SIEMENS

Green Gain

Investing in Energy Efficiency

What to do, what to prioritise and how to finance it

SFS Research Study, February 2012

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1. Management Summary

- Energy costs have steadily risen over the last decade, and are expected to carry on doing so as international consumption grows
- Businesses across the world are therefore keen to invest in energy-efficient equipment and facilities in order to reduce their energy expenditure
- Total Cost of Ownership (TCO) models – which calculate the true cost of ageing equipment, are now incorporating unnecessary energy expenditure, providing a compelling case for upgrade
- Moreover, bank credit remains tight in mature economies, and is expected to remain so in the near-term in an atmosphere of slow economic growth and concerns about stability in the Eurozone.
- Governments in key emerging markets such as China are restricting credit availability, in order to guard against inflation and to ensure that business growth is sustainable and not over-leveraged
- Businesses are therefore seeking alternatives to standard bank credit with which to finance energy-efficient investments
- To fulfil this demand, financing methods are coming to market which offset the energy-efficient investment cost against energy savings across the financing term, effectively providing a zero-net-cost investment technique
- In some cases, financing arrangements can be applied where monthly payments are less than the energy cost savings, making the situation cash positive from day one
- Businesses are using asset financing and performance contracting techniques to conserve scarce cash, ready to be spent on market or acquisition opportunities
- This paper reviews these innovative financing methods, and also maps out priority areas for investment in energy-efficient initiatives

2. Introduction

Each region of the world is addressing energy issues. In 2005, China passed a ground-breaking law to promote renewable energy, and in 2011 the China Clean Energy Database was launched to make key documents and information available in the world's lingua franca[1]. In the US, at the equipment and technology level, the Institute of Electrical and Electronics Engineers (IEEE) has a specific initiative to deliver "balanced, technically sound information on energy related matters"[2]. In 2006, India became the only major country in the world to specifically have a Ministry dedicated to renewable energy, the Ministry of New and Renewable Energy[3]. Russia's national energy strategy through to 2030 specifically aims to reduce Russia's dependence on fossil fuels by increasing the share of renewable sources in its energy mix[4]. Covering the whole of Europe, in January 2007 the European Commission adopted a communication[5] proposing an energy policy, with the goal to combat climate change and boost the EU's energy security and competitiveness. One aim of the policy was to give energy users greater choice, and another was to encourage investment in energy infrastructure. Based on this proposal, the Council ratified the following targets:

- To reduce greenhouse gas emissions by at least 20% (compared to 1990) by 2020;
- To improve energy efficiency by 20% by 2020;
- To raise the share of renewable energy to 20% by 2020;
- To increase the level of biofuels in transport fuel to 10% by 2020.

The use of renewable energy sources is seen as a key element in energy policy. However, the second key element – the core subject of this paper - is constraining demand, by promoting energy efficiency – particularly by end-users.

In answer to the question of whether these targets are being met, the answer has to be an emphatic "Somewhat". In a recent paper, the OECD celebrates progress, but also emphasizes the gap between targets and performance: "Although the combined pledges do not put emissions on the desired long-term pathway, these efforts do represent a significant break from current trends. If current trends would continue unabated, global emissions would by 2020 reach levels that are more than 30% above 2005 levels.[6]"

There are some truly pioneering countries. Germany has already managed to reach 20% of renewable energy in its energy mix (18% in 2009 according to Enerdata). Despite a

