INDUSTRY AND OPPORTUNITY ANALYSIS
OF THE NORTH AMERICAN
ENERGY SERVICES COMPANY (ESCO)

by

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Abstract

The North American Energy Service Company (ESCO) industry has grown year over year and competed directly with rivals who offer a lower cost, vertically fragmented solution. More recently, however, the industry has and continues to undergo significant changes driven by environmental, social and political forces. These changes have brought about both challenges and opportunities, which have attracted the attention of Information Technology giants with deep pockets and an appetite to dominate, who are trying to leverage their core competencies in adjacent technologies, and obtain a piece of this rapidly changing energy business.

Despite these changes, North American ESCOs continue to have a strong presence and reputation. In order for them to take advantage of these changes, it is critical that they have a sound understanding of the industry trends and how they are positioned relative to their competitors.
Executive summary

How does a North American Energy Services Company (ESCO) maintain a competitive advantage where environmental, social and political pressures have resulted in significant changes in an already rivalrous industry?

The growth of the ESCO industry in North America during the 1990s attracted rivals, which now capture a 30% market share. More recently, environmental, social and political pressures have resulted in a significant increase in government grants for promising renewable energy sources and pressured the utility providers to reduce energy consumption to avoid costly new energy-source projects. This has attracted the attention of innovative start-ups and some large Information Technology giants in an already crowded market space.

After analysing the rivalrous North American ESCO industry, I consider how each of the competitor groups addresses the needs of the “down-stream” end-user. I then repeat this for the “up-stream” utility provider and I identify potential uncontested market space in the form of five opportunities (carbon trading, renewable energy source, smart grid/demand response, micro grid/district energy and super grid). I then analyze each of these opportunities against the competitor groups in terms of risk and core competency alignment and conclude with recommendations on what opportunities each of the ESCO players should focus on.
Dedication

I dedicate this work to my wife Ana and my children Janice and Justin who supported me during the past 19 months.
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There are many people who have made a lifelong impression on me during this EMBA learning experience. Firstly, I would like to thank my study group, Dragon Ventures, who have been supportive throughout the program. Our numerous conference calls, bi-weekly meetings and work sessions provided me with an excellent forum to learn from your experiences in both work and your private lives.

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Glossary

CSR  Corporate Social Responsibility
DG    Distributed Generation
DSM   Demand Side Management
ECM   Energy Conservation Measure
EPC   Energy Performance Contract
ESCO  Energy Services Company
EU ETS European Union Emissions Trading Scheme
GHG   Greenhouse Gases
HVAC  Heating Ventilation and Air Conditioning
IEC   International Energy Agency
MNE   Multi National Enterprise
MUSH  Municipalities, Universities, Schools and Healthcare
PV    Photo Voltaic
REC   Renewable Energy Credits
RGGI  Regional Greenhouse Gas Initiative
R&D   Research and Development
SSM   Supply Side Management
tCO$_2$e  tonnes of carbon dioxide equivalent
VC    Venture Capital
WCI   Western Climate Initiative
WTP   Willingness To Pay
1: INTRODUCTION

1.1 Project Purpose

The purpose of this project is to review the changes in the North American energy industry\(^1\) and what this means for the Energy Service Companies (ESCO) that provide a broad range of comprehensive energy solutions, including the design and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply as well as risk management. This paper focuses on understanding these industry changes and what this means for the traditional ESCOs, so that they can position themselves to take full advantage.

The energy business is in a state of flux. Traditional ESCO players will have to adapt or they will cease to exist as conditions and major players change. ESCOs who have a sound understanding of their core competencies, as well as where the energy business is headed can position themselves for significant growth as the industry changes. Those that do not, will not survive.

When growth is easy, companies often stray from their strategy. ESCOs must use the current economic climate of slower growth and a challenging environment to force discipline into their growth planning process.

\(^1\) This includes electrical energy generation, transmission, distribution and control (supply and demand).
1.2 Project Methodology

Secondary research and personal experience will provide the basis for the industry analysis. Several frameworks will be employed to structure the analysis.

Specifically, the project methodology used in this paper was first, to gain a strong understanding of the ESCO industry. I did this by defining the industry and its boundaries and analyzing the industry supply chain (Table 1). Having done this, I then analysed the focus and positioning of each of the competitor groups in terms of the ESCO landscape (Table 2). At this point, I summarised the results of the ESCO industry analysis using Porter’s Five Forces model\(^i\) (Table 3).

To understand how the ESCOs can maintain a competitive advantage, I decided to analyse the ESCO industry from a “blue ocean strategy” perspective\(^ii\). After identifying the end-user needs, I used a value curve analysis to plot how each of the competitor groups were able to satisfy these needs (Table 5). I identified that energy supply cost management showed a potentially uncontested market space. I then repeating the same value curve analysis from the utilities’ perspective (Table 6), and the results identified some significant uncontested market space.

I then analysed the utility needs which were associated with the uncontested market space and I identified five potential ESCO opportunities. Each of these opportunities were then analysed in terms of risk (Table 7) and core competency alignment (Table 8) for each of the players in order to make recommendations on which opportunities each of the three major ESCO groups should focus on.
2: INDUSTRY ANALYSIS

2.1 The Energy Service Company (ESCO)

An ESCO is a commercial business providing a broad range of comprehensive energy solutions, primarily to the Municipal, University, Schools (K-12) and Healthcare (MUSH) sector. These solutions include the design and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. The ESCO performs an in-depth analysis of the MUSH sector buildings, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period. The savings in energy costs are often used to pay back the capital investment of the project over a five- to twenty-year period, or reinvested into the building to allow for capital upgrades that may otherwise be infeasible. If the project does not provide sufficient returns on the investment, the ESCO is often responsible to pay the difference.

2.1.1 Industry Background

In the 1970’s and 1980’s the first wave of North American ESCOs were often small divisions of large energy companies, or small, upstart, independent companies. With the rising cost of energy during the 1990’s and the availability of new
technologies in lighting, HVAC (Heating, Ventilation and Air Conditioning), and building energy management, ESCO projects became much more commonplace.

Rising energy costs, compounded by the deregulation of the U. S. energy markets in the 1990’s, drove a rapid rise in the energy services business. Utilities, which for decades enjoyed sheltered positions as monopolies with guaranteed returns on power plant investments, had to compete to supply power to many of their largest customers. They now looked to energy services as a potential new business line to retain their existing large customers. The growth during the 1990’s attracted rivals focusing on niche parts of the ESCO supply chain (which will be reviewed in more detail in paragraph 2.4). In the wake of the Enron collapse in 2001, and the sputtering or reverse of deregulation efforts, many utilities shut down or sold their energy services businesses. There was a significant consolidation among the remaining independent firms which continues to this day.

2.1.2 Industry Revenue and projections:

Figure 1 displays the growth from 2006 to 2008 in U.S. ESCO revenues to $4.1 billion (a 7% average annual growth rate). Interestingly, this growth was resistant to the major economic downturn of 2008 and revenues are expected to grow to $7.3 billion by 2011.iii

2.1.3 ESCO Market segments:

The MUSH sector has historically hosted the largest share of ESCO projects – reference Figure 2. The MUSH sector accounted for $2.8 billion in ESCO revenues in 2008, about 69% of total industry activity. The MUSH sector share of
total ESCO revenues has increased over 10% since 2006. The remaining 31% of the ESCO industry activity was Federal (15%), Commercial and Industrial (C&I) (7%), Public Housing (3%) and Utility residential programs (6%).

2.1.4 ESCO Technology shifts:

Figure 3 shows that although energy efficiency technologies continue to represent a major share of industry activity (75% in 2008), on-site renewable energy has increased from 10% in 2006 to 14% in 2008. Factors that may contribute to the increased deployment of renewable energy and onsite generation technologies include publicly-funded incentives, and bundling renewable energy with energy efficiency improvements to help customers meet various goals (e.g. energy independence and environmental footprint reductions). It is expected that this trend will continue.

2.1.5 Contract Types:

Energy Performance Contracts (EPC) continues to be the dominant contract type for ESCOs – reference Figure 4. In an EPC the ESCO guarantees the performance (energy savings) over a long-term (usually around ten years), thereby reducing the owner’s risk. Continued reliance on EPC’s is largely driven by legislative or procurement requirements placed upon institutional sector customers (without a concomitant increase in capital budgets) that push the customers into long-term performance contracts or the increased use of power purchase agreements. Non-EPC contract types, which account for 30% of the U.S. ESCO industry revenues in 2008,

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2 More efficient lighting, high efficiency boilers and furnaces, improved building insulation and improved heating and cooling control strategies.

3 Wind power, solar power, hydroelectric power and bio-fuel.
are the dominant contracts used by the ESCO competitors (see the discussion in paragraph 2.4, below).

2.2 Industry Structure and Boundaries

The North American ESCO market structure has essentially reached maturity with 16 major players in three major ESCO groups:

- **Equipment affiliated** (Carrier, Honeywell Building Solutions, Johnson Controls Government Systems, L.L.C., Schneider Electric, Siemens Government Services, Inc., Trane U.S. Inc.)

- **Utility affiliated** (ConEdison, Constellation, FPL Energy Services)

- **Non-utility energy services** (Ameresco, The Benham Companies, LLC (SAIC Acquired), Chevron Energy Solutions, Clark Energy Group LLC (formerly Clark Realty Builders, L.L.C.), Lockheed Martin Services, Inc., McKinstry.

  Equipment affiliated firms use EPC’s as a sales channel for their products. Utility affiliated firms offer ESCO projects as an added service to attract and retain large customers, and generally focus on their utility customer base. Non-utility energy services companies are product neutral and tend to have a larger (more dispersed) geographic customer base. They typically offer a wide range of services from energy retrofits\(^4\) to renewable energy development\(^5\).

\(^4\) This refers to the improving of existing buildings with energy efficiency upgrades such as more efficient lighting, high efficiency boilers and heating and cooling control strategies.

\(^5\) Renewable energy development includes solar thermal, solar photo-voltaic (PV), wind and geothermal renewable energy solutions.
2.3 Industry Supply Chain

The ESCOs provide a vertically integrated energy solution – they do their own R&D and manufacture of their products, as well as solution identification, engineering and installation. This allows ESCOs to provide a long term performance guarantee and to create and capture value by offering a comprehensive turnkey solution at low risk to the customer. More specifically, with reference to Table 1, the ESCO industry supply chain model and characteristics are as follows:

- **R & D:** Equipment affiliated ESCO companies make significant internal investments into the development of their product range, which is their core competency and can be segmented into:
  - Controls equipment ESCOs (e.g. JCI, Siemens and Honeywell), which focus on implementing automated building strategies which control mechanical and electrical building systems to reduce energy consumption;
  - HVAC equipment ESCOs (e.g. Trane, Carrier and Schneider) which focus on installing more efficient mechanical or electrical building equipment to reduce energy consumption.

