

Energy Services Companies (ESCOs) and Motor System Projects

Paolo Bertoldi

European Commission DG JRC

What is Performance Contracting?

A means to deliver infrastructure improvements to facilities that lack any of the following:

- Energy engineering skills
- Manpower or management time
- Capital funding
- Understanding of risk
- Technology information

Energy Service Companies

Energy Service Companies (ESCOs) offer the same services of ESPCs. However, ESCOs differ from ESPCs in the following ways:

- ESCOs guarantee the energy savings (a performance guarantee can revolve around the actual flow of energy savings from a project, or can stipulate that the energy savings will be sufficient to repay monthly debt service costs).
- The remuneration of ESCOs is directly tied to the energy savings achieved;
- Retains an on-going operational role in M&V over the financing term
- ESCOs can finance, or assist in arranging financing for the operation of an energy system by providing a savings guarantee (not main Characteristic).

Typical ESCO Services

- Energy audits, feasibility studies
- Engineering design
- Equipment procurement
- Subcontractor management
- Construction
- Measurement and verification
- Operation and maintenance
- Project financing

Typical ESCO Process

- Site survey and preliminary evaluation
- Investment grade audit
- Financial presentation and client decision
- Project financing
- Final design
- Construction
- Commissioning and acceptance
- Measurement and verification
- Operate and maintain

Sample Technologies

- Boilers
- Chillers
- Lighting
- Air handling
- Pumps
- Energy management systems
- Cogeneration
- Water conservation
- Compressed air
- Refrigeration systems
- Variable speed drives
- Thermal storage
- Renewables
- Motors
- Electrical upgrades

Typical Contract Terms

- No **results**, no payment
- Recognizes ownership of **risks**
- Acknowledges responsibilities
- Establishes the **baseline**
- Documents equipment to be installed
- Usually **long-term** relationship
- Identifies **M&V** requirements

Financing is a Key Issue

- ESCO is a **Service Company** not a Bank;
- Some ESCOs cannot invest their working capital to develop & implement Energy Efficiency Projects unless “**reliable**” and “**commercially viable**” long-term Project Financing is available.

Two Types of External Financing

- **ESCO Financing** (ESCOs subsidiary of large groups)
- **Third Party Financing** (mainly banks)

In these cases the ESCO carries the financial risk!

General Barriers to ESCOs Projects

- Low awareness, lack of information and skepticism at the demand side of the market for energy services.
- Poor understanding of energy efficiency by financial institutions
- Small size of projects.
- Legal and Regulatory Frameworks.
- Insufficient Understanding of Measurement and Verification Protocols.
- Administrative hurdles.
- Lack of motivation.
- Limited government support.

Specific barriers in the industrial sector and motor systems

- High technical risk perceived and concerns over the safety and reliability of equipment.
- Fear of job losses.
- Energy savings are “not tangible”.
- Lack of trust in ESCOs.

ESCO projects in Motor Systems (1)

- There are a few ESCO projects in motor systems. These upgrades include the replacement of the motors (with EFF 1 or premium motors), the installation of Adjustable Speeds Drives (ADSs), which save energy in fluid application with variable flow, but only rarely the improvement/replacement of the end-use device such as fans, pumps and compressors.
- The fluid distribution system (piping, ducts, and compress air system distribution network) are usually not part of the ESCO projects, though these could also be optimized and could result in large savings.
- Motor systems may be a relative small component of total energy consumption especially in energy intensive companies (e.g. cement or chemical companies). For this reason, motor systems usually do not justify an ESCO project covering only the motor system. There is however no reason why motor systems may not form part of an overall larger ESCO project.

ESCO projects in Motor Systems (2)

- According to the European Motor Challenge programme, non-energy intensive sectors (such as dairies, textile, mechanical sector, etc.) have the potential to achieve large and substantial energy saving in motor systems. These savings could be of the order of 500 MWh or more per year, i.e. approximately 50000 Euro saving per year (representing from 10 to 30% of total electricity costs). Most of these projects are not undertaken by ESCOs, but by the companies themselves using external consultants and equipment manufacturers. As far as we are aware, out a total of 50 such projects, ESCOs have implemented only two of them, and they too as part of larger projects also including HVAC and lighting improvements.
- In the European GreenLight programme, there are many projects of small saving size (from about 3000 to 15000 Euro per year) undertaken by ESCOs only doing lighting refurbishments in commercial buildings. This confirms that additional difficulties and barriers do exist in ESCOs implementing projects in motor systems in the industrial sector.
- To add to the barriers already listed, motors are often embedded in other equipment (pumps, blow moulding machine, compressors, etc.) and it is almost impossible for the ESCO to "get inside" the equipment and change the motors or add the ASD. In this case ESCOs need to develop the solution with the OEMs.

ESCO projects in Motor Systems (3)

- In the retail sector a number of ESCOs have optimized the electricity consumption of refrigeration systems in supermarkets, often by installing an ASD. However these projects fall more into buildings and commercial sector rather than in industry and the process sector.
- In the industrial sector a common type of contract is the contracted supply of compressed air. (This is quite close to the concept of the energy performance contracting) , In this type of contract the ESCO may invest in a new compressor with improved efficiency performance and the payment of the service is made through the compressed air unit price, which includes the cost of electric consumption (the ESCO therefore has significant motivation to optimise the compressed air production). In principle, this is not dissimilar to the boiler upgrade in pure "energy contracting" contract types. The price charged to the customer for the service i.e. compressed air (or Heat in the case of Chauffage,) is at the point of generation.
- In the case of air distribution contracts, large savings are usually available downstream (e.g. by reducing the leakages). It would be more interesting to see contracts where the cost of the supplied air is charged at the point of use. The ESCO in that case would have a strong motivation in optimising also the distribution system.