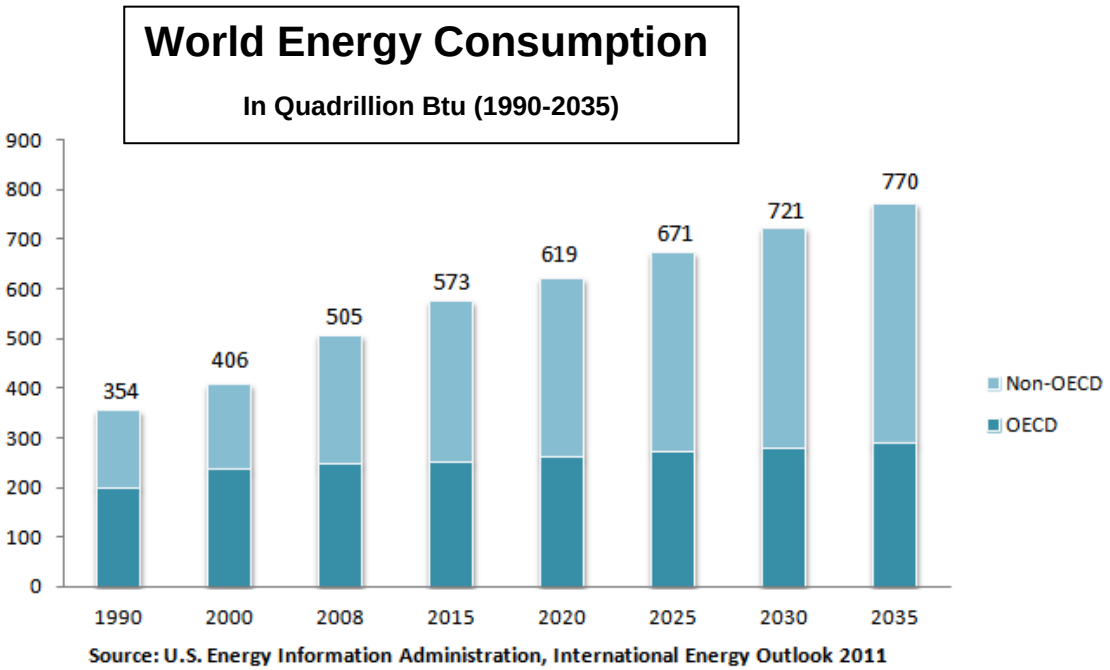
[1] See Martinot, Renewable energy information, http://martinot.info/china.htm
[2] See www.ieeeusa.ord
[33] Sunil Dhingra, TERI, Renewable energy in India policies and development, 5 May 2011
[4] Merar, Renewable energy in Russia, 28 Mar 2011
[5] EU, Communication from the Commission to the European Council and and European parliament – An energy policy for Europe, COM (2007) 1)
[6] OECD, Costs and Effectiveness of the Copenhagen Pledges: Assessing global greenhouse gas emissions targets and actions for 2020, May 2010

fundamental revision of its energy strategy in summer 2011 (away from nuclear power), the German government has emphasised its commitment to existing expansion plans for renewables and the national climate target, even under the new regime. By 2020 at least 35% of electricity demand shall be generated by renewable means and greenhouse gas emissions are still to be cut by 40% (compared to 1990)[7].

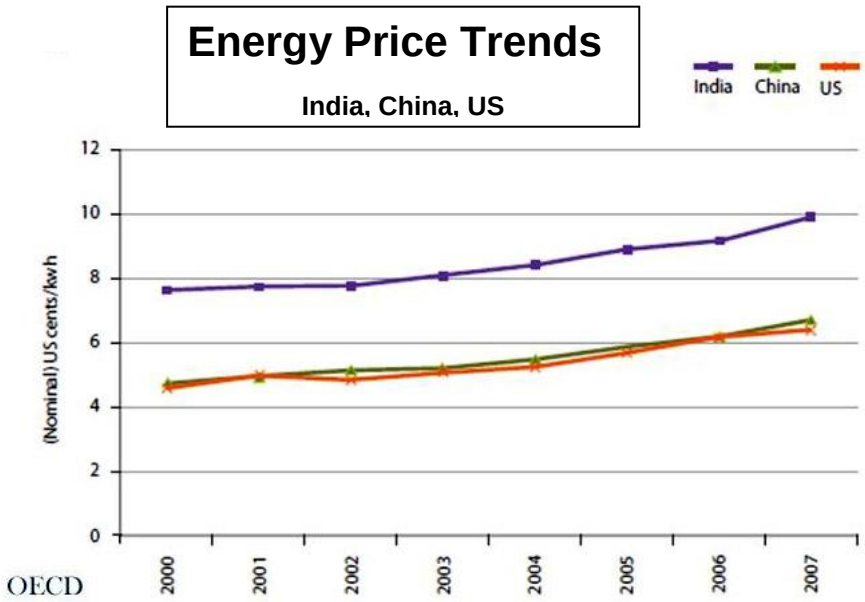
Electricity generation is an issue bound up in politics and world fuel prices, involving vast investment sums and thorny issues around planning and community relations that sometimes stretch development timescales long beyond their original schedules. Additionally, investment by the business community in equipment that consumes less energy is an area that can be implemented quickly, and where the cost of that investment can often be offset against the energy savings achieved, resulting in many cases in a net investment of zero.