R&D investment outside their core competency and focus is high risk and understandably very low. Notwithstanding this, it is common for ESCOs to form strategic alliances, or even to acquire complementary intellectual property (IP) technologies which are adjacent to their core technologies and which are often spin-offs from universities or venture capital (VC) financed start-up companies, who offset some of their risk through government grants.
- **Product Manufacturers:** For equipment affiliated ESCOs, the manufacturing portion of the ESCO supply chain model is their area of core competency and the area where they are able to extract high value. They enjoy significant manufacturing economies of scale and they distribute their products through their own supply chain, as well as through those of independent retailers. The economies of scale provide a significant barrier to entry to the manufacturing stage of the industry supply chain.

- **Solution Identification and Solution Engineering:** After two decades as the focus of building energy reduction, energy conservation measures (ECM’s) which are inexpensive and result in significant energy savings (i.e., a quick, simple payback) are no longer commonplace. As such, ESCOs have to be more creative in identifying energy savings, and these solutions are often more complex and higher risk. In addition, energy consulting firms have become commonplace in the industry, and they have essentially commoditized this stage of the supply chain.

- **Grant and Incentive Support:** Governments provide incentives to generate clean energy and to reduce energy consumption, since the cost of additional generation infrastructure is expensive and often associated with societal, environmental and political risks (public protests against flooding behind dams, pollution from coal fired generation and pressure to keep utility prices low). More recently, utility and government grants and incentives have grown to encourage the development, in particular, of renewable energy and onsite generation technologies, and to offset costly capital-intensive infrastructure
investments. Utility providers have also simplified the grants and incentives application process for small scale renewable energy production, which has reduced the dependence on ESCO support for utility grants and incentive support.

- **Solution Installation as well as Service and Support:** The output of the engineering solution phase by energy consultants typically includes sufficient information for the customer to initiate a competitive bid process, which in turn has largely commoditized the installation and on-going support work. This has had a profound impact on the equipment affiliated ESCO companies, as their business model relies on extracting value out of the service and support opportunities which flow out of EPC projects.

- **Energy guarantee:** Over the past few years, the traditional ESCO customer has placed a lower value on the energy savings guarantee. This is because the energy savings process and risk is by now well understood by the potential customer. However, for higher risk renewable energy and onsite generation technology projects, the energy savings guarantee holds a significant value to the ESCO customer.

### 2.4 Competitor Analysis

The three major ESCO groups defined in paragraph 2.2 are not the only competitor groups in the ESCO industry. There is a competitor group, “ESCO rivals”, which extracts value by focussing on specific segments of the ESCO industry supply chain. There is another ESCO competitor group, “new entrants”, which has become
more prominent over the past few years. The new entrants consist of two distinctly different groups: information technology giants (IT giants), and innovative start-ups. A more detailed analysis of the ESCO rivals, the new entrants and the three major ESCO groups are as follows (see Table 2):

2.4.1 ESCO Rivals:
ESCO rivals focus on those particular stages of the supply chain that are aligned with their core competencies. For example, independent energy engineering consultants will only focus on solution identification and solution engineering. Similarly, mechanical or building trade subcontractors will only focus on solution installation and in some case on-going support and installation. ESCO rivals have a pricing advantage over the three major ESCO groups, all of whom have much larger organizational structures with their attendant higher agency and influence costs. Customers who are price sensitive favour the rivals’ solution. This solution has become more popular in the last 10 years, resulting in the rivals capturing a 30% market share, largely at the expense of the three major ESCO groups.

2.4.2 New Entrants:

Information Technology giants (IT giants)
The IT giants have a reputation for being disruptive. They also have deep pockets and a strong affinity for technology, and are therefore well positioned to enter the ESCO industry. For example, Google and CISCO’s core competencies are the management of information and networking, respectively. Considering that energy solutions are becoming more reliant on the integration and management of building automated
systems, firms with either skill appear to be able to take advantage of a potentially disruptive renewable energy and onsite generation technology. Based on the good fit between the outermost ends of the supply chain and the core competencies of the IT giants, I expect that they will focus on these stages, and will subcontract the rest out, provided that this can be done at sufficiently low transaction costs (see Table 2).

**Innovative start-ups:**

The high growth energy sector opportunities (in particular, in renewable sources and in on-site generation technology) have attracted the attention of investors, particularly those firms that are distinguished by their attractive risk/reward profiles and scalability\(^6\). In other words, ventures which have low operating costs, higher risk and a higher potential return on investment through rapid expansion with limited investment in capital, labour or land are very attractive to VC’s, and are therefore primarily VC backed start-ups. These firms usually promise a potential high reward, but with high risk, and have an exit strategy to sell out to a larger established player.

**2.4.3 ESCO strategic groups:**

**Equipment affiliated competitors:**

Both the controls focussed and the HVAC equipment focussed groups are vertically integrated. This allows them to offer a bundled turnkey low risk energy saving solution to their customers.

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\(^6\) “Scalability” refers to the ability to grow by large amounts without increasing unit costs or risk.
All of these players have a similar pricing structure, product offering, brand equity and reputation in the industry. As such, rivalry amongst these companies is high as they try to differentiate themselves in a crowded marketplace that is shifting towards renewable, and higher risk, solutions.

**Utility affiliated competitors:**

For the most part, utility providers have been de-regulated in North America. However there are regions (e.g. British Columbia and Saskatchewan) where this is not the case. Nonetheless, utility affiliated competitors are less vertically integrated and have a narrow market focus of serving their larger (industrial, in particular) customers.

**Non-utility affiliated:**

Of the three major ESCO groups, the non-utility affiliated ESCOs appear to be best suited to forming strategic alliances with the new entrants, as they operate in the stages of the ESCO supply chain which the new entrants are expected to commoditize (reference Table 2). This will be discussed in more detail later in this paper.

### 2.5 Industry analysis using Porters 5 forces

The results of an industry analysis that uses the Porter’s Five Force model to determine the trends in the ESCO industry are as follows (see Table 3):
2.5.1 Bargaining power of Suppliers: Low / alternate energy: Medium

With the exception of suppliers of emerging technologies (renewable technologies and other), the suppliers are highly fragmented and have very low bargaining power, resulting in highly competitive pricing. Emerging technology companies struggle to gain exposure and acceptance without the backing of a strong brand or a company with deep pockets. However, if they own alternative technology products which differentiate them from other products, they can demand higher prices.

2.5.2 Bargaining power of Customers: High / renewable energy- Medium

With the maturity of the ESCO offering, customers have become more informed of alternative options. For example, for the low risk ESCO solution customers have significant bargaining power, since the rivals have provided them with an alternative to the already competitive ESCO solution. For the higher risk renewable energy and onsite generation technologies (which are IP protected), customers have limited options and therefore lower bargaining power.

2.5.3 Threat of New Entrants: Low / New IT: Very High

Considering the market is already crowded, the threat of a new “traditional” entrant is low. However, the threat of IT giants (Google, Cisco or other) entering the market is very high. The reason is that certain IT giants are very well positioned (with strong brands, reputations and deep pockets) to acquire an emerging technology and disrupt the industry by establishing a new set of rules. This threat will be analysed further later on in this paper.
2.5.4 Threat of Substitutes: Low

The ESCO rivals have already had a significant impact on the ESCO industry structure and pricing models. Although the marketplace has become crowded, the threat of new substitutes is low. However, with the focus and investments in renewable technologies, there is a potential for a disruptive technology to open up the opportunity for a new offering. This threat will be analysed further later on in this paper.

2.5.5 Rivalry amongst existing Competitors: High

ESCO rivals with a narrow focus on particular stages of the supply-chain have entered and essentially commoditized the ESCO supply chain for the traditional energy measures. This has resulted in a crowded marketplace where ESCOs (with high fixed costs) struggle to differentiate themselves from each other. This has encouraged a strong focus on emerging technologies amongst the ESCO competitors.

2.6 Analysis of the ESCO industry dynamics

The ESCO value proposition has been eroded by rivals. Over the past 10 years, a significant number of customers have moved away from the vertically integrated, “bundled”, low risk, turnkey ESCO solution in favour of the lower cost rival solution. This shift has become stronger in more recent years as the customer has become more knowledgeable about how to quantify and take steps to mitigate risks. The rival solution now accounts for a 30% market share (reference Figure 4).
Governments are facing increased pressures from voters and non-governmental organizations (NGO’s) to reduce greenhouse gasses (GHGs) and to curb global warming. This has resulted in a significant increase in government grants for promising renewable energy sources. Similarly, utility providers are under intense pressure to reduce energy consumption to avoid costly new energy-generation projects. This, coupled with public pressure to shift towards “green” energies and GHG reductions suggests that the ESCO industry is going to continue to be a growth industry (particularly in renewable energy sources and onsite generation technologies). These developments are already attracting the attention of new entrants, such as innovative start-ups and IT giants such as Google, CISCO and HCL, who are well positioned to take advantage of emerging new technologies and disrupt the marketplace.

In support of the above, the following report was released on November 30th, 2010:

“InsideBayArea.com – Flying high in alternative energy at Alameda Point you’ve seen a strange object up in the air over Alameda Point and wondered what it was, here’s your answer: It’s an airborne wind turbine, being developed by a cutting-edge Alameda-based company called Makani Power…”. “…Makani’s team is relying on an initial grant of $20 million from Google and a recent $3 million grant from the Department of Energy to fund further development and testing. ”It was great that Google was willing to take a chance on us and saw the potential of our game-changing technology…”"
2.7 Summary of the ESCO Industry analysis

The strong growth and profitability of the ESCO industry and low entry barriers at certain stages of the supply chain have resulted in the entrance of rivals. This has increased the number of players going after the same customer base, resulting in excess capacity and reduced profitability margins. In addition, the comprehensive turnkey ESCO solution has lost its value for some customers, which has reduced their willingness to pay (WTP). This, coupled with the low cost advantage of the rivals, has shifted the pendulum against the ESCO offering.

In addition to the rivals, the growth and emerging opportunities of the ESCO industry has attracted the attention of new entrants with deep pockets such as Cisco, Google and HCL, who are already actively investing in new technologies to gain a piece of the energy business. These new entrants are well positioned to enter the energy industry, since their past success has been built on winning in a rivalrous marketplace through the introduction of disruptive technologies.

