IEA DSM TASK XVI

Competitive Energy Services
(Energy Contracting, ESCo Services)

Outsourcing to ESCO vs. in-house implementation for EPC light

Discussion paper

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This project is carried out within the framework of the IEA research cooperation on behalf of the Austrian Federal Ministry of Transport, Innovation and Technology.

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Synopsis:

This discussion paper focuses on the development, demonstration and the promotion of EPC-light- projects, i.e. energy saving projects with no- and low-cost investments.

The main target group of this discussion paper is - internal or external - consultants and energy experts that perform energy saving projects via energy-efficiency measures. The specific goal is to bring up a discussion whether outsourcing the tasks to an ESCO is possible and profitable or if at least a partly dedication of tasks brings advantages.

Author:

DI (FH) Reinhard Ungerböck

Graz Energy Agency (Grazer Energieagentur) - GEA
Kaiserfeldgasse 13, 8010 Graz, Austria
Tel.: +43-316-811848-0
Email: office@grazer-ea.at
http://www.grazer-ea.at

Project Coordination:

DDI Jan W. Bleyl-Androschin (IEA DSM Task XVI „Competitive Energy Services" Operating Agent), GEA, until 12/2012
DI Boris Papousek, GEA, since 01/2013

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Financing Partners of IEA DSM Task XVI, Phase 2:

Austria
Federal Ministry of Transport,
Innovation and Technology
www.bmvit.gv.at
www.nachhaltigwirtschaften.at/iea

Belgium
Federal Public Service
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http://economie.fgov.be/

India
Bureau of Energy Efficiency
Ministry of Power
www.bee-india.nic.in

Netherlands
Agentschap NL
Ministerie van Economische Zaken
www.agentschapnl.nl

Spain
Red Eléctrica de España
www.ree.es

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Table of Contents

1 Introduction

This discussion paper focuses on the development, demonstration and the promotion of EPC-light-projects, i.e. energy saving projects with no- and low-cost investments.

The main target group of this discussion paper is - internal or external - consultants and energy experts that perform energy saving projects via energy-efficiency measures. The specific goal is to bring up a discussion whether outsourcing the tasks to an ESCO is possible and profitable or if at least a partly dedication of tasks brings advantages.

We start with an evaluation of strengths and weaknesses of the different actors and proceed with insights into various distributions of tasks to the different actors. We also underline our observations through examples in practice.

The discussion paper contains the following chapters:

- Summary
- A general description of EPC light
- A compilation of different insights and point-of-views regarding in-house- and outsourcing-solutions
- Evolution perspectives of EPC light
- Best practice examples of EPC light

2 EPC Light Description

One of the most urgent challenges for our common energy future continues to be the search for suitable “tools” to execute energy conservation potentials in order to reach energy policy goals (EU 2020). The level of success is far from satisfactory as the continuous increase in final energy consumption in most European Union member countries reveals.

EPC light is a systematic approach to examine existing building equipment systems, their operation and maintenance procedures and interactions with building occupants. In order to achieve intended performance specifications, improvement measures are developed, implemented and follow up through controlling and quality assurance instruments. Of particular importance is an interdisciplinary perspective:
Besides technical issues, economic, financial, organizational and legal aspects are investigated and accounted for.

EPC light typically is applied to existing building technologies like HVAC, controls, electrical or compressed air systems. In principles, EPC light can be implemented with in-house personnel or outsourced to external consultants or a project specific mixture of both.

Research has shown that the energy saving potential in commercial buildings of 5-30% can be achieved simply by improving the way they are operated and used. EPC light Services offer building owners a straight forward approach to make use of their potential for energy savings. These are the five steps of Re-Co Services for your building:

1. **Design:** The Energy Services Consultant creates an overview of the owners building stock and works out the individual strategic objectives for the building owner and corresponding success indicators. E.g. improving energy efficiency, reducing operating cost or improving user comfort.
2. **Investigation:** The Energy Services Consultant investigates the building stock, identifies high potentials and defines specific measures of improvement and a plan for their implementation. The owner receives a clear calculation of costs and benefits of each measure to decide about the implementation. A concept for evaluation – usually a suitable technical metering system – is defined and installed.
3. **Implementation:** The measures are being implemented. All cost and timelines are documented. Operations are actually starting to improve.
4. **Evaluation:** All measures are evaluated using individual approach according to success indicators. The evaluation shows the individual cost effectiveness of each measure and the amortization of the whole EPC light Service.
5. **Continuity:** Re-Co Services are intended to come and stay. The metering concept and the success indicators are great tools to continuously monitor the performance of your buildings, to maintain the savings and to even identify further measures of improvement.