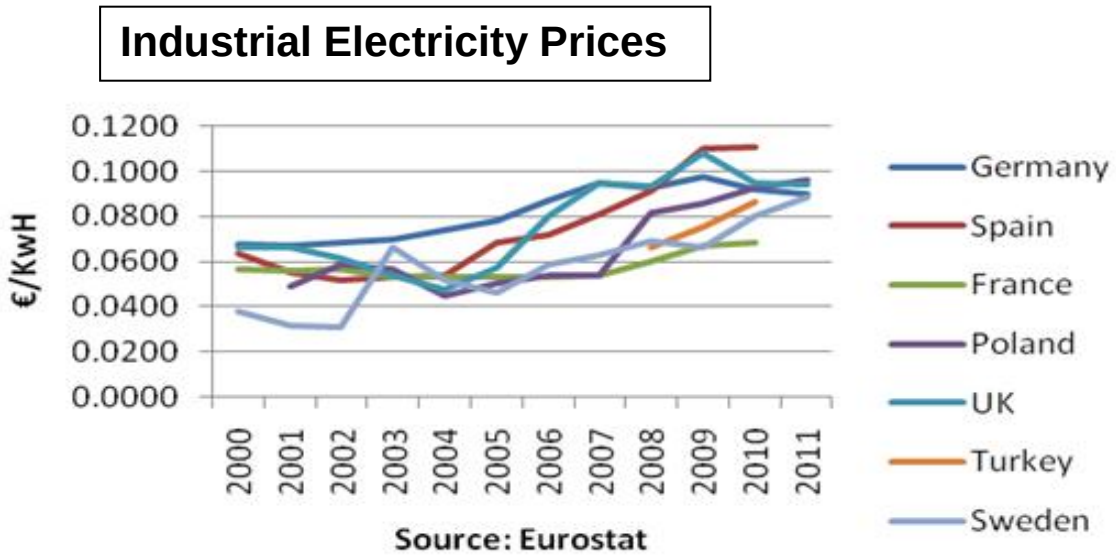
3. Rising Energy Costs

The cost of energy for business is an increasingly significant issue. Certainly, energy prices and consumption seem to be on a steady upward trajectory, as evidenced in the following charts.



[7] Euractiv, Europeanising the German energy transition, 15 Nov 2011





The pattern amongst European countries seen here is replicated in rapidly developing economies. China recently increased the cost of electricity for industrial use in fourteen provinces and Chongqing municipality[8], and has rationed industrial consumption[9]. In India, industrial electricity prices are extremely high, largely to subsidise low domestic charges, and these prices are set to continue rising[10]. Russia is also seeing major rises in electricity prices, with hydro charge increases being capped at 15% for the current year[11]. In fact, it is widely

[8] AFP, China hikes industrial electricity prices, May 30, 2011; CCTV News Channel, 31 May 2011
[9] Financial Times, China forced to ration electricity, May 17 2011
[10] N.Rao,G.S. Sant,S.C. Rajan, An overview of Indian energy trends, 2009
[11] BBC, Can foreign firms make Russia's electricity cheaper? 31 Mar 2011; NewsBCM, Rise in Russia's hydro rates not to exceed 15% in 2011, 21 Mar 2011

acknowledged that the soaring energy consumption in rapidly developing economies is one of the principal causes of rising world energy prices.

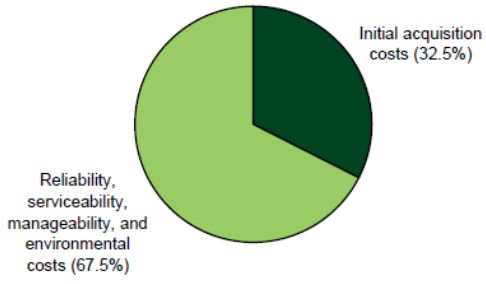
Since electricity prices are rising globally, then the motivation to reduce the cost of that electricity becomes greater with every month that passes. In a survey conducted by the Organisation for Economic Co-operation and Development (OECD) on business energy consumption in its member countries (among which are France, Spain, India, USA, Russia, Poland, the UK, Germany), 96% of participating (large) businesses indicated that they had started implementing energy-saving measures[12]. Moreover, when asked about their motivations to reduce energy consumption, respondents cited 'reduce energy costs' as their most important driver, followed by 'improve image' and 'expected regulation'[13].

Reducing energy costs, then, is the prime motivator for companies to introduce energy-efficient policies and 'go green'. However, reduced access to capital across the world puts a barrier in the way of investing in energy-efficient equipment. This paper looks at ways in which financing techniques are being used to overcome that barrier.

4. Total Cost of Ownership

Before embarking on the core subject of financing energy-efficient equipment, a short side-note is necessary concerning a concept known as 'total cost of ownership' or TCO. There are various definitions of this term. One definition says that "TCO includes the representation of the sum total of the present value of all direct, indirect, recurring and non-recurring costs incurred or estimated to be incurred in the design, development, production, operation, maintenance of an facility/ structure/asset over its anticipate lifespan[14]." Another definition describes TCO as a concept "used to represent all of the costs, including direct and indirect costs, associated with owning capital assets required to support your business operations. TCO seeks to identify and quantify all of the people, process and tool-related expenses needed to operate and maintain instruments and equipment, so that organisations can make more informed business decisions on new purchases and disposition based upon