ESCOs are generally mature organizations and have not had a strong focus on innovation other than on their own controls or HVAC equipment products (i.e. equipment affiliated ESCOs). In fact, the criteria that ESCO managers use to make decisions that keep their present business healthy make it difficult for them to focus on doing the right thing for the future of the business. This is a result of the reactive nature of the service business mindset, which conflicts directly with the longer term strategic and visionary focus which is required in order to take advantage of the shifting dynamics of this growth industry. This is, of course, very concerning
considering the changes in the industry and the fact that positioning now is the key to the future in the energy industry.

Notwithstanding the above, ESCOs continue to have a strong presence and understanding of the market, but they also need to have a good understanding of the trends in the industry, what their competitors are doing and how they can position themselves to benefit from these changes. If they get this right, the rewards will be handsome – if not, they may cease to exist. The time for ESCOs who want to take advantage of the growth in the energy industry is now. Those who show up early and are well positioned will reap the benefits.
3: BLUE OCEAN ANALYSIS – END USER

Given that the new entrants have entered the already crowded ESCO business, how does an ESCO maintain a competitive advantage? I have approached this from a “blue ocean” value innovation perspective, following the prescriptions of Kim and Mauborgne:

- Seek out uncontested market opportunities instead of competing in existing markets;
- Identify opportunities which make the competition irrelevant instead of beating the competition;
- Create and capture new demand instead of exploiting existing demand;
- Break the value-cost trade-off instead of make the value-cost trade-off; and
- Align the whole system “value proposition” in pursuit of differentiation and low cost instead of differentiation or low cost.

To this end, I initially completed a value curve analysis of the ESCO industry from an end-user perspective (down-steam analysis). Each analysis was mapped out for the rival solution, for the three major ESCO groups, and for the new entrants.
3.1 Key factors of competition:

Based on input solicited from owners of EPC contracts, I have identified the following eight key “pain points” which are important to the end-user, and I will use these to identify “blue ocean” opportunities:

- Comprehensive long-term solution ownership;
- Energy savings performance guarantee;
- Sustainable regulation compliance;
- Corporate Social Responsibility (CSR);
- Carbon credits and trading;
- Price – Simple payback;
- Leading edge solution; and
- Energy supply cost management.

A detailed description of each of these key factors follows:

3.1.1 Comprehensive long-term solution ownership

Energy conscious corporate end-users are challenged by the decision to identify and implement energy savings internally, or to subcontract this out to others. When operations groups make the decision they most often decide to do this work in-house. These projects often struggle or even fail because:

- Operations staff focus on short-term costs rather than on operating and life-cycle costs, which are significantly impacted by energy efficiency;
Operations staff are already fully engaged in the day to day operations of the facility and “special” projects are a lower priority – resulting in an extended completion date and lost energy savings opportunities;

“Low-hanging fruit” (i.e. ECM’s with short payback) are harvested first, making medium term payback measures more difficult to justify.

Top executives at MUSH sector firms usually decide to subcontract this work to ESCOs, as they have a longer vision and have a better understanding of the ESCO long-term performance value proposition.

The comprehensive turnkey solution is a core to the ESCO value proposition and this allows them to differentiate themselves from the rival solution. Larger customers in the MUSH sectors who are risk averse place a high value on this offering, while the non-MUSH sector customers value price rather than a comprehensive offering. On the other hand, new entrants vary significantly in their offerings. They are well positioned to challenge both the ESCO and the rivals, as they have deep pockets which allow them to assume performance risk and to compete at a lower price in order to gain market share in the energy industry.

3.1.2 Energy savings performance guarantee

Having harvested the low-risk, “low hanging fruit” opportunities, owners understand that renewable energy sources and on-site generation solutions will be higher risk and have a longer payback. As such, it is expected that top executives (in the MUSH sector in particular) will once again place a high value on the performance
guarantee. The guarantee essentially transfers performance risk from the end-user to the ESCO.

Customers who favour the rivals offering typically view the EPC as expensive (partially a result of the high cost associated with the vertical integrated ESCO model) and hence opt for the non-guaranteed (higher risk) solution. With a shift to more risky renewable solutions, the energy performance guarantee will become more valuable to these potential customers. New entrants, who want to become major players in the crowded energy business, are likely to provide an energy savings guarantee at no cost, in order to compete with the ESCOs and gain quick market acceptance.

3.1.3 Sustainable regulation compliance

Federal, state and provincial governments are drawing up energy sustainability regulations. For example, governments are legislating renewable energy sources. The drawbacks are that these renewable energy sources are expensive and not reliable. This is driving new business models in the energy business. For example:

- Demand management, which is the modification of consumer demand for energy through various methods such as financial incentives and education.
- Renewable technologies, which includes solar-voltaic, solar photo-voltaic (PV), wind and geothermal.
- Supply management, which is the utilities’ management of energy resources (generation, grid and distribution network) to ensure a reliable and efficient energy supply to meet consumer energy demand needs.
Government regulation and incentives have attracted a lot of interest in the last few years, resulting in an increase of innovative start-up new ventures. The IT giants, in particular, have been keeping a close watch on regulation shifts and on innovative start-up companies with promising emerging technologies and new product ideas, so that they can leverage their core competencies through adjacent technologies to capture a part of the energy business.

3.1.4 Corporate Social Responsibility (CSR)

The goal of CSR is to embrace responsibility for the company’s actions and encourage a positive impact, through its activities, on the environment, consumers, employees, communities, stakeholders and all other members of the public.

Social networking is the new CSR watchdog, placing a focus on larger corporations in particular. Corporations are therefore taking the triple bottom line\(^7\) more seriously than ever before. This has encouraged corporations to “partner” with ESCOs to drive environmental stewardship through the implementation of energy savings and employee behavioural changes. ESCOs that are perceived to be socially responsible can provide an opportunity for corporate customers to associate themselves with this same socially responsible approach. The drivers and focus of CSR in terms of energy consumption are the acceptance of carbon emission trading (voluntarily or regulated), embracing renewable energies, methane collection and combustion, and overall energy efficiency.

\(^7\) Triple bottom line means expanding the traditional reporting framework to take into account ecological and social performance in addition to financial performance.
3.1.5 Carbon emissions trading

Carbon emissions trading is a form of trading that specifically targets carbon dioxide (calculated in tonnes of carbon dioxide equivalent or tCO$_2$e) and it currently constitutes the bulk of emissions trading. This form of permit trading is a common method that countries utilize in order to meet their obligations specified in the Kyoto Protocol, namely the reduction of carbon emissions in an attempt to reduce (mitigate) future climate change.

The problem of climate change is one where emitters of GHGs do not face the full cost implications of their actions. There are costs that emitters do face, for instance, the costs of the fuel being used, but there are other costs that are not necessarily included in the price of a good or service. These other costs are called external costs or externalities. They are "external" because they are costs that the emitter does not face. External costs affect the welfare of others. In the case of climate change, GHG emissions affect the welfare of people living in the future, as well as affecting the natural environment. These external costs can be estimated and converted in a common (monetary) unit. The argument for doing this is that these external costs can then be added to the private costs that the emitter faces. In doing this, the emitter faces the full (social) costs of their actions.

In 2009, 8.2 billion metric tons of carbon dioxide equivalent changed hands worldwide, up 68% from 2008 according to the study by carbon-market research firm Point Carbon, of Washington and Oslo. But at EUR94 billion, or about $135 billion, the market value was nearly unchanged compared with 2008, with world carbon prices averaging EUR11.40 a ton, down about 40% from the previous year according
to the study. The World Bank's “State and Trends of the Carbon Market 2010” put the overall value of the market at $144 billion, but found that a significant part of this figure resulted from manipulation of a value-added tax (VAT) loophole.

The global carbon market is dominated by the European Union, where companies that emit GHGs are required to cut their emissions or buy pollution allowances or carbon credits from the market, under the European Union Emission Trading Scheme (EU ETS). Europe, which has seen volatile carbon prices due to fluctuations in energy prices and supply and demand, will continue to dominate the global carbon market for another few years, as the U.S. and China—the world's top polluters—have yet to establish mandatory emission-reduction policies.

On the whole, the U.S. market remains primarily a voluntary market, but multiple cap-and-trade regimes are either fully implemented or near-imminent at the regional level. The first mandatory, market-based cap-and-trade program to cut CO₂ in the U.S., the Regional Greenhouse Gas Initiative (RGGI), kicked into gear in Northeastern states in 2009, growing nearly tenfold to $2.5 billion, according to Point Carbon. Western Climate Initiative (WCI) - a regional cap-and-trade program including seven western states (California notably among them) and four Canadian provinces - has established a regional target for reducing heat-trapping emissions of 15 percent below 2005 levels by 2020.

Carbon trading regulation will result in the expansion of the traditional ESCO focus of energy conservation projects to reduce demand, to include the funding of renewable energy projects to help lower the carbon intensity of energy supply.
These project types primarily include renewable energy, methane abatement, energy efficiency and, to a lesser extent, reforestation and fuel switching. A description of each is as follows:

- **Renewable energy**

  Renewable energy offsets commonly include wind power, solar power, hydroelectric power and bio-fuel. Some of these offsets are used to reduce the cost differential between renewable and conventional energy production, increasing the commercial viability of renewable energy sources.

  Renewable Energy Credits (RECs) are also sometimes treated as carbon offsets, although the concepts are distinct. Whereas a carbon offset represents a reduction in GHG emissions, a REC represents a quantity of energy produced from renewable sources. To convert RECs into offsets, the clean energy must be translated into carbon reductions, typically by assuming that the clean energy is displacing an equivalent amount of conventionally produced electricity from the local grid. This is known as an indirect offset (because the reduction doesn't take place at the project site itself, but rather at an external site), and some controversy surrounds the question of whether they truly lead to "additional" emission reductions, and who should get credit for any reductions that may occur.

- **Methane collection and combustion**

  Some offset projects consist of the combustion or containment of methane generated by farm animals (by use of an anaerobic digester), landfill, or other
industrial waste. Methane has a global warming potential (GWP) 23 times that of CO$_2$; when combusted, each molecule of methane is converted to one molecule of CO$_2$, thus reducing the global warming effect by 96%.

An example of a project using an anaerobic digester can be found in Chile where, in December 2000, the largest pork production company in Chile initiated a voluntary process to implement advanced waste management systems (anaerobic and aerobic digestion of hog manure) in order to reduce GHG emission.

Another local example is Nexterra, which is located in Vancouver, BC, Canada. Nexterra develops, manufactures, and delivers advanced gasification systems that enable customers to self-generate clean, low cost heat and power at industrial and institutional facilities using waste fuels.

