency measures. If the savings are lower that guaranteed, the ESCO supports the payment of the difference between what was promised and what was achieved. In some cases, such a scenario would lead to additional penalties for the ESCO.

In Europe, most of the ESCO projects were undertaken in the public sector since public institutions are usually perceived as a client who is unlikely to go out of business. Most implemented ESCO projects targeted areas such as energy management, co-generation, public lightning, and heating, cooling and ventilation in public industrial facilities, commercial centers and hospitals.

The main instruments and methodologies used for energy performance contracting are the regulation for certification of the solution provider that implements energy performance contracting and the European Code of Conduct for Energy Performance Contracting (CC – CPE)..

B) Energy Management Systems

At a global level, many companies turned their focus on the on-growing demand for energy management to reduce costs, pollutant emissions, and to improve security and comfort within home, public and work buildings. Several energy management solutions are already available on the market for both home users and utilities. In this section, we briefly analyze three of the main energy management solutions, focusing on their business model and market strategy.

Cisco Energy Management Suite [9] is a Cloud solution that provides energy consumption measurement, monitoring and management features for each IP device connected in a network, independent of the vendor. The solution is available in four different modules, each adapted to specific needs:

- Cisco Energy Management for Distributed Offices – this module provides energy usage data visualization and analytics for physical IP connected devices;
- Cisco Energy Management for Data Center – in addition to the module dedicated to distributed offices, this module provides network-based monitoring of all connected physical and virtual devices and systems;
- Cisco Energy Management Optimization Service – this module is based on an annual subscription and provides optimization of energy usage within client's IT infrastructure. By the means of a proprietary software, namely Cisco Energy Management Software, it provides centralized access for network devices;
- Cisco Energy Management as a Service – this is a SaaS (software-as-a-service) application which allows the management of energy consumption without requiring any hosting of the proprietary application in client's data center. Basically, since the solution is not hosted by the customer, it does not imply any costly server administration. Clients can have access to this solution by the means of one-, three- or five-year subscription.

Additionally, Cisco offers a free start trial with a 45-day license for access to trial versions of the software and limited-function monitoring and reporting features for up to several hundred of connected devices.

DEXCell Energy Manager [10] is a web-based energy management software developed by DEXMA, which provides real time monitoring and analysis, utility bill tracking, user friendly dashboards, energy patterns and energy grader based on Big Data algorithms, benchmarks. The platform supports integration of different protocols and devices from several manufacturers.

Within their current business model, DEXMA offers the DEXCell Energy Manager as SaaS (Software-as-a-Service), on an annual subscription basis, with two standard packets – "Starter" and "Professional", and a custom packet dedicated to more complex needs – "Enterprise". Additionally, they also provide a demo account with 30-day free access to three examples of fully functioning projects, including consulting by phone with an energy specialist. Some details for each subscription packet are presented as follows:

- Starter – this is the basic packet, it provides features for single site projects, including dashboards, simple analysis, notifications, reports. This offer features one location and ten data points and it also includes access to a collection of external energy efficiency applications built on DEXMA APIs, collection known as "Energy Apps Market";
- Professional – this packet provides all the features from the Starter packet, plus more advanced data analysis, alerts and reports. Also, this offer features unlimited locations and 20 data points;
- Enterprise – this offer features unlimited locations and data points and provides all features from the Professional packet, addressing to customers with large and complex projects. The subscription is fully customizable, implying that the product's features and price offer are set upon request.

All subscriptions, except for the Enterprise offer, are provided on an annual fixed cost and allow for the addition of more data points upon request, at a fixed monthly cost.

Engage [11] is an energy management solution developed by Efergy, which provides tools for real-time visualization and statistics of data related to energy usage and energy costs, aiming to improve customers' energy usage habits. Integration of Internet of Things (IoT) and time-critical cloud applications represent the main challenge [12, 13]. The solution is available in the form of software (Engage platform and app) and hardware kits with different pricing schemes, that include access to the web platform and the additional devices needed, according to the scope and features of each kit. Some of the main offers in the actual business model are described below:

- Engage Hub Kit – provides features and tools for monitoring home energy using devices such as computer, smartphone, tablet. This kit includes the web-based software and a hub device which is to be installed in the home to gather energy data;
- Engage E2 Hub Kit – provides the standard Engage Hub Kit features with an additional software – elink, which enables users to download the data from the energy management platform, features more advanced data visualization and simulation of different consumption patterns and tariff schemes. The kit includes the web-based software platform, the elink software, one sensor, one data transmitter, one hub and one wireless home data visualization device;
- Engage Solar Kit – this solution provides the standard Engage Hub Kit monitoring features for both energy generation and consumption. The kit includes the software solution, two electricity sensors with two data transmitters and a data hub device.