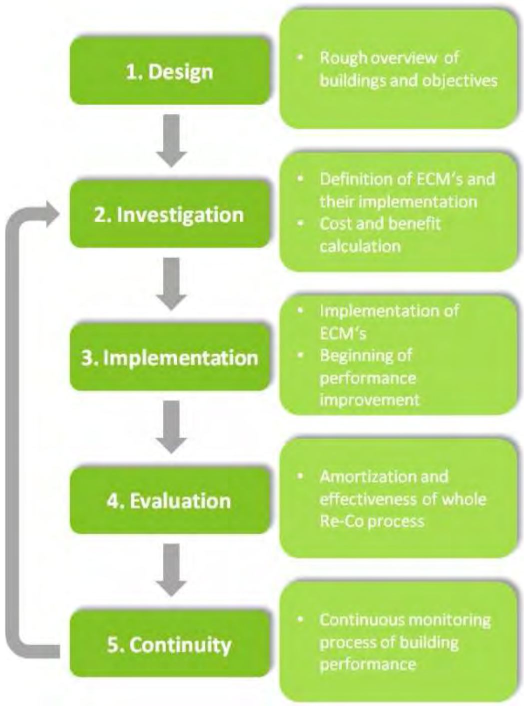

Figure 2: EPC light process scheme

EPC light uses a comprehensive approach to optimize your building. And they have shown amazing savings in numerous cases by tackling a variety of issues in modern buildings. Here are just some of the options EPC light offers to building owners:

- **Technical optimization:** Complex buildings undergo changes in usage. By checking and adjusting set point, air exchange rates and schedules to the actual use energy consumption can be significantly reduced.
- **Coaching:** Users can make a difference! Whether it's a room temperature, quick ventilation via windows or shutting down the computer during lunchtime: a ESCO coach can show your employees easy and effective ways to save energy and even improve comfort in the office!
- **Energy Administration:** A EPC coach can help you to implement a cost-by-cause concept in your buildings. Accounting energy to the individual units of your company or renters gives clear information and saving opportunities to all building users.

There are lots of saving potentials which can be identified in a Re-Co project. The biggest advantage is the payback time: since Re-Co Services target at low- or no-investment measures payback times are typically shorter than three years.

2.1 EPC light Services in Practice

Projects demonstrate that EPC light is working in building operation practice. This is done by the implementation of more than 15 pilot projects covering all in the project participating countries.

All pilot projects are realized in comparatively complex buildings (hospitals, universities and one public buildings pool) addressing low-or-no cost measures in existing building technologies like HVAC, controls, electrical or compressed air systems with a comprehensive look at all consumption media (electricity, heating, cooling, compressed air and water).

EPC light in these pilot projects builds on 5 key components already mentioned in the chapter above.

EPC light is implemented using a specific mixture of inputs from in-house personnel as well as external expertise from building technology consultants, which are part of the ESCO project team. The terms and conditions of collaboration of internal and external experts are precisely defined in specific co-operation agreements.

In their further process the teams aim at implementing and verifying savings of at least 10% of primary energy without major investments (refurbishment, renewal, backfitting) in building technologies thus demonstrating the technical feasibility and financial viability of the Re-Commissioning process in complex existing non-residential buildings.

Some of the pilot projects are displayed in chapter 5 of this discussion paper.

3 Ressources, internal and external costs – inhouse vs. external

As EPC light concentrates on optimizing existing building technology and starting a campaign for change of user behaviour the resources needed are mainly staff power with support of specific analysis and measurement tools. These resources have to be provided, either by internal staff, external experts or a combination of both. It is crucial that these resources are approved by the top management and the procedure, under which conditions measures are realizable, should be communicated in a transparent way.

3.1 Internal technical staff

The advantage of internal staff is the experience with the facility for a long period and the access to most controls and readings directly on-site and that they are already there. This pool of know-how must not be underestimated as it is often done by planers, external consultants and managers.

On the other hand experience shows that the regular internal staff has to bear a large number of different duties – starting with regular operational management and maintenance, supervision of various external technical contractors (HVAC, electrics, technical-medical specialists,…), issues of fire safety, escape lighting and/or hygienic standards, and many more. In some organizations the management tends to delegate also issues of occupational health and safety and waste management to the internal technical staff.