- **Energy efficiency**

While carbon offsets, which fund renewable energy projects, help to lower the carbon intensity of energy supply, energy conservation projects seek to reduce the overall demand for energy. Carbon offsets in this category fund projects of several types, e.g.:

1. Cogeneration plants generate both electricity and heat from the same power source, thus improving upon the energy efficiency of most power plants which waste the energy generated as heat.
2. Fuel efficiency projects replace a combustion device with one which uses less fuel per unit of energy provided. Assuming energy demand does not change, this reduces the CO₂ emitted.

3. Energy-efficient buildings reduce the amount of energy wasted in buildings through efficient heating, cooling or lighting systems. In particular, the replacement of incandescent light bulbs with compact fluorescent lamps can have a drastic effect on energy consumption. New buildings can also be constructed using less carbon-intensive input materials.

3.1.6 Price – Simple payback

Payback period in capital budgeting refers to the period of time required for the return on an investment to "repay" the sum of the original investment. For example, a $1000 investment which returned $500 per year would have a two year payback period. The time value of money is not taken into account. Payback period intuitively measures how long something takes to "pay for itself." All else being equal, shorter payback periods are preferable to longer payback periods. Payback period is widely used because of its ease of use, despite recognized limitations, described below.

The term is also widely used in other types of investment areas, often with respect to energy efficiency technologies, maintenance, upgrades, or other changes. For example, a compact fluorescent light bulb may be described as having a payback period of a certain number of years or operating hours, assuming certain costs. Here, the return to the investment consists of reduced operating costs. Although primarily a
financial term, the concept of a payback period is occasionally extended to other uses, such as energy payback period (the period of time over which the energy savings of a project equal the amount of energy expended since project inception); these other terms may not be standardized or widely used.

3.1.7 Leading edge renewable solutions

Drivers such as social pressures, carbon credits and trading, government incentives, CSR etc., are encouraging owners to incorporate leading edge energy saving solutions, albeit at a higher risk than other, more traditional energy saving solutions. The forward-thinking owners see this as an opportunity to make a public statement regarding their commitment to energy reduction.

During the five years from the end of 2004 through 2009, worldwide renewable energy capacity grew at rates of 10–60 percent annually for many technologies. For wind power and many other renewable technologies, growth accelerated in 2009 relative to the previous four years (see Table 4). More wind power capacity was added during 2009 than any other renewable technology. However, grid-connected solar (PV) increased the fastest of all renewable technologies, with a 60-percent annual average growth rate for the five-year period.

As time progresses renewable energy will likely fall in price relative to fossil fuels, for three main reasons:

1. Once the renewable infrastructure is built, the fuel is free forever. Unlike carbon-based fuels, the wind and the sun and the earth itself provide fuel that is free, in amounts that are effectively limitless.
2. While fossil fuel technologies are mature, renewable energy technologies are being rapidly improved. So innovation and ingenuity give us the ability to increase the efficiency of renewable energy and reduce its cost.

3. Once the world makes a clear commitment to shifting toward renewable energy, the volume of production will itself sharply reduce the cost of each windmill and each solar panel, while adding yet more incentives for additional research and development (R&D) to further speed up the innovation process.

New and emerging renewable energy technologies are still under development and include cellulosic ethanol, hot-dry-rock geothermal power, and ocean energy. These technologies are not yet widely demonstrated, or have limited commercialization. Many are on the horizon and may have potential comparable to other renewable energy technologies, but still depend on attracting sufficient attention and R&D funding.

3.1.8 Energy supply cost management

Electricity pricing usually peaks at certain predictable times of the day and the season. In particular, if generation is constrained, prices can rise as power is imported from other grid jurisdictions, or more costly generation is brought online. It is believed that billing customers by time of day will encourage consumers to adjust their consumption habits to be more responsive to market prices. Regulatory and market design agencies hope these "price signals" will delay the construction of additional generation, or at least the purchase of energy from higher priced sources,
thereby controlling the steady and rapid increase of electricity prices. This is analyzed later in this paper.

3.2 Value curve analysis

Table 5 provides an end-user value curve analysis to evaluate the abilities of the ESCOs, their rivals and the new entrants to address the key factors of competition “pain points” of the end users.

3.2.1 Key Observations

- ESCOs and the rival solutions performance profiles are the opposite of each other, with the exception of the energy supply cost management.

- This industry appears stable, with the exception of energy supply cost management; neither the ESCOs nor the substitutes are currently addressing this utility pain point at this time.

- The new entrant (IT giant) is closely aligned with the rivals’ offering; however they diverge for energy supply cost management with the new entrants as the only solution.

- MUSH and non-MUSH sectors show the potential to shift away from the traditional ESCO towards the rival solution and new entrant offering. New entrants are more closely aligned with customer trends than is the traditional ESCO offering.
3.2.2 Opportunities

The value curve analysis suggests that there are some emerging opportunities to address the up-stream “energy supply cost” utility provider pain point. In the past, ESCOs have almost solely focussed on the end-user pain point. This would suggest that there may be some uncontested “up-stream” market space – or even some blue ocean opportunities. Before exploring the ‘up-stream’ opportunities, I have summarized the ESCO opportunities as follows:

- The MUSH sector continues to be a growth sector and the ESCOs should maintain their focus on this area instead of competing directly with the rivals’ offering. Also, public sector leaders have a broader and longer term vision, and therefore are better aligned with the value proposition of the ESCO comprehensive long term solution ownership which allows ESCOs to increase the WTP and extract value for their offering.

- Although the rivals have diluted the value of the energy saving guarantee, the shift towards leading edge “green” technology solutions has increased the risk for the end-user. This shift will increase demand for the ESCOs’ value proposition, and increase the WTP for those customers who are more risk averse.

- ESCOs can leverage their brand power, reputation and ownership track-record in the marketplace by forming strategic alliances with the innovative start-ups, which face significant barriers to entry. Also, these start-ups are typically run by a small group of creative minds who are motivated by creating innovative solutions rather than market penetration. Their strategies are typically to innovate, develop and sell out to a Multi-National Enterprise (MNE). It is, however, paramount that
ESCOs focus on those technologies that either complement their existing core competencies, or that enable them to extend their core competencies.

- ECSO’s have focussed on overall energy reduction. The majority of these energy savings result from energy reduction during low energy demand periods, and this does not address the utilities larger problem of reducing peak load through significant peak load reduction or load shifting. As such ESCOs can leverage their technology and customer base to respond to energy supply cost management (largely an untapped opportunity). One technique that transmission grid operators currently use with their industrial customers is called demand response (a grid management technique where customers are requested either electronically or manually to reduce their load).

The next chapter will apply the same blue ocean analysis from a utility provider’s perspective, in order to understand the “up-stream” opportunities.
4 BLUE OCEAN ANALYSIS – UTILITY PROVIDER

4.1 Key factors of competition:

Having completed a value curve analysis of the ESCO industry from an end-user perspective (down-stream analysis), it became apparent that there were a number of “up-stream” utility pain points which should be investigated. Based on this, the value curve analysis was repeated from the perspective of a utility provider. Each analysis was mapped out for the rivals, the three major ESCO groups, as well as for the new entrants (IT giants and innovative start-ups).

However, before analyzing the utility provider pain points, the paper will first discuss the electricity pricing models. In many electric systems, some or all consumers pay a fixed price per unit of electricity independent of the cost of production at the time of consumption. The consumer price may be established by the government, regulator, and represents an average cost per unit of production over a given timeframe (for example, a year). Consumption therefore is not sensitive to the cost of production in the short term. In economic terms, consumers' consumption of electricity is inelastic within short time-frames since they do not face the "real" price of production (see Figure 5). If consumers were to face actual prices in short periods, they would increase and decrease their use of electricity in reaction to price signals.
Electricity producers are implicitly or explicitly paid according to a system intended to encourage priority usage of lower-cost sources of generation (in terms of marginal cost). In many systems that use market-based pricing, the wholesale cost will vary according to demand and available supply. The variation in pricing can be significant: for example, in Ontario between August and September 2006, wholesale prices (in Canadian dollars) paid to producers ranged from a peak of $318 per megawatt hour (MWh) to a minimum of - (negative) $3.10 per MWh. In the latter case, the negative price indicates that producers were being charged to provide electricity to the grid and consumers paying real-time pricing may have actually received a rebate for consuming electricity during this period. It is not unusual for the price to vary by a factor of two to five due to the daily demand cycle.

In cases where consumers do not face actual market prices, they have little or no incentive to reduce consumption (or defer consumption to later periods) during times when production costs are significantly higher.

Two Carnegie Mellon studies in 2006 looked at the importance of demand response for the electricity industry in general terms, and with specific application of real-time pricing for consumers for the PJM Interconnection Regional Transmission Authority. The latter study found that even small shifts in peak demand would have a large effect on savings to consumers and avoided costs for additional peak capacity: a 1% shift in peak demand would result in savings of 3.9%, which translates into billions of dollars at the system level. An approximately 10% reduction in peak
demand (achievable depending on the elasticity of demand) would result in systems savings of between $8 and $28 billion.

A study carried out in 2007vii for the United States showed that even a 5 percent drop in peak demand would yield substantial savings in generation, transmission, and distribution costs – enough to eliminate the need for installing and running some 625 infrequently used peaking power plants and associated power delivery infrastructure. This would yield an annual saving of $3 billion over the next two decades, which has a present value of $35 billion.

In Ontario, Canada, the independent electricity system operator has noted that in 2006, peak demand exceeded 25,000 megawatts during 32 system hours (less than 0.4% of the time), while maximum demand during the year was just over 27,000 megawatts. The ability to "shave" peak demand based on reliable commitments would therefore allow the province to reduce built capacity by approximately 2,000 megawatts.

Having reviewed the electricity pricing structure and its problems, a review of the utility providers will help us better understand the pain point analysis. The three components of a complete grid: generation, transmission, and distribution of electrical power, can all be found in most large utilities. A utility can be completely self-sufficient, but finds it advantageous to have the opportunity to buy and sell power to and from neighboring utilities. This improves their reliability, and that of their neighbors. Utilities are often awarded a "monopoly" status (at least at the distribution level) simply because it doesn't make sense to have competing utilities installing their
hardware in the same location as another utility. The idea of a monopoly becomes less compelling as one considers the generation of electrical power. Wildly varying costs for the production of electricity and the opportunity to encourage free market competition spurs many legislatures to move towards deregulation of the electric utilities. The idea of de-regulation usually involves the dividing of the generation, transmission, and distribution operations into separate financial entities. Generation assets in particular can often be sold off to the highest bidders. With the aging infrastructure present at many utilities and the pressure to de-regulate, there are numerous opportunities to re-engineer the system.

