



# Lot 11 Interim Report

## **Report to European Commission**

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# 1 The Energy Using Product Directive and the Lot 11 Preparatory study – key technical issues effecting our overall approach

The purpose of this introductory document is to present a technical overview of the four separate Preparatory studies for the European Commission Energy Using Product Directive studies within Lot 11, describing at a high level how the products have been defined, and how the studies relate to each other.

## Scope of Lot 11

- (1) Electric motors 0,75 - 200 kW, (task leader University of Coimbra)
- (2) Water pumps (in commercial buildings, drinking water pumping, food industry, agriculture), (task leader AEA Energy and Environment).
- (3) Circulators in buildings, (task leader AEA Energy and Environment).
- (4) Fans for ventilation in non-residential buildings (task leader Fraunhofer Institute)

## The EuP Directive

The Energy Using Product (EuP) Directive (1) allows the European Commission to implement (unspecified) measures to reduce the eco-impact of energy using products within the EC. Products that do comply with these measures may have the CE mark attached, those which do not could ultimately be prohibited from being traded within the EC.

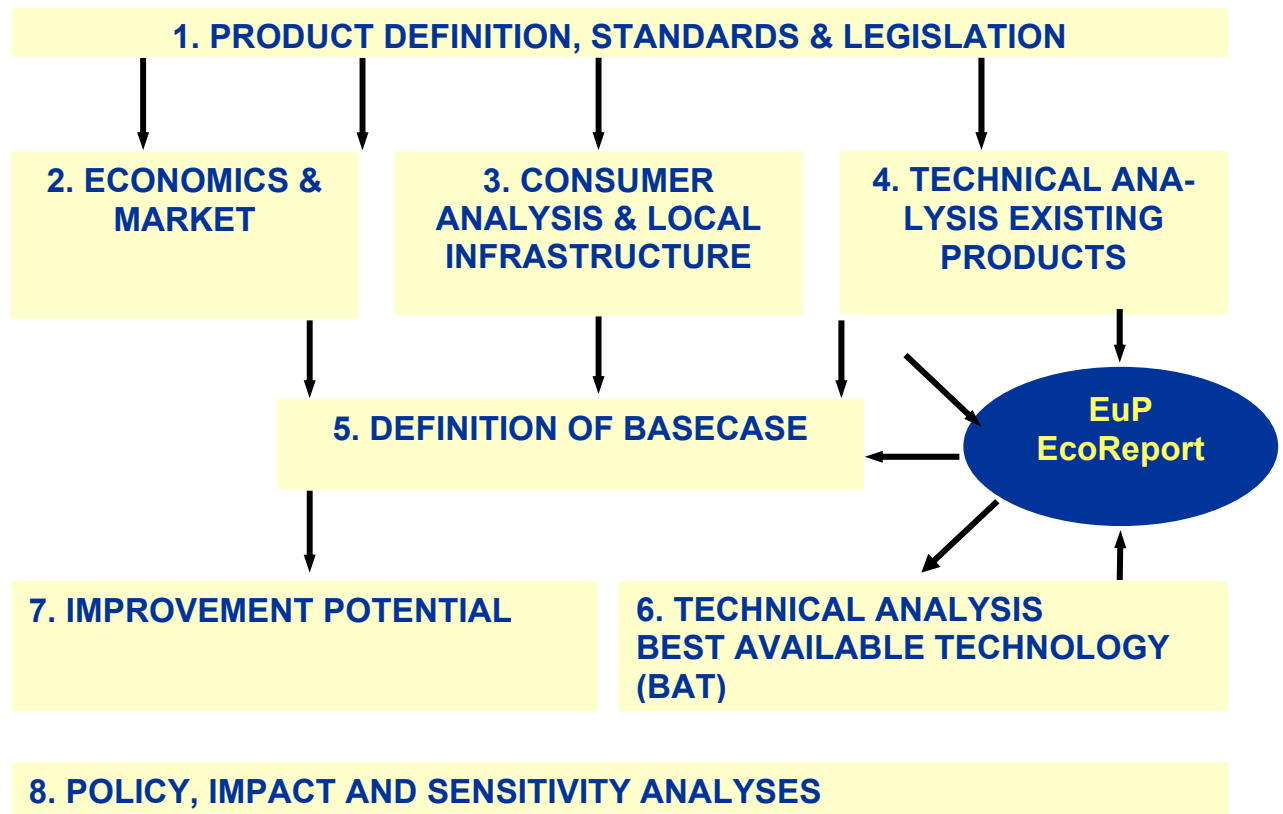
This Directive goes beyond just energy efficiency considerations including all relevant environmental aspects, as it also considers whole life cycle costs, including production and disposal costs. It can therefore be thought of as “energy efficiency, but not at any price.”