Store Systems Investment:
Acquisition Costs are a Small Part of TCO



From: Global Retail Insights, Understanding Total Costs of Ownership in building an advanced Store Systems business case, 2008

[12] OECD : Transition to a low-carbon economy, public goals and corporate practices, 2010
[13] ibid
[14] Federal Facilities Council (FFC), International Facility Management Association (IFMA), International Facility Management Association (IFMA)

financial and nonfinancial factors[15]." Another more IT-oriented definition of TCO describes it as 'A comprehensive assessment of information technology (IT) or other costs across enterprise boundaries over time….TCO includes hardware and software acquisition, management and support, communications, end-user expenses and the opportunity cost of downtime, training and other productivity losses[16].' In relation to the main thrust of this paper, TCO underlines and quantifies the likely hidden costs of hanging on to older equipment. Whatever the technology, it is usually the case that after a certain period, its maintenance costs begin to soar, and the mean time between equipment failures contracts, pushing up the cost of service and parts and increasing unproductive downtime.

The disadvantages of ageing equipment have been verified and calibrated by independent third parties, as has the notion of acquiring equipment through a financing agreement, rather than out of capital. For instance, one research organisation suggests that leasing IT systems and replacing them every three/four years can reduce IT systems total cost of ownership by 25 per cent[17]. Another research also estimates that the hardware acquisition costs associated with datacentres contribute approximately 20% of TCO, which leaves 80% of the total cost for the setup, operation, and support of the hardware. This ratio of capital to operational expenses has grown tremendously as the amount of IT infrastructure needed to support a business has grown[18].

TCO is relevant to the main topic of energy-efficient equipment investment, as there are financial benefits of regular equipment replacement over and above the reduction of energy consumption. In a nutshell, investing in energy-efficient equipment saves on energy costs; moreover that new equipment is often more productive and less costly to maintain.

[15] Thermo Fisher Scientific, How understanding the total cost of ownership of your instrumentation or equipment can reduce costs, increase performance and improve workforce productivity
[16] Gartner, IT Glossary
[17] IDC, Managing IT infrastructure renewal, Sept 2010
[18] IDC, Forecasting total cost of ownership for initial deployment of server blades, Jun 2006

5. Access to Capital

In mature western economies, access to capital for companies has been highly restricted for the last two to three years, and has continued to experience difficulties because of factors such as slow economic growth and concerns about stability in the Eurozone. In rapidly developing economies, pressures on capital availability are rather more subtle; governments are keen to restrict soaring rates of corporate debt in the fear that these borrowings will be unsustainable in the long-term. Small and medium-sized firms are often relatively neglected, with restricted access to credit[19]. Developing economies are wisely less keen on short-term gain if it is storing up long-term pain. They aim to be the dominant world economic powers of the future, not its lame ducks.

A quick review of the issue across the globe helps to give a wider economic context to energy-efficient investments.

Beginning with the world's largest economy, the latest report from the US Federal Reserve indicated that "fewer domestic banks eased standards and terms on Commercial and Industrial (C&I) loans… compared with previous quarters[20]" and that a quarter had tightened lending standards.

Finding banks that are willing to lend money to middle market companies for this type of asset class remains challenging today. Most still prefer to lend against capital equipment which can be easily identified and has an expected future market value.

Eurozone banks reported a very significant net tightening of credit standards on loans to non-financial corporations in the most recently reported quarter[21]."

In the UK, overall availability of credit to corporates was reported to have increased a little in 2011 Q3 – mainly for large corporations[22]; availability to small businesses and medium-sized corporations was static or tightening[23]. Net lending decreased in the third quarter of the year[24].

Poland is inevitably harnessed to the Eurozone's fortunes and, although a rapidly developing economy, has felt the impact suffered by Europe, even if only in terms of a slowdown in

[19] See for instance: World Bank, Small and medium enterprises, Jan 2011; Regus, Small is beautiful but tough, Nov 2010; Economist Intelligence Unit, Surviving the drought, 2009.
[20] Federal Reserve, Senior loan officer opinion survey on bank lending practices, Oct 2011
[21] European Central Bank, Euro area bank lending survey, July 2011
[22] Bank of England, Credit condition survey 2011 Q2
[23] Daily Telegraph, UK banks miss first Project Merlin business lending target, 23 May 2011
[24] Bank of England, Time series, net lending

growth. In Poland, in the third quarter of 2011, business lending standards were eased for some short-term loans, but the majority of the banks did not revise their lending policies[25].

Turkey, China, India and Russia are economies in higher growth mode. In most, monetary policy is currently being implemented to stop growth running out of control.

Turkey's central bank increased the reserves banks must deposit while keeping the benchmark interest rate unchanged, saying that tighter monetary conditions are needed to offset surging global oil prices[26]. Turkey's Central Bank Governor has also remarked that, "Our problem is slowing down the pace of lending[27]." Turkish banks did not receive government subsidy during the crisis.