Based on the above analysis and discussions with local BC Hydro staff, the utility key “pain points” can be summarized as follows:

- Deregulation;
- Supply Side Management (SSM) consisting of:
  - Grid (transmission and distribution) infrastructure management;
  - Capacity management;
  - Availability factor management; and
- Demand Side Management (DSM).

A detailed description of each of these follows:

4.1.1 Deregulation

Utilities, which for decades enjoyed the shelter of monopolies with guaranteed returns on power plant investments, had to adapt to the changes which resulted from
the deregulation of the energy markets in the 1990’s. Deregulation primarily focused on the generation component, while the utility maintained the “monopoly” status for the transmission and distribution.

The intent of deregulation was to encourage competition in the generation of electricity by independent power producers. This, however, also opened up the door for market manipulation, where illegal shutdown of independent power producers created shortages of electricity supply in order to increase prices, resulting in an unreliable supply of electricity to the end-user. For example, the California energy crisis of 2000-2001 was a situation where California had a shortage of electricity caused by market manipulations and illegal shutdowns of generation by energy consortiums. The state suffered from multiple, large-scale blackouts because of supply manipulation, resulting in a large demand and supply gap. This allowed traders to sell power at premium prices, sometimes up to a factor of twenty times the normal value. Because the state government had a cap on retail electricity charges, this market manipulation squeezed the industry's revenue margins, causing the bankruptcy of Pacific Gas and Electric Company (PG&E) and near bankruptcy of Southern California Edison in early 2001. It is estimated that this crisis cost the State of California between $40 billion and $45 billion.

4.1.2 Supply Side Management (SSM)

SSM can be broken down into three main areas: grid infrastructure management, capacity management and availability factor management.
Grid (transmission and distribution) infrastructure management

The utility owned and operated grid infrastructure places some significant risk and constraints on the ability to deregulate the industry. Essentially, the current grid design is impacting the ability to fully embrace the potential of renewable technologies. Many renewable technology energy sources provide only intermittent power (any source of energy that is not continuously available due to some factor outside direct control). This intermittent power may be predictable (e.g. tidal energy) or non-predictable (e.g. wind, solar etc) and not be available when demand requires it. The effective use of these growing intermittent power sources in an electric power grid usually relies on using intermittent sources to displace fuel that would otherwise be consumed by thermal power stations, or by storing energy in the form of pumped storage, compressed air or ice, for use when required.

The use of small amounts of intermittent power has little effect on grid operations. Using larger amounts of intermittent power may require upgrades or even a redesign of the grid infrastructure to ensure a reliable and robust supply of energy. Considering the above, the increased use of intermittent renewable energy sources is placing pressure on utility companies to increase spending on grid redesign and grid expansion, a highly capital intensive venture. In summary, the growing shift towards renewable energy sources continues, and the associated growth is increasing the grid infrastructure pain point for the utility provider.
The net **capacity factor** of a power plant system is the ratio of the actual output of a power plant system over a period of time, to its output if it had operated at full capacity the entire time. Capacity factors vary greatly depending on the type of fuel that is used, since the use of different fuels affect maintenance requirements and the design of the energy plant source. Traditionally, utilities managed capacity factors through the establishment of a mix of three sources: base load power plants, peak load power plants and load following power plants. A brief description of each follows:

- **Base load power plants** – Base load plants have the lowest costs per unit of electricity because they are designed for maximum efficiency and are operated continuously at high output. Typically in North America, the majority of the base load power plants are coal fired and have ageing infrastructure, resulting in increased equipment failures or routine maintenance which account for the single largest contributor to capacity factor reduction.

- **Peaking load power plants** – By design, peaking load power plants output is curtailed when the electricity is not needed or because the price of electricity is too low to make production economical. This accounts for most of the unused capacity of peaking power plants. Peaking plants may operate for only a few hours per year or up to several hours per day, and they are usually in the form of gas turbines which run on natural gas or aircraft fuel. Their electricity is relatively expensive. It is uneconomical, even wasteful, to make a peaking power plant as
efficient as a base load plant because they do not operate enough to pay for the extra equipment cost, and perhaps not enough to offset the embodied energy of the additional components.

- **Load following power plants**, also called intermediate power plants, are in between these extremes in terms of capacity factor, efficiency and cost per unit of electricity. They produce most of their electricity during the day, when prices and demand are highest. However, the demand and price of electricity is far lower during the night, so intermediate plants shutdown or reduce their output to low levels overnight. Load following power plants include hydroelectric power plants and steam turbine power plants that run on natural gas or heavy fuel oil, although heavy fuel oil plants make up a very small portion. A relatively efficient model of gas turbine that runs on natural gas can also make a decent load following plant.

  The shift towards renewable energy sources has complicated the management of capacity for utilities since the fuel source (wind, sunlight or water) is not reliable.

  More specifically:

  - Hydroelectric capacity factor varies significantly based on geography. The worldwide average capacity factor for hydroelectric power is around 44% but typically varies between 22 and 75%. When hydroelectric plants have water available, they are useful for load following, because of their high *dispatchability*.\(^8\) A typical hydroelectric plant's operators can bring it from a

\(^8\) Dispatchability is the ability of a given power source to increase or decrease output quickly on demand. The concept is distinct from intermittency; maneuverability is one of several ways grid operators match output (supply) to system demand.
stopped condition to full power in just a few minutes. In some regions such as BC, Canada, hydroelectric power is used as a base power source.

- Wind farms capacity factor varies between 20 and 40% due to the natural variability of the wind. Because a wind farm may have hundreds of widely spaced wind turbines, the farm as a whole tends to be robust against the failure of individual turbines. In a large wind farm, a few wind turbines may be down for planned or unplanned maintenance at a given time, but the remaining turbines are generally available to capture power from the wind.

- Solar (PV) capacity factor typically varies between 12 and 19%. The variability is largely based on the daily rotation of the earth and because of cloud cover.

According to the Solar PACES program\(^9\) of the International Energy Agency (IEA), solar power plants designed for solar-only generation are well matched to summer noon peak loads in areas with significant cooling demands, such as Spain or the south-western United States. However, it needs to be considered that solar PV does not reduce the need for generation of network upgrades, given that air conditioner peak demand often occurs in the late afternoon or early evening when solar output is zero. As such, Solar PACES states that by using thermal energy storage systems, the operating periods of solar thermal power (CSP) stations can be extended to better meet some base-load needs. The IEA CSP Technology Roadmap (2010) suggests that “in the sunniest countries, CSP can be expected to become a competitive source of bulk power in peak and intermediate loads by 2020, and of base-load power by 2025 to 2030”.

\(^9\) SolarPACES (Solar Power and Chemical Energy Systems) is an international programme of the International Energy Agency to further the collaborative development, testing and marketing of concentrating solar power plants.
- Geothermal has a higher capacity factor than many other power sources, and geothermal resources are available 24 hours a day, 7 days a week. While the carrier medium for geothermal electricity (water) must be properly managed, the source of geothermal energy, the Earth's heat, will be available for the foreseeable future.

**Availability factor management**

The availability factor of a power plant system is the amount of time that it is able to produce electricity over a certain period, divided by the amount of the time in that period. Occasions where only partial capacity is available may or may not be deducted. The availability factor should not be confused with the capacity factor. The availability of a power plant varies greatly depending on the type of fuel, the design of the plant and how the plant is operated. Everything else being equal, plants that are run less frequently have higher availability factors because they require less maintenance. Most thermal power stations, such as coal, geothermal and nuclear power plants, have availability factors between 70% and 90%. Newer plants tend to have significantly higher availability factors, but preventive maintenance is as important as improvements in design and technology. Gas turbines have relatively high availability factors, ranging from 80% to 99%. Gas turbines are commonly used for peaking power plants, co-generation plants and the first stage of combined cycle plants.

The availability factor of wind and solar power plants depends on whether the periods when the plant is operational, but there is no wind or sunlight, are counted as
available, unavailable or disregarded. If they are counted as available during these times, solar PV plants have an availability factor approaching or equal to 100% and modern wind turbines have very high availability factors around 98% (these availability factors are much lower if the times when sunlight or wind are not available are taken into account).

In summary, the increased focus on renewable energy sources is adding to the utility pain point to manage supply capacity and ensuring a reliable and robust energy supply. This is further compounded by the grid infrastructure limitations, the deregulation of the industry, and the creation of independent power producers that are largely unregulated.

4.1.3 Demand Side Management (DSM)

DSM is the modification of consumer demand for energy through various methods such as financial incentives and education. The term DSM was coined during the 1973 and 1979 energy crises.

Reducing energy demand is contrary to what both energy suppliers and governments have been doing during most of modern industrial history. Whereas real prices of various energy forms have been decreasing during most of the industrial era due to economies of scale and technological improvements, the expectation for the future is the opposite. It was not unreasonable to promote energy use when cheaper and more abundant energy sources could be anticipated in the future, or when the supplier had installed excess capacity that would be made more profitable by increased consumption.
In centrally planned economies, subsidizing energy was one of the main economic development tools. Subsidies to the energy supply industry are still common in some countries. In the future, however, energy prices and availability are expected to deteriorate. Governments, if not the energy suppliers themselves, are tending to employ energy demand measures that will increase the efficiency of energy consumption.

Usually, the goal of DSM is to encourage the consumer to use less energy in general, less energy during peak hours, or to move the time of energy use to off-peak times such as nighttime and weekends. Although peak demand management does not necessarily decrease total energy consumption, it will reduce the need for investments in networks and in power plants.

Electricity use can vary dramatically over short and medium time frames, and the pricing system may not reflect the instantaneous cost as additional higher-cost ("peaking") sources are brought on-line. In addition, the capacity or willingness of electricity consumers to adjust to prices by altering demand (elasticity of demand) may be low, particularly over short time-frames. In many markets, consumers (particularly retail customers) do not face real-time pricing at all, but pay rates based on average annual costs or other constructed prices.

Various market failures rule out an ideal result. One is that suppliers' costs do not include all damages and risks of their activities, and therefore external costs are incurred by others directly or by damage to the environment, and are known as externalities. One solution would be to add external costs to the direct costs of the
suppliers as a tax (internalization of external costs). An alternate approach is to intervene on the demand side by some kind of rebate for consumers who reduce consumption during peak demand periods.

DSM activities should bring the demand and supply closer to a perceived optimum. Governments of many countries mandated performance of various programs for demand management after the 1973 energy crisis.

Demand for any commodity can be modified by the actions of market players and government (regulation and taxation). Energy demand management implies actions that influence demand for energy. DSM was originally adopted in energy; today DSM is applied widely to utilities including water and gas.