A previous EC-funded project has designed a MEEUP (Method for Eco analysis of Energy Using Products) methodology (2) that gives eco-weightings for all key environmental factors, (energy, waste, water, emissions to air, emissions to water). This preparatory study is essentially about collecting the data for inputting to this model, and comprises economic, material and energy use data. The model just requires the input of this information in a structured way, and uses an internal database to convert material quantities from product Bill of

Materials (such as grammes of types of plastic, metal and other materials) in to standard ecofactors.

Latest details on the Lot 11 study can be found at [www.ecomotors.com](http://www.ecomotors.com), with Final reports due Autumn 2007. Anybody with an interest in the study is invited to formally register as a stakeholder, which will ensure that notification is received of new web-content and invites to stakeholder meetings.

Figure 3 High level structure of the MEEUP Methodology



## 1.1 General Points

### **The over-riding importance of energy efficiency**

A major feature of all the products shown is that the financial cost of energy over the typical lifetime far exceeds that of the purchase price. Similarly, the eco impact of the in use phase far exceeds that of the production or end of life phase. This is both a reflection on the long running hours and the relatively low cost/kW of the products themselves. Having verified this fact in the initial analysis of the products, this justified the decision to focus the work on the in use phase, ie the energy performance. In fact, for most products in terms of net eco-impact, there is considerable room for “buying” energy efficiency at the price of additional material usage.

### **Lack of appropriate test standards**

In many cases it has been found that either there are no applicable test standards on which implementing measures can be based, or those that do exist have too wide a tolerance. In such cases, the requirements of future standards have been stipulated, but no attempt has been made to describe how the standards should achieve this, as this is generally a matter for the appropriate trade bodies to define. Lack of appropriate standards at this time is not a reason for postponing implementing measures. If appropriate, the study can propose calculation methods to be annexed in the possible implementing measures. The study will also take into account the wide tolerances when proposing possible minimum performance levels or labelling schemes.

### **Product vs. system efficiency**

The EuP Directive is about products and not systems. However, the directive does not forbid the analysis of energy using products in the system context. On the contrary, as defined in the Art. 2.11-13, the directive focuses on environmental aspects of energy using products during their life cycle. This can only be done when knowing how the product interacts with its environment, which the wider system is part of.

Consequently, system considerations will be made as described in the MEEUP methodology, but only to the extent that different technologies will interact in different ways. More general discussions on the energy saving opportunities in the system will be presented for reference only, as this subject is explicitly beyond the scope of the study.

## 1.2 Special features of the Lot 11 products

### Products can be parts of larger products

The Lot 11 products are unusual in that most of them can only be used as part of a larger item of equipment. This raises several interesting issues:

- Actual performance is influenced not just by user behaviour, but also by the performance of the balance of equipment that it is incorporated into and the matching of the product to the system. For example, a motor may be driven at 110% load in an air compressor, but in a direct drive fan the additional cooling means that it could be driven safely beyond this point.
- If the item of equipment that it is incorporated into is itself the target of an implementing measure, how will this match with the implementing measure that is applied to the individual product? For example, should implementing measures for boiler integrated circulators apply to the circulator itself, or to the boiler as a complete unit? This study analyses the circulator itself, but the data is also being made available to the boiler study so that the findings can be taken account of in any implementing measures for boiler electrical performance that are defined.
- For the fan and the pump by themselves, without the motor, the actual energy input is mechanical power, not electrical power. This differs from other products being studied at this time, but as mechanical energy as such has no identifiable environmental impacts, the link with the primary energy or electricity must be identified within the context of the Directive. However, special consideration must be made in the way that the components that convert the electrical energy to mechanical energy are treated.
- Because of the use of mechanical energy as the input power generated from primary energy sources, care must be taken to ensure that energy savings in the fan/pump are not double counted in both motor and fan/pump reports. Section describes the protocol that has been adopted for this.

### Operating profiles

Detailing the typical use profiles of products such as motors is extremely difficult, because they are used in so many different applications. Inevitably this will mean that minimum energy performance standards would adversely impact users with installations that have very low running hours, as it is hard to

financially justify more than a minimal additional purchase price. But this is true of all minimum standards, and so is not an issue.

But what is interesting is that the eco-impact of buying lower efficiency products might actually be negative, due to the additional materials that are likely to be used. . Indeed, the study will at times specify what the limits to efficiency might be in terms not only of financial investment but also of additional production phase impact of goods.