China's central bank raised the percentage of deposits that banks must hold in reserve for the sixth time in June 2011, moving quickly to further dampen lending after the inflation reading showed prices rising at the fastest pace since July 2008. The reserve increase, which took effect June 20, pushed to 21.5% the portion of deposits that most major banks must set aside instead of lend out—and so removed around $58 billion from China's financial system[28]. Lending and money growth has slowed in recent months in response to the tightening steps after an extraordinary surge in bank credit in 2009 to counter the global financial crisis[29].

In summary, Western banks are keeping their corporate criteria tight, and are only gradually easing lending conditions. Stability concerns in the Eurozone may yet reverse this trend. Yet Western corporations are extremely keen to have access to capital in order to invest in energy-efficient equipment. As a result, they are exploring alternative financing methods to standard corporate borrowing in order to meet the challenge of a tight credit market[30].

In more rapidly developing economies, such as China and Turkey, the authorities are in many cases concerned about ensuring controlled and sustainable growth and are applying pressure on the availability and cost of funds to counter possible racing inflation and inappropriate borrowing. At the same time, smaller firms are finding obstacles in their attempts to access credit across the globe: for instance, one analyst notes that, "in China, small private sector firms still suffer from capital shortages.[31]"

[25] National Bank of Poland, Senior loan officer opinion survey on bank lending practices and credit conditions, Q3 2011
[26] Bloomberg, Turkey's central bank boosts reserves, warns of inflation, 23 Mar 2011
[27] Wall Street Journal, Turkey's central bank says lending needs to slow, 14 Jan 2011
[28] Wall Street Journal, Asia business, Inflation prompts a new lift of reserves, 15 Jun 2011
[29] Reuters, China says money, credit growth in line with policy, 28 Mar 2011
[30] See, for instance: HBS-USC Conference, Alternative financing in a stabilized economy, May 2010; Global Corporate Venturing, Funding business growth in an age of scarcity, Feb 2011; Davos 2010, Financing low carbon growth.
[31] China Analytics, Industrial policy in China and the 12th five-year plan, 12 Oct 2011

6. Affording Energy-Efficient Investments

How then, are firms across the world managing to access capital to make energy-efficient equipment investments? Alternatively, how are emerging market companies ensuring that their energy-efficient investments are financially sustainable in the longer-term?

Two related forms of equipment finance are coming to the fore: first is an equipment financing arrangement where the energy savings offset the cost of the investment; second is 'performance contracting' where the facilities management of, say, a plant room or building is financed through energy cost savings – guaranteed within the financing agreement. In some cases, finance payments even flex with the energy saving or energy generation outputs from the new equipment. Both forms of financing are important, given that recent research has shown corporates' greatest concern to be lack of confidence over whether energy-efficient investments will deliver the promised savings[32]. Combined financing and equipment solutions overcome this obstacle as the providers know exactly what the solution should deliver and predicate the finance arrangement on projected savings being met. In the US, the performance contracting model has become a highly used method to reduce energy consumption at the Municipal, State, County and City level. Different legislation appears in almost every state to govern this model.

6.1 Leasing Arrangements

A good example of official support for zero-net-cost leases for energy-efficient equipment exists in the UK, where the Carbon Trust – a not-for-profit company set up by the UK government – has created the Energy Efficiency Financing Scheme.

The Energy Efficiency Financing Scheme is designed to provide organisations of all sizes with financing for energy-efficient equipment where the energy savings pay for the equipment investment. The scheme has been created by independent authority the Carbon Trust, with finance provided by Siemens. The Carbon Trust's independent and proven assessments can be trusted to accurately assess energy savings. Finance from Siemens provides affordable finance separate from standard (and scarce) bank credit. Where possible, the scheme wraps everything into a single financing package, including energy efficiency assessment, the equipment itself, installation etc, all via a loan, lease or hire purchase arrangements. Payments are designed to be equal to, or lower than, the energy savings and in many early cases deliver savings and net positive cashflow immediately. Where a project cannot completely offset the equipment upgrade with energy-efficiency cost savings, the financing arrangement nevertheless subsidises the larger part of the upgrade cost. In the

[32] Green Monday, Energy efficiency, Summer 2011

manufacturing sector, this is often highly attractive as up-to-date equipment may not only lower energy costs, but also boost productivity, generating more revenue and margin.

A finance agreement under this kind of integrated scheme has the advantage of tax efficient, fixed payments for the agreement term, which are calculated taking into account the type of equipment, its expected working life and the customer's individual circumstances, so that the customer has the specific reassurance that tailored finance payments can be offset against the expected energy savings. In addition, the customer taking out the finance may be able to wrap other aspects such as service into their monthly payments, as well as negotiate upgrades and add-ons in the future as their needs change.