In this respect targets are often to keep the whole system working – no matter if it's energy-efficient. It is undisputed that operation reliability is the major focus. Nevertheless most internal technical teams seek to implement energy-efficiency through investment or proper operation as long as the timely resources are available.

Another issue is that there is a certain risk for organisational blindness. Sticking to the daily routines, potentials for energy-efficiency are often negated, declined, disliked or mostly not identified at all.

If it comes to decisions for implementation of energy-efficiency-measures it has been observed that the opinion of internal staff sometimes weights less than the opinion of external experts, not taking into account what communication means and skills were available. At least in most cases proposals for measures by the internal staff have to be justified by externals.

3.2 External experts

As external consultants for energy-efficiency are normally specialised in their field and are providing their expertise for quite a number of clients and facilities they can make use of many examples either best practice or lessons learnt. The external consultant can usually make good use of specialised equipment for calculation and simulation of measures, metering equipment, etc.

The view from outside can open the path to new ideas and start designing about measures, which the client (=internal staff) would not be considering by himself.

It should not be ignored that the external expert can only take a – timely limited – glance at the whole technical facility. As the operational parameters, energy consumption and energy load, sometimes comfort readings (like temperature, humidity) and original planning can be investigated and evaluated quite complete, he hardly can evaluate the fine tuning, "habits" of the equipment and the reactions by users onto changes and incidents with the equipment.
For this information the external expert has to rely on statements of the internal staff.

3.3 A question of costs, resources and competences

The carrier of a facility usually has to decide about where to take the resources from, if he decides to perform a energy-efficiency project. These resources can either be external or internal and are costly in both cases.

From the perspective of costs the client would most probably decide to perform the project with internal staff as long as he can provide enough free time resources and the costs are lower than with external staff. As mentioned above, the internal technical staff has to perform a lot of various duties besides to technical management, so in many cases the resources are not available for a energy-efficiency project (exception: other internal projects come to an end and the free resources can be used for energy-efficiency).

In case that not enough internal resources are available the carrier of the facility has to hire external resources to perform EPC light. This causes external costs, which usually have to be approved by top management, if the costs exceed a certain amount. In addition if the desired actions should be performed exclusively by an external expert, a new problem of defining proper interfaces is created and the performed actions have to be communicated and documented after their implementation in a rather complex procedure to ensure the knowledge-transfer.

A more effective (and efficient) solution would be if internal staff and external consultant could work in cooperation by taking into account the local experiences of the internal staff during planning and implementing the measures and performing a training on the new systematics during the implementation for the internal staff.

3.4 Decisions have to be taken

If it comes to decisions whether a measure (or a bundle of them) should be implemented, the measures mainly have to be prepared regarding feasibility, economics and other effects and they have to be communicated to the (right) decision makers.

In-house staff, who (should) know its company, knows best who makes the decisions in the organization and which groups/persons have to be involved into the decision making process so the measures reach the optimal impact on energy efficiency, comfort or else.

On the other side experience shows that the in-house experts often not very experienced to find the right arguments to position energy efficiency measures correctly. For this case the integration of an external expert seems legit provided he can provide the tools and the experience to argue for the planned measures comprehensively and effectively.

Experience also shows that in some organizations the opinions of internal staff weights less than the expertise of externals – even if the same issue should be approved. In this case too cooperation between internal staff and external experts makes sense to increase the probability of implementation.

3.5 Combining forces – a cooperative approach of inhouse staff and external experts

In the majority of the Re-Co projects the implemented measures have been developed and decided by both in-house staff and external experts in a cooperative way. In this process both sides brought in their strengths:

- In-house staff:
  - Detailed experience about operating system and its requirements
  - Experience in the business-as-usual
  - Experience with failures
  - Knowledge about decision paths in the organization
  - Knowledge and experience with special needs and habits of users
- External expert:
  - Successful examples of measures from other facilities
  - Experience in the development and argumentation of energy-efficiency-measures
  - Calculation and presentation of life-cycle costs
  - Systematical project management approach to energy efficiency
  - Experience in mediation
  - Application of analysis- and simulation-tools
  - Status of "the external expert", when it comes to recommendations for measures towards the management

With this concept of cooperation there has been a lot of good experience, as the acceptance of the developed measures – among management, users and internal technical staff – was very high. Still it is crucial to give the credit for the measures and their success to the whole team – in-house and externals – and to communicate it in the organization.