An important aspect of this is that there is still a place for products that may consume more energy than more efficient alternatives. For example, vacuum cleaners use small and very high speed motors that are inefficient. But to replace these with standard induction motors would make the vacuum cleaner more efficient but exceedingly heavy and have a far higher production phase eco impact. So there will always be a place for products with a low production phase eco impact where it is known that the typical operating duty is only very low.

By contrast, in applications where a product is working 24/7, a higher cost and production phase eco-impact can be assumed. There is though no precedent for setting standards on the basis of application, and so this is not discussed further in this study. Rather, labelling and other information should be used to inform the buyer about the advantages of specifying premium equipment in such situations.

### **The importance of maintenance and reliability**

Lifetime of the product is heavily dependent on how it is used. Examples include:

- Alignment of shafts. Poor alignment will use additional energy and lead to more rapid wear of bearings and ultimate failure.
- Using a pump far from its Best Efficiency Point causes many hydraulic problems, such as cavitation, that will lead to rapid deterioration in performance and efficiency.
- Use of a fan in the unstable portion of its characteristics will greatly accelerate wear.

There are many detailed examples in the studies of trade-offs between initial efficiency and longer term performance. While efficiency is important, it is rarely a good idea for this to be traded off against general robustness, as the eco-impact of this deterioration in performance and premature failure is likely to outweigh these up front savings.

Many of the products in these studies are of such value that they will be repaired when they fail. For example, the motor repair business is of a similar

size to that of the new motor business, showing its importance in the whole product life cycle.

The cost of failure of products within Lot 11 can be huge, especially if it is part of a continuous industrial process where the cost of down-time may be measured in tens of thousands of euros per incident. This can, or should, put a huge emphasis on reliability and maintenance of equipment. These costs over the lifetime of equipment can exceed that of the initial purchase price of the product.

**Table 2 The energy costs of product failure**

Effect of unplanned breakdown	Related energy cost
Temporary reduction of output during breakdowns	Background energy used to maintain essential services is spread across less product, so specific energy consumption rises
Start-up losses	Energy is lost during the warm-up phase of high-temperature processes
Using alternative methods to regain production	Less efficient production methods may be used, possibly relying on older equipment or involving extra transport costs
Loss of production during warm-up phase	Some processes result in scrapped product while they are warming up
Energy lost in part-processing a product	Energy may have been expended in getting a product close to the end of a production line. This will be wasted.
Disposal of damaged products	There may be energy costs involved in disposing of scrapped products
Emergency repairs made to restart plant	Because of the urgent need to get a plant running again, speed may take priority over getting the best quality repair or looking for the most efficient replacement parts.
Rework costs	Extra energy is needed to rework spoiled products
Time lost for less urgent work	Time that could have been spent on cutting energy consumption is lost.

### 1.3 Applying the definition of “Product”, “Part” and “Component”

Because the products will sometimes be integrated into larger more complex products. For the purposes of this study, it is therefore important that the concepts energy using product, part and component are particularly well defined.

A **Product** is any item that is traded in the meaning of the Directive. Only products that use energy are Energy Using Products.

**Parts** are items within a Product that itself uses energy.

**Components** are items within a Product that do not use energy.

It should be noted that this slightly different wording from that in the Energy Using Product Directive is not an attempt to challenge the Directive, rather it is a pragmatic approach to better define the properties of the different items within the Lot 11 studies.

, The same object may be classified as a product in one case and as a part in another case. An example of this is belt driven fans, where the motor and the fan are mounted on the same frame and sold and distributed together as a single product, but which could also be split into two parts, which could then be sold as separate products. Art 2.1 of the directive leaves this issue open to be defined within these preparatory studies, and so a pragmatic solution is presented in order to avoid lengthy theoretical discussions about the intentions of the legislator.

The starting point is that a life cycle analysis considers environmental impacts from the direct or indirect use of primary (e.g. coal or oil) or secondary (e.g. electricity) energy. In addition, the study must deal with the technical concept of mechanical power in order to understand the transfer of primary and secondary energy into product functions. This provides the scope to include products that are driven by a motor as an Energy Using Product. In accordance with the Directive, a key condition is that the environmental impact of the part can be independently assessed and that a reliable measurement method exists or can be developed within this study. Note that the lack of an existing test standard is NOT a barrier to the study of a particular product or part, rather the preparatory studies will highlight where relevant standards are missing, and gives suggestions as to the basis on which they can be developed or develop suitable calculation methods that could be used in potential implementing measures.