6.2 Energy Performance Contracting

Performance contracting solutions allow facility and capital improvements to be made and funded through energy savings achieved within the facility, typically for facilities with a baseline annual energy consumption of over €100,000-€150,000 per annum[33]. The provider guarantees that energy savings will cover the costs of equipment and service over time, to the extent that they contractually have to make up any financial gap between the two. According to Siemens data, the potential energy savings in Europe are mainly to be found in Transport (28%), Industry (31%) and Buildings (41%)[34]. Buildings in Europe waste €270bn per year in unnecessary energy usage[35].

A typical approach would go through several stages:-

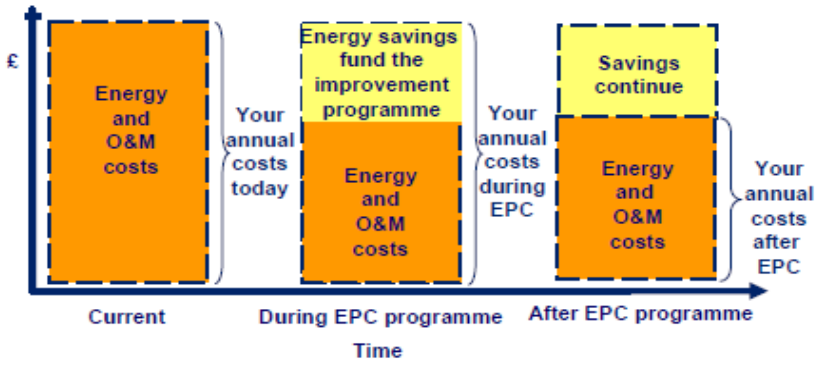
- A preliminary analysis to determine the organisation's energy use and identify areas to maximize energy savings
- A detailed energy analysis (known as an Investment Grade Audit) to determine the improvement measures that make the most impact on the facility and the organisation's bottom line
- Construction and installation of new equipment and the implementation of facility improvement measures
- Regular measurement and verification to ensure savings are achieved.

Unlike leasing, where payments commence once the component technology has been acquired, energy performance contracting will usually arrange the finance to cover the set-up and installation period, starting payments from the point that the enhanced facility is starting to generate energy cost savings[36]. This adds a cash flow benefit to the fact that performance risk is born by the supplier. In fact, the supplier manages the project from design to

[33] Siemens, Maximise efficiency, 2009
[34] ibid
[35] RBS, Energy performance contracting for UK public sector buildings
[36] Dr Hubert Keiber, Energy performance contracting, 2011

installation, to monitoring, always with a vested interest in energy savings predictions translating into reality and offsetting the investment in energy-efficient equipment[37].

The Benefits of Energy Performance Contracting (EPC)



Performance contracting financial structures are varied and tend to be tailored for each specific facility. However, typically they might involve a sale-and-leaseback arrangement (where the lessor takes on ownership and credit risk), an invoice-financing arrangement (where the energy savings contract's receivables are sold to a financier), or an arrangement where asset ownership transfers to the end-user over the financing period, but an energy savings performance guarantee is bought from the service supplier.

[37] EPC Watch, Measurement and verification of energy efficiency projects, 2007

7. Getting the Energy-Efficient Investment Cycle Right

Whether making individual energy-efficient equipment investments or engaging in a 'whole facility' performance contracting arrangement, businesses need an awareness of which key areas of their infrastructure are most susceptible to, and have the greatest payback on, energy-efficiency initiatives. This following section draws on Siemens' experience to highlight eleven typical areas where major energy-reduction can be achieved.

7.1 Heating, Ventilation and Air Conditioning

When it comes to energy efficiency, heating, ventilation and air conditioning - HVAC, is one of the chief consumers of power – whether in the office or the industrial context. In fact, according to one authoritative source, "Air conditioning can increase a building's energy consumption and associated carbon emissions by up to 100%. Heating and hot water can account for 60% of total energy costs. And because it's possible to reduce your heating costs by up to a third, the potential savings are substantial.[38]" Technologies that enable combined heat and power (CHP) play an important role: CHP plants achieve a significantly greater degree of energy efficiency, compared to conventional methods, by generating electricity and heat simultaneously. Ideally, the demand for heat is first reduced, and then the CHP scheme is sized to meet the new heat load. In some schemes, overall efficiency is further improved by 'trigeneration' – using additional absorption chillers to convert waste heat into cooling.

7.2 Biomass Heating

Biomass production of space or process heating is becoming increasingly popular amongst manufacturing, processing and agricultural organisations. Organic materials, including virgin wood, energy crops, and uncontaminated industrial residues are put through a combustion process to heat water or air. The system will consist of a biomass boiler plant, a heat transfer network, and a method of receiving, storing and feeding fuel to the boiler.