ESCO projects in Motor Systems (4)

- More recently we are beginning to see an increasing interest by ASD manufacturers to install this energy saving technology in the industrial sector using an ESCO delivery model. In some cases the ASD manufacturers have teamed up with an existing ESCO serving the industrial sector. The ESCO has provided that audit, arranged the financing, provided the technical guarantees and monitored the savings.
- An example is the Kemira GrowHow fertilisers plant ventilation system upgrade by a Finnish ESCO together with a large equipment manufacturers, which resulted in savings of 4000 MWh per year.
- Another interesting area of increasing interest for ESCO projects is the water supply and waste water treatment where large pumps are employed. Here the application of ASDs could save large amount of energy.

The Way Forward

- Increase Dissemination of ESCO Services and Projects
- Launch an accreditation system for ESCOs
- Increased cooperation between ESCOs and vendors/OEMs.
- Turning small contractor into a special breed of ESCOs
- Develop Funding Sources
- Standardise Contracts and M&V
- allow access to the carbon market through CDM projects



The European Motor Challenge Programme

**A voluntary initiative of the European
Commission:
to aid industry in reducing electricity
consumption in motor driven systems
Support: tool box, software,
documents...**



**An initiative by the
European Commission**

Motor Challenge

Partner Procedure

- **Inventory systems →**
 - Identify cost saving measures
- **Enterprise formulates an *Action Plan***
 - Voluntary
 - Meet the Reliability/Quality/Cost criteria
- **Commission approves plan →**
 - *Partner* status
- **Execution of Plan**
 - Annual reporting
 - Commission renews *Partner* status



Motor Challenge Focus areas

System Approach:

- Drives
 - (starter, motor, speed control, transmission)
- Compressed Air
- Fans
- Pumps
- Industrial refrigeration
- Electricity distribution
- **Management policies**



Benefits of *Partner* Status

- Reliability, Quality ↗
- Costs ↘
- Public recognition, image ↗
 - Use of logo
 - Motor Challenge publicity efforts
 - Showcase an installation
 - Awards, catalogue



Angelini Company: Compressed Air Module

Action	<ul style="list-style-type: none"> •New reciprocating air compressor •New computerized control system
SEC (specific electric consumption)	-31% (from 159 Wh/m³ to 109 Wh/m³ @ 7,5 bar)
Energy Savings	550000 kWh/y (394900 kg/y CO₂ avoided)
Addictional action	<ul style="list-style-type: none"> ▪Air Pressure Delivery: Reduction up to 2 bar during no working day ▪Air leak measurement and reduction
Future action	New second reciprocating compressor in 2007
Simple Pay Back Period	2,9 y



Angelini Company Pump Module



- Shut down unnecessary pumps: discharge head from the public local water dealer (90000 kWh/y saved – 64620 kg CO₂ avoided);
- Shut down n.1 water cooling pump during no working hours and no working days (96000 kWh/y saved – 68928 kg CO₂ avoided);

Angelini Company Management Policies



Utility Area	<ul style="list-style-type: none">▪ Lowering in Compressed Air pressure deliver▪ Compressed Air leak searching campaign and repair▪ HVAC units thermoregulation where not available▪ New refrigeration main plant; shut down peripheral units▪ Shut down unnecessary pumps
Production Area	<ul style="list-style-type: none">▪ Compressed Air leak repair, new air-stop valves and new hand held blow guns▪ Air conditioning “on demand” instead of 24h/24h
Laboratories	<ul style="list-style-type: none">• Compressed Air leak repair, new air-stop valves and new hand held blow guns• Thermostat for heating/cooling, new fancoil
Storage Area	<ul style="list-style-type: none">▪ Temperature as minimum required▪ New low consumption lighting devices
Offices	<ul style="list-style-type: none">▪ Trainig on end user energy good practice (computer, lighting, air conditioning)



Brasseries de Bourbon

The Main Actions

- Reuse of the compressed air after the polyethylene bottle blowing for the low pressure network
- Global action on the maintenance, the control and the regulation of the compressed air system
- Control of the ventilation system with timer and sensors
- 50% of the refrigerating compressors use VSD
- Global study for the optimization of the pumping system especially on the cold water network
(study to install VSD and to downsize the installed pumps)
- Demand of high Efficiency Motors when a replacement is needed

Alpenmilch Salzburg



- Motivation
 - Benchmarking with other dairies in Germany and Eastern Europe highlighted electricity demand for compressed air systems
 - Main electricity consumers in dairies: compressors for cold and compressed air production
 - financial support for the energy audit (DEXA MCP)
- Expectations
 - Cost reductions by energy savings



Alpenmilch Salzburg



Action Plan Compressed Air

- Installation of an **automatic control system** for all compressors
- **Heat Recovery** of the CAS station for preheating of the boiler feed water in combination with a reverse osmosis process
- Measuring and **Reduction of leakages**
- **Lower pressure level**
- **Reduction of pressure variations** by installation of a ring line and air tanks
- Benchmarking of energy for compressed air consumption with



Thank you for your attention

For more information contact me at

paolo.bertoldi@ec.europa.eu