3.6 Outsourcing of risks

For a number of institutions – and it's especially the public ones – it is quite common to reach legal security through external expertise. In fact this is relatively often the reason, why externals are considered to be assigned for consultancy.

In the sense of the EPC light -concept besides to the outsourcing of the legal risk also the outsourcing of the economic risk by the usage of a success-oriented payment of the external expert should be possible – making an ESCo out of the expert. In similar branches – i.e. facility management – or in other partial areas – i.e. optimization of heating controls – this is already in practice.

The next step is to establish success-oriented payment for the EPC light -concept as a whole, which could generate advantages for clients, provided that not the whole economic risk is transferred to the external expert because of the need of financial motivation on side of the client for the successful cooperation (especially user motivation, but also technical optimization). What is more that low-cost-investments (energy monitoring system, additional sensors and adaptions in the control system), which have to be provided by the client in the EPC light -concept, create an additional risk for the ESCo (in case that certain low-cost-measures are not being implemented or with delay).

One solution for this situation could be to integrate certain investments into the contract of the ESCo. Because the respective measures with need of low-cost-investment normally are being developed within the analysis-phase of the Re-Co-process, it is recommended to make use of a two-stage allocation procedure:

- Step 1: analysis and development of measures as a contract without success-orientated payment
- Step 2: implementation, adjustment and quality assurance of measures with success-orientated payment

This concept has not been tested within EPC light so far. In this field there is still a need for development. The concept seems to possess certain similarities to existing energy-service-concepts that is that experience from other EPC-concepts could be adopted therefore.

4 Evolution perspectives for EPC light

4.1 EPC light as an energy service with guarantees? An outlook

As mentioned in the chapter above the development of EPC light -services into the direction of energy services makes sense as soon as a success-orientated payment is involved. The concept could possibly be built up similar to a maintenance-contracting, respecting the major difference that in EPC light services a cooperative approach between in-house staff and external experts has to be taken into account.

Moreover the baseline-problem of EPC [1] must be solved. A solution could be a qualitative confirmation of the performance of the expert or temporary metering.[2]

The transfer (outsourcing) of economic risks to external experts has to be considered in principal as positive, as long as the transferred risks are in the area of influence of the expert for avoiding unnecessary risk-surcharges (i.e. change of usage of an object). On all accounts there is demand for development for this topic to develop business-models with success-orientated payment and to research the differentiation of risks.

4.2 EPC light as a catalyst for the introduction of an energy management system?

Applying EPC light in a facility is not only about technical optimization and new equipment, but very much about continuity of the implemented measures – maintenance, adjustments to changes in usage, continuous improvements – and therefore about processes, which have to be implemented into the organizational structure, especially when it comes to introduction of user behavior and user information, but also with the implementation of an energy monitoring system, which must not stay on itself but should lead to consequences in form of optimizations of controls, user information and technical measures.

The structures of these processes are perfectly represented in the PDCA-cycle[3]. The continuous evolution of this scheme leads to a construction, which is almost identic with an energy management system like ISO 50001.

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[1] Integrated Energy Contracing (IEC) - Discussion paper, chapter 3.4:
[2] Integrated Energy Contracing (IEC) - Discussion paper, chapter 4.3:
[3] PDCA-cycle (Plan-Do-Check-Act): http://en.wikipedia.org/wiki/PDCA

5 EPC light in Practice

5.1 BGU Ludwigshafen – Optimisation of Ventilation Systmes[4]

The Steinbeis-Transferzentrum Energie-, Gebäude und Solartechnik Stuttgart (STZ) is improving the energy performance of the emergency hospital *BG Klinik Ludwigshafen* in the course of the Re-Co project. The clinic has an annual energy consumption of about 25 GWh which corresponds to energy costs of about 2,7 million Euro.

Basic data of the pilot project	
Net floor area	68.000 m^2
Number of beds	418
Energy consumption	ca. 25 GWh/a
Energy costs	ca. 2,7 mio. €/a

During the EPC light project already about 8% heat and electricity have been saved through optimisation of the ventilation systems.

First, a rough analysis was carried out by the external expert, to find out where the consumed energy (from the energy bills) went. This resulted in an energy flow chart *(Figure 4)*, which points out the main energy consumer.

From the energy flow chart, it is clearly visible that the ventilation systems need approximately 45% of the total energy used. This corresponds to about 54% of the clinic's total energy costs.