Biomass boilers work best when they run continuously. And broadly speaking, the longer the annual run hours, the more cost effective the system will be. Typical payback periods are three to nine years, although fuel costs are effectively zero if the business produces a combustible by-product.

[38] Carbon Trust Research: Heating, ventilation and air conditioning technology overview (CTV003), 2006

7.3 Onsite Solar and Wind Power

The business case for installing renewable energy technologies, such as solar panels or small scale wind turbines, is getting steadily stronger. Research suggests that annual return of over 10% can be gained from the installation of such onsite renewable energy systems[39]. Increasing demand for smaller solar and wind power generation units is now beginning to industrialise their scale of production, reducing price per unit and improving manufacturing consistency[40].

7.4 Supply Voltage Optimisation

Most modern equipment is designed to operate at the standard European voltages of 400V/230V. However, facilities in some countries suffer from persistent over-voltages resulting in reduced efficiency, equipment failure and increased maintenance. Optimising supply voltage to an optimum level can save between 5% and 15% in electricity consumption, depending on the equipment being powered. Because the optimisation units are connected in series with the main supply transformers, installation is usually quick and the benefits can be realised across the whole site's electrical supply.

7.5 Power Management Solutions

By using intelligent power management systems and load management equipment organisations can take advantage of lower tariff structures and incentive payments. As well as delivering substantial savings, power management solutions also tend to reduce maintenance and enhance the lifetime of equipment. Intelligent load management and utilising of on-site generation can be used to provide a dynamic, real-time response to energy demand, which means a precise matching of load with tariff structure and therefore better management of costs.

7.6 Increased Factory or Process Automation

Up to 80% of potential savings in an industrial plant come from improved automation. Implemented correctly, automation can increase productivity, reduce downtime and minimise maintenance requirements – whilst simultaneously cutting energy consumption and reducing carbon emissions. Optimisation systems are often also be used as the backbone for data collection for the metering and instrumentation required for the energy management system. Combining an enhanced control scheme, the appropriate metering and instrumentation solution together with advanced software tools ensures that system not only delivers the

[39] Carbon Trust, The case for renewables in UK business

[40] See, for instance: Financial Times, UN Solar power nears competing on price, 8 Jun 2011; CleanBiz, Chinese solar firms feel the pinch of pricing slump, 22 Aug 2011

optimum plant or process performance, but also provides real time reporting on all the key performance indicators (KPIs) and high level management information reports.

7.7 Intelligent Lighting Controls and Low-Energy Lighting

According to one authority on the subject, 25% of an organisation's electricity costs come from lighting; but with energy efficient lighting, these costs can be cut by up to a third[41]. Aside from installing more energy-efficient equipment, patterns of usage can also make a difference. By installing intelligent lighting systems organisations have been able to save over 40% of the energy used in lighting[42]. One sector which can particularly benefit from low energy lighting and effective lighting controls are logistics operations, where 24/7 warehouse operations need to maintain safe and conducive working conditions, while at the same time minimising energy costs.

The payback times from low energy lamps are short – typically a few months – and changes can be quick and easy to implement. By deploying efficient lamp technologies such as LEDs, CFL and energy-saving halogen lighting, savings of up to 80% are possible compared with traditional lamp technology.

Light fittings can be individually controlled to turn off or to dim the output as required. Used in conjunction with light level sensors and presence detection, controls can be optimised to take full advantage of natural daylight savings and maximise off periods. Further major savings come from reduced maintenance, which is also more easily scheduled with predictive failure analysis.

7.8 Building Controls

Of all energy consumed, around 40% is used by buildings[43], whether offices, retail premises, warehouse operations or industrial factories. By deploying effective building controls, consumption can typically be reduced by up to 30%. Substantial savings also often result from an expert review of existing building controls, which may have been incorrectly commissioned or poorly maintained. The three basic functions of a Building Energy Management System (BEMS) are improving plant control, monitoring and displaying energy consumption and optimising equipment operating schedules.

Building owners are looking for greater interaction between the different services in their premises such as HVAC, fire, security, lighting, etc. Many customer benefits including significant energy savings can be achieved with a truly integrated BEMS. BEMS are fully

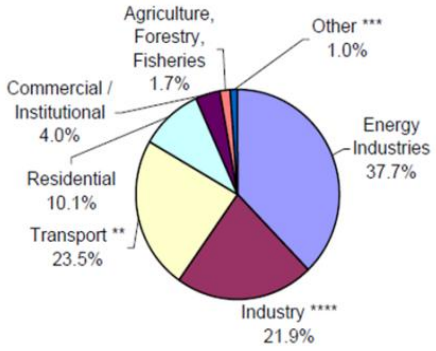
[41] Carbon Trust, Lighting technology overview
[42] Siemens Industry
[43] ibid

scalable and can be used in all types of commercial and public sector buildings, from small to large.