III. CLOUD ENERGY MANAGEMENT PLATFORM

This section aims to present authors' conceptual model of a Cloud Energy Management platform that aims to provide enterprises with the means to manage energy consumption while enhancing comfort and security in the working environment.

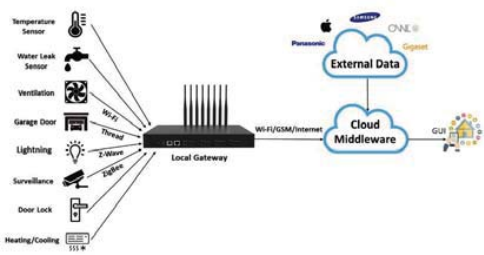

Fig. 1. Energy-aware resource monitoring and management platform

As depicted in Fig. 1, the proposed platform aims to:

- Monitor air quality (temperature, relative humidity, air pressure, pollution, particles, etc.), visual comfort, acoustic and energy demand parameters in real time by using a wide variety of sensors deployed in the working environment;
- Generate energy consumption awareness by providing data regarding energy consumption in various forms and by pointing out the sources of inefficient energy usage (technologies, processes, habits, etc.);
- Use machine learning to detect and learn movement patterns and typical interactions, thus combining human with software based control to ensure automation of decisions taken to enhance comfort, security and energy efficiency;
- Import data from third party Clouds of commercial energy management solution providers, such as Apple, OWL, Gigaset, Panasonic, Samsung, etc., by the means of a Cloud Middleware;
- Provide support for a wide variety of sensors and appliances from various Smart Home solution providers by the integration and convergence of different communication systems and protocols tough a Gateway;
- Allow integration within the existing electric network infrastructure;
- Provide the user with a web application to remotely control and survey the building.

IV. PROPOSED SUSTAINABLE BUSINESS MODELS BASED ON ENERGY PERFORMANCE CONTRACTING

The development of adaptation mechanisms based on new business models and concepts is an important item on the agenda of companies that want to play a major role on the market.

The proposed business models for the platform market deployment are based on EPC (Energy Performance Contracting) and imply that the customers are provided with the solution (Cloud energy management platform) as an energy management measure and also with the guarantee that the savings generated by its implementation will be sufficient to finance the full cost of the investment.

Fig. 2 illustrates the principles Energy Performance Contracting relies on.

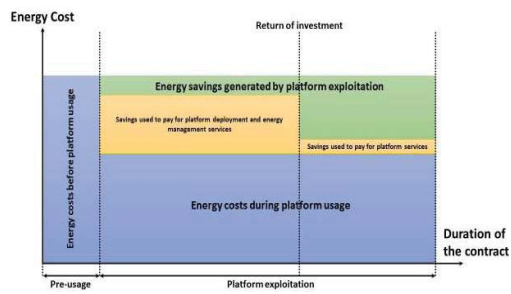

Fig. 2. Energy Performance Contracting

Therefore, the key points of EPCs are:

- The energy management platform provider ensures a proper deployment and exploitation of the platform during the whole contract duration;
- The energy management platform provider needs to ensure energy cost savings compared to the pre-implementation energy cost baseline;
- The cash flow generated by the means of savings achieved during the exploitation of the platform are used to pay back the investment in the platform implementation;
- Until the full return of investment for the platform deployment within customer's facility, the energy savings are split between the platform provider and the beneficiary;
- After the full return of investment, the customer only pays the platform provider a fee associated with the provided platform services;
- The relationship between the entity providing the platform and the customer is a long-term, fair and transparent one;
- All the steps within the EPC contract are done in a legal matter.

Even though most of the energy performance contracts are financed by long term loans, some customers would be able to pay a part of the platform implementation cost with capital budget allocations.

The amount of energy saved can be verified using one of these methods:

- Deemed or stipulated savings – The customer pays the energy management platform provider estimates which were agreed upon before signing the contract;
- Savings based on utility bills – This method is based on a comparison between the baseline consumption determined by past energy bills and the energy consumption measured before adopting any energy efficiency actions;
- Measured savings – This method is the most expensive to use yet the most exact in determining savings. It involves consumption measurements both before and after platform implementation in customer's facility. The method also relies on adjustments based on weather conditions (specific to a certain time of the year or climate), changes in the use of customer's facility, equipment loads which might vary (as a response to the market demand), etc.