For a detailed analysis the operation of the selected ventilation systems was simulated under current operating conditions and the yearly energy consumption could be calculated. Afterwards the energy saving potential was calculated through adapting the mode of operation to its actual use in cooperation with the internal technical staff, the users and involved companies. The calculated savings of an exemplary ventilation system are shown in the *Figure 5*.

[4] Re-Co Newsletter No 3, Ursula Rieger, STZ

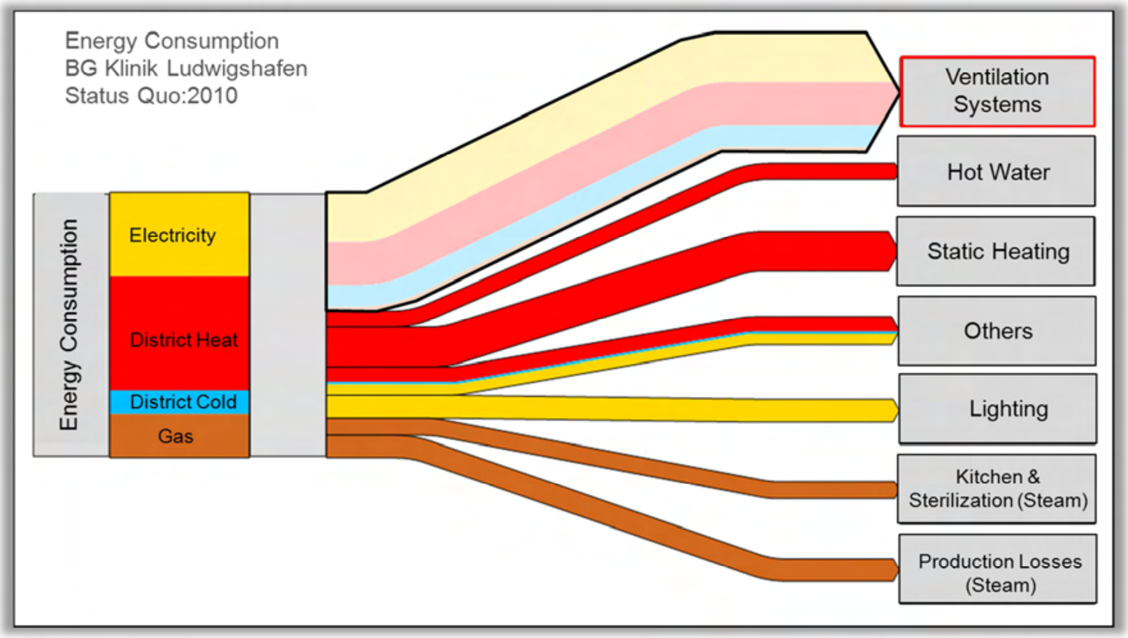

Figure 3: Energy flow chart of the BG Klinik Ludwigshafen

The calculation for the individual ventilation systems showed the energy saving potential in the range from 4% to even 58% with average savings of more than 35% of the originally used energy.

These savings were reached by implementing low- or-no-cost measures. The highest potential was found in measures adjusting the supply to the demand side such as shutting down the system overnight, reducing the volume flow, adapting the actual time profiles in the building management system to its actual use or adapting the conditions to new utilisation of the supplied rooms. Other measures increasing the energy efficiency were: reducing of set values of the supply air pressure, exchanging damaged regulating flaps and checking several controls of the volume flow.