Traditionally utilities have partnered with ESCOs and provided incentives to end-users to identify and implement sustainable energy reductions.

4.2 Value curve analysis:

Table 6 provides a utility value curve analysis to evaluate the ability of ESCOs, their rivals and the new entrants to address the key factors of competition, the “pain points” of the utility provider.

4.2.1 Key observations:

From the value curve analysis, it can be seen that all of the identified utility pain points show increasing trends. In other words, the pain is becoming more intense for the utility providers. It is also important to note that all of the players have negatively
impacted the utilities’ SSM pain point, making it harder for utilities to achieve supply management objectives. On the demand side, it can be seen that the new entrants are well positioned to provide relief for this utility pain point. The key observations for each of the utility pain points are as follows:

- The purpose of deregulation of the energy generation industry in the 1990’s was to create competition in the industry. This has resulted in significant challenges for governments and utility providers, as experienced during the 2000-2001 California energy crisis, which has compounded the challenge for utilities to provide reliable power at a reasonable price. More recently, however, governments are looking at ways to pass on the external costs of generation to the end user. The model used in Europe to achieve this is carbon trading. Although this is still at a voluntary stage in North America, it is driving a renewed focus on the following:
  - Renewable technologies
  - Methane gas collection and combustion; and
  - Energy efficiency.

Neither the ESCOs, the rivals nor the new entrants provide any direct relief to the utility provider in terms of the deregulation pain point. In fact, the analysis which follows will illustrate how these players have negatively affected this utility pain point.

- Traditional SSM have balanced capacity factor with base load, peak load and load following power plants. Renewable technologies have added a number of new
complexities to this – dispatchability, intermittency, variability and reliability.

ESCOs, substitutes or the potential entrant have all negatively impacted this pain point for the utility providers. Unlike the European grid system, the North American grid infrastructure is highly regionalized and therefore less adaptable in terms of allowing it to embrace growth in the application of renewable technology solutions in order to lower capacity and availability factors, as compared with traditional energy sources. The increased focus on renewable energy sources with intermittent availability also adds to the utility pain point of ensuring a reliable supply of energy.

- Utilities have moved their focus away from promoting the consumption of energy on the grounds of economies of scale to a focus of reducing the consumption of energy by treating energy as a scarce resource. More specifically,

  o Utilities have partnered with ESCOs and provided incentives to end-users to identify and implement sustainable energy solutions. This has had a significant impact of reducing end-user load reductions of up to 30% in many cases. ESCOs still have a dominant market position to continue with end-user load reduction. But it should be noted that the new entrants are well positioned to address this utility pain point by embracing emerging (and possibly disruptive) renewable energy solutions.

  o The ESCOs focus for energy savings has been on overall energy demand reduction, and most often the savings are achieved at low load energy times which does not provide much relief to utility providers (very little focus has been given to peak load reduction). Utility providers have not
been able to transfer the true cost of energy supply to their consumers because of some inherent market failures. As such, they have not been able to transfer their SSM core pain points to the end user. This in turn has resulted in a serious disconnect between SSM and DSM. By embracing emerging technologies, ESCOs and the new entrants are well positioned to address this utility pain point.

4.2.2 Opportunities:

The value curve analysis clearly shows how the ESCOs have added to the utility pain points and suggests that there are some potentially uncontested market space opportunities. Based on this analysis, I have identified the following five opportunities:

1. **Carbon Trading:** North America is one of the world’s top GHG polluters but has yet to establish mandatory emission-reduction policies. Currently, the North American Carbon Trading market remains a primarily voluntary market. However, multiple cap-and-trade regimes are either fully implemented or near-imminent at the regional level. Based on the infancy of this initiative to cut GHG emissions, there is a potential opportunity for strategic alliances between ESCOs, utility companies and investment brokers to position themselves in this evolving opportunity.

2. **Renewables:** The utility pain points associated with renewable technologies are only going to get worse with the exponential growth in renewable R&D spend and installations. For example, the global revenues for solar PV, wind power, and
bio-fuels expanded from $76 billion in 2007 to $115 billion in 2008 (see Figure 6). New global investments in clean energy technologies expanded by 4.7 percent, from $148 billion in 2007 to $155 billion in 2008.

3. **Smart grid / Demand Response** - Numerous efforts are underway to develop a "smart grid". In the U.S., the Energy Policy Act of 2005 and Title XIII of the Energy Independence and Security Act of 2007 are providing funding to encourage smart grid development. The objective is to enable utilities to better predict their needs, and in some cases involve consumers in some form of time-of-use based tariff. Funds have also been allocated to develop more robust energy control technologies.

   Smart grid applications improve the ability of electricity producers and consumers to communicate with one another and make decisions about how and when to produce and consume electricity. This emerging technology will allow customers to shift from an event-based demand response where the utility requests the shedding of load, towards a more continuous demand response where the customer sees incentives for controlling load all the time. Although this back and forth dialogue increases the opportunities for demand response, customers are still largely influenced by economic incentives and are reluctant to relinquish total control of their assets to utility companies.

   One advantage of a smart grid application is time-based pricing. Electricity customers who traditionally pay a fixed rate per kilowatt hour (kWh) per month can set their threshold and adjust their usage to take advantage of fluctuating prices. This may require the use of an energy management system to control
appliances and equipment. Another advantage, mainly for large customers with
generation capacity, is being able to closely monitor, shift, and balance load in a
way that allows the customer to save peak load, and not only save, but be able to
trade electricity that they have saved in an energy market. Again, this involves
sophisticated energy management systems, incentives, and a viable trading
market.

Smart grid applications increase the opportunities for demand response by
providing real time data to producers and consumers, thereby enabling the
economic and environmental incentives to affect supply and demand.

4. **Micro grid**\(^{10}\) / Distributed Generation - Decentralization of the power transmission
and distribution system is vital to the success and reliability of the energy system.
Currently the system is reliant upon relatively few generation stations. This makes
current systems susceptible to impact from failures. Micro grids would have local
power generation, and allow smaller grid areas to be separated from the rest of the
grid if a failure were to occur. Furthermore, integration of micro grid systems
could help power each other if needed. Generation within a micro grid could be a
downsized industrial generator or several smaller systems such as solar (PV)
systems, or wind generation. When combined with smart grid technology,
electricity could be better controlled and distributed more efficiently.

With everything interconnected, and open competition occurring in a free
market economy, it starts to make sense to allow and even encourage distributed

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\(^{10}\) A *micro grid* is a localized grouping of electricity generation, energy storage, and loads that is normally
connected to a traditional centralized grid.
generation (DG). Smaller generators, usually not owned by the utility, can be brought on-line to help supply the need for power. The smaller generation facility might be a home-owner with excess power from their solar panel or wind turbine. It might be a small office with a diesel generator. These resources can be brought on-line either at the utility's behest or by owner of the generation in an effort to sell electricity. Many small generators are allowed to sell electricity back to the grid for the same price they would pay to buy it. On-site renewable energy source revenues have increased from 10 to 14% of total ESCO revenues from 2006 through 2008 (see Figure 3).

5. **Super grid** - Various planned and proposed systems to dramatically increase transmission capacity are known as super, or mega grids. The promised benefits include enabling the renewable energy industry to sell electricity to distant markets, the ability to increase usage of intermittent energy sources by balancing them across vast geographical regions, and the removal of congestion that prevents electricity markets from flourishing. This will also allow utilities to better embrace renewable energy sources. Local opposition to installing new lines and the significant cost of these projects are major obstacles to super grids.
5 OPPORTUNITY RISK ANALYSIS AND CORE COMPETENCY ALIGNMENT

Having identified five potential ESCO opportunities, the next step is to recommend which opportunities each of the three major ESCO groups should focus on. To do this, I first analysed each opportunity in terms of risk for the three major ESCO groups and the new entrants. I then analysed each opportunity in terms of core alignment for the same players and conclude with my final recommendations.

5.1 Risk analysis

Since the risk of an opportunity increases significantly if the product or service is new, or alternatively if the opportunity is in a new market, I plotted each opportunity on a “risk quadrant” for each of the players to determine the relative risk (and relative risk advantage) of each opportunity. The results are as shown in Table 7.

5.2 Core competency alignment

A core competency is a specific factor that a business sees as being central to the way it, or its employees, works. It fulfils two key criteria:

- It is not easy for competitors to imitate.
- It can be leveraged widely across many products and markets.
A core competency can take various forms, including technical subject matter know-how, a reliable process or close relationships with customers and suppliers.

According to Baine’s five year study of 1,850 companies, the chances for success in growth initiatives were nearly three times higher for companies moving into adjacencies from strong leadership positions in their core business. As such, I have reviewed each of the five identified opportunities against the core competencies of the new entrants and the three major ESCO groups.

The methodology I used to create the analysis in Table 8A through 8E is as follows:

- Define a list of core competencies. I did this by listing the core competencies of each of the players. I then added those core factors that are critical to the success of each of the five identified opportunities, if not already listed, and then consolidated the list down to fifteen core competencies and success factors.

- I then reviewed each of the players against this list of core competencies. I assigned weighted ratings of core, high, medium, low and none with values of 9, 5, 3, 1 and 0, respectively. For example, I reviewed the start-ups, the IT giants, the equipment affiliated, utility affiliated and non-utility affiliated ESCOs against the “R&D - renewables” core competency and rated them as 9, 5, 0, 5 and 5, respectively.

- Similarly, I then reviewed each of the five opportunities in terms of how critical each is for the opportunity to be a success (factors of success). I rated the factors
of success as either core, high, medium, low or none and I assigned weights 9, 5, 3, 1 and 0, respectively.

For example, with reference to the “Renewable energy source” analysis (Table 8B), I identified that “R&D - renewables” is a core opportunity factor of success and assigned a weighted value of 9.

- Having assigned evaluations to each of the player’s core competencies and then having done the same for the factors of success for each opportunity, I multiplied the results in order to compare the competency alignment between the players and each of the five opportunities.

Using the same example as noted above, the results for the “renewable energy source” opportunity shows very high alignment for the start-ups (scoring 81), good alignment for the IT giants, utility affiliated ESCO and the non-utility affiliated ESCO (scoring 45 each) and no alignment for the equipment affiliated ESCO (score 0).

5.3 Results

Table 8A through Table 8E analyze the core competency alignment between the new entrants’ and the three major ESCO groups’ core competencies, and the five identified opportunities.

Table 9 summarises the results of the risk analysis and the core competency alignment analysis for each of the identified opportunities, for each of the players. For this final analysis, I have ignored the innovative start-up group as I consider them
to have significant barriers to entry, and the most attractive path for them would be to either ally with or to sell-out to the IT giants or one of the three major ESCO groups.