In order to distinguish between products with different combinations of parts, this study will use three further product concepts as follows:

- **(Standalone) Products** with one main technology only. For example a motor, or a pump sold without a motor.
- **Combined Products**, which are sold as a combination of two or more parts (such as a close coupled motor+pump), which can be very easily separated and the parts analysed individually as energy using products.
- **Integrated Products**, which are so closely integrated in to single physical products that it is no longer possible to split them into parts or products. An example is the electronically commutated fan where the motor/drive and fan can not work independently from each other, as they share some components.

## **1.4 Functional Parameters – or what a product does**

Central to the definition of what the product is, is the concept of Functional parameters, which are by definition “technology blind.”

The primary functional parameter explains what the product is intended for, or what it primarily does. This is simple, and relates in the most general terms to the outputs of the products, (pressure and flow for pumps and fans, and speed and power for motors).

The secondary functional parameters are the crucial issues to be discussed after the analysis and measurements made at the level of the primary functional parameter. Differences in secondary functional parameters may for instance dictate that two products with the same primary functional parameters can not be regarded as substitutes, either on the grounds of cost or technology. This is crucial to ensure that suggestions for design options do not promote one technology over another if it is not always a valid choice to the end user.

Note that the number of secondary functional parameters listed in the inception reports will be reduced to the minimum necessary. Which parameters can be dropped will become clearer as the work progresses.

## 1.5 What is the product?

A fundamental issue is to define the boundaries of the product. For most of the other Lots in the study which are appliances, the boundary has been clearly drawn at the mains plug. But many of the products in Lot 11 are often traded simply as parts of a larger item of equipment. This means that the boundaries of the product are not clear, and the Directive gives no specific guidance on this point. This is the task of the study.

There has been much debate on whether to draw the boundary around the individual product or around the combined fan/pump and motor assembly. The study group had attempted to have a single unified approach for all products in this Lot, but it was found that this would have compromised the analysis of some products too much. Where the boundary is drawn for each product is therefore taken on its own merits, based on functionality, with due consideration on the possible impact that any EUP implementing measures are likely to have.

While disappointing that it is not possible to have a single approach that can be sensibly applied to all products, the benefits of this flexibility in terms of the impact of any implementing measures will justify this approach.

**In summary, there are two different ways of comparing products:**

**(i) The product is just the fan, pump or motor.**

There are two possibilities here:

- a) It is traded as a separate product  
(eg single and three phase induction motors)

OR

- b) It can be split in to parts that can be separately analysed and are themselves subject to the EUP Directive. (eg End Suction Own bearing pumps and End Suction Close Coupled pumps where the motor is analysed separately within Lot 11.)

**(ii) The product is the complete motor + fan/pump unit.**

If a product is only available as an integrated product, and where the parts are not analysed separately in this study, then it should be analysed as a complete product.

(eg all circulators where the motors are not analysed within Lot 11).

There is an acknowledged difficulty that if a product analysed by method (i) is in competition with a product analysed by method (ii), making comparisons will be difficult because the boundaries in each case are different. In these cases, new

solutions will be needed in order to apply the methodology - with each decision taken on its own merits.

**Product boundaries - points that relate to the impact of where the boundary is drawn:**

- 1.) It is clear that the pump/fan manufacturer is responsible for the performance of the product. If the boundary was drawn to include the motor, the pump/fan manufacturer would no longer have sole responsibility except in the cases where they also make or specify the motor.

The final choice of motor to accompany the pump/fan could be made by several other stakeholders in the chain. Hence responsibility for ensuring the final product was CE marked would no longer lie with the manufacturer, but with any one of these intermediaries. Ensuring that all these intermediaries comply with the requirements of the implementing measures would in practical terms be very difficult. (See Art 2.6 for discussion on responsibilities for ensuring compliance).

- 2.) Existing (academic) work on fan/pump efficiency is almost exclusively related to the fan/pump only. Keeping with this approach makes it easier to cross-check results with this large body of information.

Manipulating the efficiency data for the performance of analysis fans/pumps will be much easier if it is restricted to fluid equations only.

Graphs of efficiency performance relating solely to the fan/pump are more transparent and easier to understand than those which also include the performance of the motor.

- 3.) Mechanical power is a useful concept when analysing the environmental impacts of certain products, such as fans and pumps without motors. This is an important point, because if it was not facilitating the analysis, then we would have been forced to widen the boundary to include an (electrical) energy consuming component.

This adopted approach does though raise the question of how the carbon and other emissions can be calculated. The assumption here is that all fan/pumps are driven by electricity, and so the emissions corresponding to this quantity of electricity is calculated in the MEEUP model.

To avoid double counting of emissions, when considering motor or transmission energy consumption, only the losses from that component should be considered. The wider implications of this in the study still need to be worked through in detail. (Note that the alternative of considering the fan

+ motor as the product would also give a similar problem of double-counting the energy consumption of these motors).