A) „Guaranteed Savings" performance contracts

As depicted in Fig. 3, a "Guaranteed Savings" performance contract between the platform provider and the customer implies that contractor (platform provider) supports payment cuts or contract-stipulated penalties if the savings are lower than guaranteed.

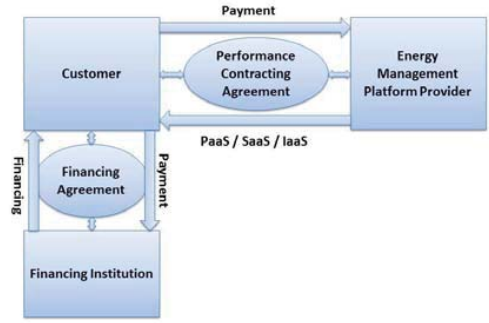

Fig. 3. Energy Performance Contract based on "Guaranteed Savings"

Under such a performance contracting agreement, the Energy Management Platform provider guarantees a certain level of energy savings, thus the client is usually absolved of any performance risk. Following this agreement, the energy management platform provider usually takes over the entire performance risk. Customers are financed directly by banks or other financing entities.

If the savings are not enough to ensure a full return of the investment for the customer, the energy management platform provider has to cover the difference. If the savings exceed the guaranteed level, the customer pays a percent of the energy savings generated by platform's exploitation to the provider.

B) „Shared Savings" performance contracts

As depicted in Fig. 4, a "Shared Savings" performance contract between the platform provider and the customer implies that the customer makes pre-fixed value or percentage payments from the savings to the platform provider until a predetermined amount or time period is achieved.

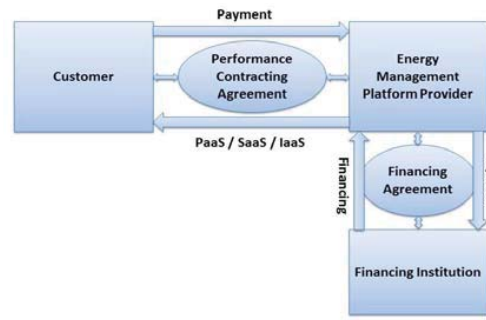

Fig. 4. Energy Performance Contract based on "Shared Savings"

Under a shared savings performance agreement, the customer takes over a pre-determined part of the performance risk. Thus, within this business model, the energy management platform provider assumes both the performance and the customer credit risk.

C) „Chauffage" performance contracts

As presented in Fig. 5, a "Chauffage" contract implies that the energy management platform provider would take responsibility for the provision of platform services and for the purchasing of energy. The energy management platform provider also takes responsibility for providing energy resources at a lower price or for providing a higher level of energy service for the same price. As in the case of "Guaranteed savings" and "Shared savings" performance contracts, the "Chauffage" contract relies on savings which are used by the customer to repay platform deployment and usage costs and also to generate a return of capital. In this scenario, the "Chauffage" contract allows the customer to outsource facility services and investment.

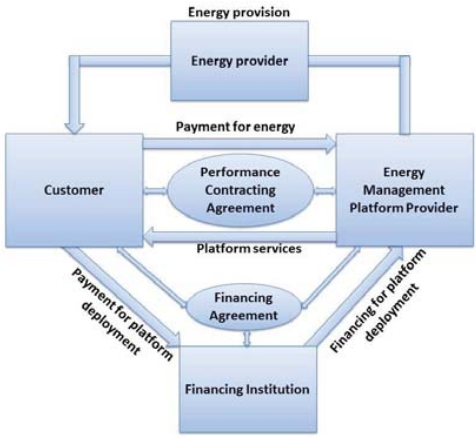

Fig. 5. "Chauffage" Energy Performance Contract

In terms of risks, the energy management platform provider is responsible both for the energy supply and demand efficiencies and for ensuring at least the guaranteed level of savings generated by the usage of the energy management platform. The credit risk is supported by the customer who benefits both from platform services and energy resources.

V. Conclusions

This paper focuses on the go-to-market strategy of energy management platform providers by proposing adaptations of EPC schemes that present a great potential for enhancing market penetration of these solutions. In the context of an increasingly competitive business sector, energy management systems became an important decision-making tool for companies of all sizes and activity domains.

Given a wide range of financing opportunities that address energy usage optimization and the provision of green products and services, energy performance contracts are to become an important mean to support the implementation of energy management platforms within enterprises.

As a future work, we intend to present insights on the achieved results after a full development of the conceptual platform, followed by its commercialization in accordance to the proposed business models based on energy performance contracting.

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