5.3.1 Carbon Trading – see Table 8A

None of the players have core competency alignment with this opportunity. In fact, they all have barriers to enter this market space. Also, with reference to the risk analysis, Table 7, it can be seen that carbon trading is a very high risk opportunity, being both a new market and a new product for all players. Notwithstanding this, based on the potential of carbon trading moving from a voluntary to a mandatory requirement in the future, this is certainly on the minds of most customers. If it is not a customer pain point at this time, it is expected to become one, in particularly with the forward looking top executive customer in the MUSH sector.

Carbon trading will essentially become an enabler by increasing the economic viability of renewable energy sources, which in turn will further increase the utility provider supply pain point and result in increased demand for smart grid, micro grid and super grid opportunities.

As such, on a macro level, I suggest that the three major ESCO groups review how carbon trading has driven change in Europe, in order to better understand how this may impact the North American ESCO business. With this understanding, they may be better able to position themselves for this anticipated change (e.g. how can they leverage existing relationships to develop new ones). They also need to understand that carbon trading will both increase the potential rewards, as well as
attract renewed interest, so choosing which opportunities to focus on is very important – the stakes are very high.

ESCOs need to educate their prospective clients on the changes that carbon trading regulation is going to have on their business and then quantify and validate the carbon offsets by analysing the reduction in energy consumption, which will result from an EPC. ESCOs should also not try to become the experts on carbon trading; instead, they should form strategic alliances with reputable third parties who have the required core competencies.

5.3.2 Renewable Energy source – see Table 8B

Not surprisingly, there is a very strong core competency alignment between renewable energy sources and the innovative start-ups. However, the challenge for the innovative start-ups is that they face significant barriers to entry, as shown in the core competency alignment analysis. They are generally small, entrepreneurial start-ups with a unique concept, and they typically have an exit strategy of selling out to a larger, more established player who can take the concept to market. The IT giants are a good “fit” for the innovative start-ups to align themselves with, even if they have a relative risk disadvantage (i.e. a new market and a new product pursuit). In other words, their deep pockets allow them the opportunity to take on higher risk opportunities that have the potential to disrupt the market space, and the possibility owning a part of this growing opportunity. As such, I expect that any renewable energy technology which is adjacent to an IT giant’s core technology area will be aggressively pursued (regardless of the risk) if the technology has the potential to be
disruptive, thereby providing the IT giants with an opportunity to dominate a part of the energy industry.

From an ECSO perspective, IT incumbents are expected to extract value from the outer ends of the supply chain (see Tables 1 and 2). As such, I think that there is a good fit for an IT incumbent, who has acquired a disruptive technology, to form a strategic alliance with a ESCO player to take advantage of their vertical integration, strong presence and understanding of the market. This will allow the IT incumbent the opportunity to bundle a disruptive renewable technologies into EPC agreements to gain quick market exposure with low risk to the end-user (fast market penetration with a disruptive technology).

5.3.3 Smart Grid / Demand Response – see Table 8C

As in the case with renewable technologies, there is a very strong core competency alignment between Smart Grid / Demand Response and the innovative start-ups, but they face significant barriers to entry. The IT incumbents, the equipment affiliated ESCOs and the utility affiliated ECSOs are well positioned to either form a strategic alliance, or buy-out an innovative start-up and take a product to market. None of the players have any relative risk advantage, as this is essentially a new product in an existing market for all players (high risk – see Table 7).

Table 8C shows that the IT incumbents currently do not have established relationships with the utility providers. However, I do believe that they are already leveraging their strong top executive relationships and developing these key utility relationships. The Table also shows that the smart grid technology is well aligned
with their IT focussed core competencies (e.g. CISCO and networking). They also have deep pockets, providing them with a risk advantage relative to the other players. So, I expect the IT incumbents with adjacent core competencies to aggressively pursue smart grid opportunities if they feel that they have the opportunity to dominate this growing utility pain point.

While the utility affiliated ESCOs have strong utility relationships, I do not see any other strong competency alignment with this opportunity. On the other hand, equipment affiliated ESCOs (controls focussed in particular) have a very good understanding of developing and delivering energy conservation strategies in buildings, and the integration of smart grid technologies is very well aligned with this core competency. They also have strong established relationships with utility providers and end-users (primarily MUSH) and they are able to both deliver and support the implementation of a smart grid system. This is certainly an attractive opportunity for the controls focussed equipment affiliated ESCOs.

Considering that the development of a successful smart grid solution will require the integration of multiple technologies and core competencies, I expect that success will go to those who form smart strategic alliances. These alliances may include innovative start-ups, IT incumbents as well as controls focussed equipment affiliated ESCOs and quite possibly utility affiliated ESCOs.
5.3.4 Micro Grid / District Energy - see Table 8D

I expect the early adopters of this opportunity will be owners of large multi-site buildings (for example, university campuses, school districts and municipal building clusters where CSR is a high focus).

From a core competency perspective, equipment affiliated ESCOs (HVAC focussed in particular) and the utility affiliated ESCOs are well aligned to exploit this opportunity as they are experienced at HVAC installations and the on-going servicing of this equipment. In addition, they have very good relationships with the utility providers, and micro grids can be included as a standard EPC solution to their existing MUSH customers.

With reference to Table 7, the utility affiliated ESCO has a risk advantage over the equipment affiliated ESCO for this opportunity. This is based on the fact that utility affiliated ESCOs are essentially in the utility business, so this opportunity is an extension of their current service offering.

However, the challenge that utility affiliated ESCOs have is that traditionally, innovation has not been part of their culture. As such, I do not think they would be able to take advantage of this opportunity without forming a strategic alliance with an innovative start-up or simply acquiring them. In the later case, I would strongly recommend that the innovative start-up be given a lot of freedom and autonomy, or else the more conservative utility focussed culture will destroy their culture of innovation.
At this time, I do not expect that IT incumbents will pursue micro grid / District Energy as an attractive market space, as this is not a good core competency fit and is considered to be very high risk for them (a new product in a new market).

5.3.5 Super Grid - see Table 8E

Table 8E clearly shows that the super grid opportunity is not aligned with any of the players core competencies. Similarly, as seen in Table 7, this opportunity is also a very high risk (new product in a new market) for all of the players. Based on this poor fit, I do not see this as a potential opportunity for any of the players.

5.4 Focussed or diversified

As illustrated in Figure 7, analysis of over-performing and underperforming industries has shown that it is advantageous to follow a focussed strategy in an over-performing industry, and a diversified portfolio in an underachieving industry.

As such, a focussed strategy may be better than a diversified portfolio in achieving successful market penetration in the fast growing and over performing energy industry. Also, along these same lines, it is critical that the organization structure be structured to support this industry focus. This may be challenging for the equipment affiliated ESCOs, who view energy as an extension to their core HVAC service and installation businesses. However, to be successful it is paramount that these organizations are structured to be aligned with the focussed business strategy. In these cases, I would suggest a matrix organizational structure to ensure both strong alignment to the focussed energy business strategy, as well as alignment to the other
core service and installations businesses. In addition to the primary objective of ensuring organization structure and business strategy congruency, this structure will allow for economies of scale, improved experience (learning) curves, lower coordinating costs and very importantly it will open significant opportunities to benefit from cross functional teams between service, installation and energy which are all complimentary to each other.

5.5 ESCO Recommendations

Since the earlier analysis suggests that carbon trading is more of an enabler for the other identified opportunities, I have not considered this as an ESCO opportunity in my final recommendations. Similarly, I do not include the super grid. My ESCO recommendations consider only the following opportunities:

- Renewable energy source;
- Smart grid / Demand response; and
- Micro grid / District Energy

Before considering each of these opportunities from an ESCO perspective, it is certainly worth reminding oneself that the IT incumbents are currently aggressively acquiring or investing in almost all emerging segments of the energy sector. It can be interpreted that these investments represent attempts to manage the uncertainty surrounding the emerging technologies in the energy sector, by creating a portfolio of real options.
Based on the analysis of this paper, my recommendations for each of the three major ESCO groups are as follows:

5.5.1 Equipment affiliated ESCO

Even though I expect the IT incumbents to continue pursuing renewable technology options aggressively, I think that ESCOs should stay in close touch with innovative start-ups to understand the areas of innovation being pursued. This will allow them to either align themselves with a start-up opportunity or, alternatively, to partner with IT incumbents who have already acquired an innovative and potentially disruptive renewable technology.

I believe that the smart grid opportunity is the most attractive opportunity for the controls focused equipment affiliated ESCO to pursue. From a strategic perspective, I believe that this technology should be acquired through an acquisition rather than an alliance as the latter may result in competing for the same or similar IP rights at a later time when the stakes are very high. As noted previously, since a smart grid solution involves integration of various types of technical expertise, the controls focussed ESCO strategic group should also actively pursue strategic partnerships with other players to create a robust smart grid solution and gain fast market penetration by being first to market.

The most attractive opportunity for HVAC equipment focussed ESCOs is the micro grid / district energy opportunity. Their traditional customers are expected to be the early adopters of this opportunity. I do not expect this to be receive as much focus from the IT incumbents as the renewable energy opportunity will.
5.5.2 Utility affiliated ESCO

The most attractive option for the utility affiliated ESCO to pursue is the Micro Grid / District Energy opportunity. This is both well aligned with their core competency and is a natural extension to their existing product and service offering. Caution should prevail, as the IT incumbents or the equipment affiliated ESCOs could also enter the race by either partnering or acquiring to know-how from a start-up.

5.5.3 Non-utility affiliated ESCO

I was not able to identify any significant opportunities for the non-utility affiliated ESCOs, so this may be an indication that they are going to find it difficult to stand their ground and maintain their marker share in the new energy world.
Appendices 1 - FIGURES
FIGURE 1

U.S. ESCO industry revenues (1990 to 2006) and projections (2007 to 2011)


FIGURE 2

2006 and 2008 U.S. ESCO industry revenues by market segment


FIGURE 3

2006 and 2008 U.S. ESCO industry revenues by project/technology type

FIGURE 4

2006 and 2008 U.S. ESCO industry revenues by contract type

![Graph showing U.S. ESCO industry revenues by contract type for 2006 and 2008.]


FIGURE 5

Utility (Electricity) Supply and Demand curve

![Diagram of utility supply and demand curve.]

Explanation of demand response effects on a quantity (Q) - price (P) graph. Under inelastic demand (D1) extremely high price (P1) may result on a strained electricity market. If demand response measures are employed the demand becomes more elastic (D2). A much lower price will result in the market (P2).