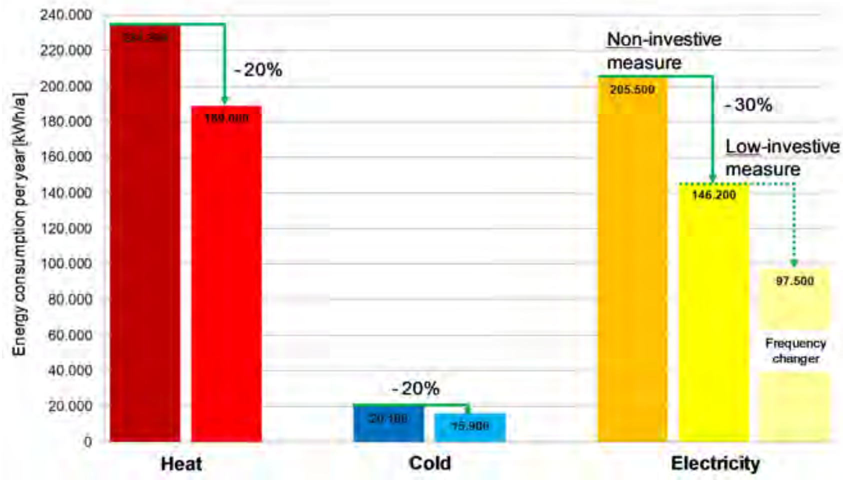

Figure 4: Example of the calculated potential energy savings

The result in the BG Klinik Ludwigshafen shows that large energy savings can be reached only by adapting set values and time profiles of the ventilation systems in the building management system.

Energy costs of about € 170.000 per year could be saved in the clinic by investing about € 110.000. The identified measures pay themselves off after less than one year.

Optimisation of ventilation systems	
Investment	ca. 110.000 €
Energy savings	ca. 1,8 GWh/a
Cost savings	ca. 170.000 €/a
CO_2 savings	700 tCO_2/a
Payback period	ca. 8 months

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IEA DSM Task XVI Participating Countries and Contacts

Austria

Jan W. Bleyl (Operating Agent and NE)
Email: EnergeticSolutions@email.de
(since 01/13), Tel: +43 650 7992820

Boris Papousek
Email: papousek@grazer-ea.at
Tel: +43-316-811848-12

Reinhard Ungerböck
Email: ungerboeck@grazer-ea.at
Tel: +43-316-811848-17

Grazer Energieagentur GmbH
Kaiserfeldgasse 13, 8010 Graz
www.grazer-ea.at

Belgium

Lieven Vanstraelen
Email: lvanstraelen@knowledgecenter.be

Fedesco
Royal Green House, Rue Royale 47
1000 Bruxelles
www.fedesco.be

Johan Coolen
Email: johan.coolen@factor4.be
Tel: +32-3-22523-12

Factor4
Lange Winkelhaakstraat 26
2060 Antwerpen
www.factor4.be

Finland (until 06/2009)

Seppo Silvonen
Email: seppo.silvonen@motiva.fi
Tel: +358-424-281-232

Pertti Koski
Email: pertti.koski@motiva.fi
Tel: +358-424-281-217

Motiva Oy
P.O.Box 489, 00101 Helsinki
Fax: +358-424-281-299
www.motiva.fi

India

Ashok Kumar
Email: kumara@beenet.in

Srinivasan Ramaswamy
Email: srinivasan.ramaswamy@giz.de
Tel: +91-11-26179699

Bureau of Energy Efficiency
4th Floor, Sewa Bhawan, R.K. Puram
New Delhi -110066, India
Fax: +91-11-2617-8352
www.bee-india.nic.in

Japan (Sponsor until 06/2009)

Takeshi Matsumura
Email: matsumura@j-facility.com

Japan Facility Solutions, Inc.
1-18 Ageba-cho Shinjuku-ku
Tokyo 162-0824, Japan
Fax: +81-3-5229-2912
www.j-facility.com

Netherlands

Ger Kempen
Email: g.kempen@escoplan.nl
Tel: +31-639-011-339

Escoplan
Dunckellaan 32, 6132 BL Sittard
www.escoplan.nl

Spain (since 07/2009)

Andrés Sainz Arroyo
Email: asainz@ree.es
Tel. +34-91-650 20 12-2252

Red Eléctrica de España
Paseo del Conde de los Gaitanes, 177
28109 Alcobendas, Madrid, Spain
www.ree.es

Ana Fernandez
Email: AFernandez@hitachiconsulting.com
Tel. +34-91-7883100

Hitachi Consulting
Orense, 32
28020, Madrid, Spain
www.hitachiconsulting.com

IEA DSM Task XVI Participating Institutions

Austria

Grazer Energieagentur GmbH
www.grazer-ea.at

Belgium

Fedesco
www.fedesco.be

Factor4
www.factor4.be

Finland (until 06/2009)

Motiva Oy
www.motiva.fi

India

Bureau of Energy Efficiency
www.bee-india.nic.in

Japan (until 06/2009)

Japan Facility Solutions, Inc.
www.j-facility.com

Netherlands

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www.essent.nl

Spain (since 07/2009)

Red Eléctrica de España
www.ree.es

Hitachi Consulting
www.hitachiconsulting.com

Contact details are provided at the inside of the cover.