7.9 High Efficiency Motors

Worldwide, there are approximately 20 million industrial motors – with vast potential for saving energy[44]. In 2007, industrial electricity consumption in Europe alone was around over 900 TWh – which is approximately equivalent to the output of 400 fossil-fuelled power generation plants. Drive technology accounts for two-thirds of this amount[45]. The potential is there – especially for auxiliary processes that do not serve production directly. Such processes include, for example, the preparation and transport of auxiliary materials, air conditioning and waste removal. The largest industrial consumers are compressors, conveyor belts, and mixing and milling systems, as well as pumps for heating, ventilation and air conditioning. In the paper industry, for example, a medium-sized operation will have more than 3,000 motors running 24 hours a day, seven days a week.

CO2 Emissions* by Sector:
EU-25 (Shares of Total CO2 Emissions)



European Commission, Directorate-General for Energy and Transport (DG TREN), EU Energy in Figures 2010, CO2 Emissions by Sector

The technology for saving exists - but high acquisition costs for energy-efficient industrial drives can put off many managers, as witnessed in the key findings from this survey. However, when viewed in the context of total costs, the acquisition price becomes a relatively insignificant factor. Given that these drives have a service life of ten years, in an example where there are 2,000 hours of operation annually, the purchase price accounts for less than 3% of total costs. Energy costs, by contrast, account for over 95%. Factor in a financing option that allows the new drives to be paid for on a form of pay-to-use basis, and the energy cost savings are effectively paying for the acquisition cost, at an affordable rate, and without tying up scarce capital.

7.10 Variable Speed Drives

Variable Speed Drives (VSDs) optimise the voltage and frequency supply to the motor to match the speed to the actual load demand, thereby significantly reducing energy consumption. In the United Kingdom alone (60m+ people, GDP c.$2.2 trillion[46]) about one million pounds sterling in unnecessary electricity costs are incurred *every day* because the appropriate systems are not equipped with variable speed drives[47].

[44] European Copper Institute, High efficiency motor systems, 2010
[45] Siemens
[46] CIA, The world fact yearbook, United Kingdom
[47] Siemens

Correctly designed VSD systems typically reduce energy consumption by 20% to 70%, depending on the application[48]. The most receptive applications tend to be pumps, fans and centrifugal compressors although worthwhile savings may even be achieved on more demanding applications such as mixers, centrifuges, reciprocating compressors and extruders.

In addition to providing substantial energy reduction, other VSD benefits include soft start-up of the equipment, reduced current on starting, reduced mechanical stress and high power factor. VSDs are intelligent devices that can easily be integrated into energy management systems, and may also be a key component in dynamic power management by helping with tariff management and demand reduction.

7.11 Monitoring and Targeting Systems

An effective monitoring and targeting system is typically the most important element of any energy management programme and will deliver the fastest payback.

The ability to measure and monitor real time key performance indicators on a site or in a building, by collecting the right data in the right way, allows organisations to highlight problem areas and identify quick payback opportunities. More than just a metering system – which does not of itself save money – an effective monitoring and targeting system will typically show that 3% to 10% of the entire utility spend can be eliminated using low cost solutions.

Ideally, the monitoring and targeting system will collect data through the automation system or building control system. If this is not possible, a separate energy management system has to be implemented. The system collects data from all the major loads to provide the required degree of visibility and will include electricity, gas, water, steam, heat, coolness, fuel oil or other parameters as appropriate.

A further advantage of a monitoring and targeting system is that it provides the information to validate the savings from major capital investment projects.

[48] ibid

8. Conclusion

This short paper highlights the increasing challenge of rising energy prices, the desire of businesses across the world to invest in energy-efficient equipment and facilities, and the challenge of restricted access to capital. Clearly, financing tools are now emerging that provide an alternative to standard bank borrowing, offset equipment investment costs against energy cost savings and effectively offer businesses a zero-net-cost method of acquiring energy-efficient equipment that not only saves on energy costs but also is often more productive than the equipment it replaces, and is less expensive to maintain and service than previous-generation technology. Organisations need to focus on areas of their operations where the highest energy savings are likely to be achieved in the shortest period, and this paper has highlighted a number of those priority areas. Finally, research confirms that corporates say their maximum payback period for energy-efficient investments is 3-5 years, but at the same time, 78% say those same investments have performed in line with, or have exceeded, expectations. It appears that, with innovative financing methods now widely available, the outlook for energy-efficiency investment is positive.