It is estimated that a 5% lowering of demand would result in a 50% price reduction during the peak hours of the California electricity crisis in 2000/2001. The market also becomes more resilient to intentional withdrawal of offers from the supply side.

Source: M.G.Tom, May, 10, 2006, “Equilibrium price under demand inelastic and elastic demand”
FIGURE 6
Renewable energy investment growth (1995 to 2007)

Source: http://irena.org/downloads/Founconf/Signatory_States_20090126.pdf

FIGURE 7
Focus vs. Diversification

Where focus counts

In outperforming industries, more focused companies took the advantage; in underperforming industries, those with more diverse portfolios did better.

400 leading global companies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IT</td>
<td>32</td>
<td>7</td>
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<tr>
<td>Financial services</td>
<td>30</td>
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<tr>
<td>Health care</td>
<td>27</td>
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</tr>
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<td>Consumer goods</td>
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<td>Energy</td>
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<td>Telecom</td>
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<td>2</td>
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<tr>
<td>Utilities</td>
<td>17</td>
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<tr>
<td>Industrial goods, services</td>
<td>16</td>
<td>In underperforming industries, focus pays off</td>
</tr>
<tr>
<td>Materials</td>
<td>12</td>
<td>-8</td>
</tr>
</tbody>
</table>

Combined median of sample 79% 3%

* Total return to shareholders.
* Focused players = companies in top half of Hirschman-Herfindahl Index of reported business unit structure for given industry; diversified players = companies in bottom half of index for given industry.
* Overperforming industries’ median TRS performance above median TRS performance of the sample from 1995 to 2000; underperforming industries’ median TRS performance from 1995 to 2000 was below that of sample.

Appendices 2 - TABLES
TABLE 1
ESCO Industry supply chain model

<table>
<thead>
<tr>
<th>Supplier bargaining power</th>
<th>ESCO Supply Chain</th>
<th>Customer bargaining power</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low bargaining power of raw material suppliers. Suppliers of emerging technologies have high bargaining power</td>
<td>Product Manufacture</td>
<td>Low customer concentration relative to firm concentration. Customers have high bargaining power.</td>
<td>High capital (sunk) costs - Rivalrous market. Brand equity and volume (economies of scale) are critical to profitability.</td>
</tr>
<tr>
<td>Low supplier barrier to entry. High concentration of suppliers relative to firm concentration. Low switching costs. Low bargaining power.</td>
<td>Solution Identification</td>
<td>Low customer concentration relative to firm concentration. Customers have high bargaining power.</td>
<td>&quot;Low-hanging fruit&quot; has been largely captured and / or commoditized. Pressure on incumbents to differentiate offering through application of newer technologies.</td>
</tr>
<tr>
<td>Low supplier barrier to entry. High concentration of suppliers relative to firm concentration. Low switching costs. Low bargaining power.</td>
<td>Solution Engineering</td>
<td>Low customer concentration relative to firm concentration. Customers have high bargaining power.</td>
<td>Commoditized - Lots of new entrants into space.</td>
</tr>
<tr>
<td>Low barrier to entry results in high concentration of suppliers relative to firm concentration.</td>
<td>Solution Installation</td>
<td>Low customer concentration relative to firm concentration. Customers have high bargaining power.</td>
<td>Commoditized through established outsourcing processes - RFQ's, Tenders etc.</td>
</tr>
<tr>
<td>Low barrier to entry results in high concentration of suppliers relative to firm concentration.</td>
<td>On-going Service and support</td>
<td>Low customer concentration relative to firm concentration. Customers have high bargaining power.</td>
<td>Commoditized through established outsourcing processes - RFQ's, Tenders etc.</td>
</tr>
<tr>
<td>Significant barrier to entry. Require deep pockets and good reputation in the industry. High supplier power.</td>
<td>Energy sustainability guarantee</td>
<td>Medium customer bargaining power.</td>
<td>Highly valued by the MUSH sectors (Municipality, University, Schools and Healthcare)</td>
</tr>
</tbody>
</table>
**TABLE 2**

Competitive ESCO landscape analysis

<table>
<thead>
<tr>
<th>NEW ENTRANTS</th>
<th>ESCO RIVALS</th>
<th>ESCO GROUPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESCO Supply chain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology Giants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google, Cisco, Virgin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core to culture</td>
<td>Identify and acquire emerging technologies</td>
<td>Yes</td>
</tr>
<tr>
<td>Product R and D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic alliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage Brand power and reach</td>
<td>Yes - but narrow focus</td>
<td>Yes</td>
</tr>
<tr>
<td>Product Manufacture / Suppliers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solution Identification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub</td>
<td>Make Non-strategic</td>
<td>Yes - but narrow focus</td>
</tr>
<tr>
<td>Solution Engineering</td>
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<td></td>
</tr>
<tr>
<td>Sub</td>
<td>Make Non-strategic</td>
<td>Yes - but narrow focus</td>
</tr>
<tr>
<td>Grants / Incentive support</td>
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<td></td>
</tr>
<tr>
<td>Sub</td>
<td>Make Non-strategic</td>
<td>Yes</td>
</tr>
<tr>
<td>Solution Installation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub</td>
<td>Make Non-strategic</td>
<td>Some</td>
</tr>
<tr>
<td>On-going Service and support</td>
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<td>Core to culture</td>
<td>Identify and acquire emerging technologies</td>
<td>Some</td>
</tr>
<tr>
<td>Energy sustainability guarantee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep pockets</td>
<td>Deep pockets</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 3

Industry analysis - Porters Five Forces model

Bargaining power of Suppliers
- Suppliers are highly fragmented - low bargaining power.
- Switching costs are low (product-agnostic)
- Largely commoditized products.
- Non-differentiated product suppliers (lighting, HVAC equip and controls) have low bargaining power
- Suppliers of emerging technologies have significant sunk costs and struggle with entry barriers unless they are backed by a strong brand (existing ESCO or potential new entry).

Threat of new entry
- Encumbent IT firms Google (information managers) or Cisco (network technologies) with deep pockets and a "disruptive reputation" are well positioned to disrupt market space with the acquisition of new technologies.

Rivalry amongst existing Competitors
- "Low hanging fruit" has largely been harvested, resulting in more players competing for same opportunities.
- ESCO’s face high fixed costs and eroded market resulting in high rivalry.
- Fragmented players with a specialized narrow focus have commoditized ESCO offering.
- Maturity of the industry has resulted in a convergence of solutions and ESCO’s struggle to differentiate offering.

Bargaining power of Customers
- High bargaining power - Customers have become more informed over alternatives to the ESCO approach.
- Customers are pressured to reduce energy costs (government regulations, operating cost pressures, GHG emissions)
- Customers have shifted away from the value of an energy savings guarantee for traditional energy saving measures.

Rivalry amongst existing Competitors
- "Low hanging fruit" has largely been harvested, resulting in more players competing for same opportunities.
- ESCO’s face high fixed costs and eroded market resulting in high rivalry.
- Fragmented players with a specialized narrow focus have commoditized ESCO offering.
- Maturity of the industry has resulted in a convergence of solutions and ESCO’s struggle to differentiate offering.

Threat of substitutes
- Substitutes are niche-focussed and have a significant price advantage.
- Low Customer switching costs.
## TABLE 4

**Selected renewable energy indicators**

<table>
<thead>
<tr>
<th>Selected global indicators</th>
<th>2007 (B)</th>
<th>2008 (B)</th>
<th>2009 (B)</th>
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<tbody>
<tr>
<td>Investment in new renewable capacity (annual)</td>
<td>104</td>
<td>130</td>
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<tr>
<td>Existing renewables power capacity, including large-scale hydro</td>
<td>1,070</td>
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<td>1,230 GWe</td>
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<td>Existing renewables power capacity, excluding large hydro</td>
<td>240</td>
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<td>305 GWe</td>
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<td>Wind power capacity (existing)</td>
<td>94</td>
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<td>Solar PV capacity (grid-connected)</td>
<td>7.6</td>
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<tr>
<td>Solar hot water capacity</td>
<td>126</td>
<td>149</td>
<td>180 GWth</td>
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<td>Ethanol production (annual)</td>
<td>50</td>
<td>69</td>
<td>76 billion liters</td>
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<td>Biodiesel production (annual)</td>
<td>10</td>
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<td>Countries with policy targets for renewable energy use</td>
<td>68</td>
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TABLE 5

End-user value curve analysis

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<table>
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Offering level

Key factors of competition
(End user pain points)

LEGEND:
- Three major ESCO groups
- ESCO rivals
- New entrants

Potentially uncontested market space
### TABLE 6
Utility value curve analysis

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</tbody>
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#### Offering level

- Potentially uncontested market space
- Key factors of competition
  - Utility pain points

#### Legend:
- Three major ESCO groups
- ESCO rivals
- New entrants

---

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# TABLE 7

Comparative opportunity risk analysis

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<th>Product / Service</th>
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<td>* Micro Grid / District Energy</td>
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<tr>
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<td>* Renewable energy source</td>
<td>* Carbon trading</td>
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<td>Very High Risk</td>
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<td>* Micro Grid / District Energy</td>
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<td>* Super Grid</td>
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<td>* Carbon trading</td>
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<td>* Micro Grid / District Energy</td>
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TABLE 8A
Carbon trading - Core competency alignment analysis

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<th>ESCO's / COMPREHENSIVE OFFERING</th>
<th>Opportunity factors of success</th>
<th>NEW ENTRANTS</th>
<th>ESCO's / COMPREHENSIVE OFFERING</th>
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<td>Tech start-ups</td>
<td>IT giants</td>
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<td>Utility affiliated</td>
<td>Non-utility affiliated</td>
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<tr>
<td>R&amp;D - Building Integration</td>
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<td>JCI, Siemens, Honeywell</td>
<td>BC Hydro, Drake</td>
<td>Ameresco, Chevon, Clark</td>
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TABLE 8B
Renewable energy source - Core competency alignment analysis

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### TABLE 8C

**Smart Grid / Demand response - Core competency alignment analysis**

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### TABLE 8D

**Micro Grid / District Energy - Core competency alignment analysis**

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<td>JCI, Siemens, Honeywell</td>
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**TABLE 8E**

Super Grid - Core competency alignment analysis

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<th>Utility affiliated</th>
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<th>Opportunity factors of success</th>
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## TABLE 9

### Opportunity analysis

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Reference list


vi Kathleen Spees and Lester Lave, “Demand Response and Electricity Market Efficiency” CEIC-07-01; and Kathleen Spees and Lester Lave "Impacts of Responsive Load in PJM: Load Shifting and Real Time Pricing", CEIC-07-02)