- 4.) The EUP Directive states that where the products can be split in to constituent products, then this can be done (art 2.1). Some fans do come in integrated units, but even in these cases the manufacturers will know the efficiency of the separate parts, and so it is possible to characterise the parts separately.

It is accepted that allocating materials to the motor or the fan/pump can be difficult. However, in practice this is not seen as being a problem, as initial analysis has shown that the material content is hardly significant in terms of overall eco-impact. Therefore any errors in allocating materials is not an important factor.

- 5.) Having implementing measures for both the motor and motor+fan would be confusing. A raising of existing minimum efficiency levels or another big advance in motor efficiency could mean that there is no need for the fan to improve individually – which would be a big missed opportunity.

If using a particularly good fan, a motor worse than that allowed for a standalone motor could be used and still achieve the combined fan:motor performance level.

- 6.) Considering the parts separately will unfortunately lose the benefits from the careful matching of the pump/fan to the motor:

- For standard induction motors, in practice the motor is regarded as an inter-changeable item, and so there is rarely any consideration of the precise torque:speed characteristics.
- Motors for particularly short duties or which are run in a fan air-stream can be a reduced size, and so this factor should be noted.
- In addition, the transmission belt will be excluded from the calculations, and so must be included in any comparisons.

- 7.) Considering the parts separately will contradict the approach taken in smaller domestic appliances outside of this lot where the energy performance figures are based on the whole product rather than the parts individually. The view is that this approach has been taken for small appliances simply because there are currently no standards on many of the individual parts. Further, the diversity of these products would make standards hard to devise, although not impossible.

Motors, fans and other parts that are part of these products are usually custom made, and so manufacturers do ask for products to be improved in order to help them to achieve efficiency targets.

For standard parts where there are lower sales volumes, manufacturers will not have the same pull on designs. Therefore it makes sense for the constituent products to have separate implementing measures.

For other larger products such as air compressors, which in smaller sizes are only available as packaged units, industry standards relate to total electrical power consumption. It would therefore be in keeping with industry norms if the total package was considered to be the product. However, as a general principle it should be noted that adherence to industry norms may not always be the best approach in achieving the objectives of the EUP Directive.

- 8.) Comparing different products will be easy, as it can be done at the level of the single fan/pump. In the case of products that are only available as a combined fan/pump : motor unit, then they may be analysed at this level. (This seemingly contradicts the main argument, but it is reasonable in that the fan/pump producer is still clearly identifiable as being responsible for the whole product. Furthermore, such products usually include motors that are non-standard, and so would not fall within the scope of any EUP implementing measures.)

However, a key problem is that it is difficult to compare an integrated product with those comprising two or more separate products. This is necessary when both options are available for sale into the same application.

In order to have a level playing field, it is essential that the two options are compared on the same basis – ie both with or without a motor. To do this, bare fan/pumps could have a default motor added to them, or integrated products could have the motor removed. This decision will be made on a case by case basis.

## 1.6 Efficiency at part load conditions

### Controls

A recent market trend is for products to be sold with a VSD or other controls incorporated in the product. Wherever possible, the control elements are excluded from the analysis, as this enables attention to focus on the product itself (motor, fan or pump). The primary justification for this is that it is these components that the manufacturers have most influence on, and which the EUP Directive is focused on. It also avoids the difficult question of what load profiles (in particular system resistance) to assume in order to demonstrate the energy savings from the use of different types of control.

Such controls are undoubtedly a good thing in the right application, and a separate chapter on the energy savings from the use of controls, particularly VSDs, is included in the report.

In the case of motors with an integrated VSD, these are analysed in the first instance as a combined unit, as the thermal constraints influence the design of both the motor and the VSD. Because many types of motor can not run directly off the mains, they have to have a controller. Therefore the controller is also included in the analysis.

### Load factors

In real life, the products in this lot will spend most of their life operating at part load. The method of analysis must therefore take account of operation at part load in order to reflect real life conditions. In this study, Full load refers to operation at the rated or 100% output condition, Part load refers to operation at an output condition less than this.

For a motor, it is common practice to characterise efficiencies at 50%, 75% and 100% of rated torque. Efficiency remains fairly similar over this range.

For pumps and fans, there is no such convention. These products are less efficient at very low outputs, and pumps may also be damaged, and so it is only sensible to characterise them by efficiency over a much more limited range. These products can usually be safely used beyond rated flows, and so a flow above rated is also included. The flows chosen for pumps are 75%, 100% and 110% of rated flow. Efficiency may fall off very significantly either side of the 100% point – which is usually the Best Efficiency Point.

It should be noted that this analysis is all at fixed speed. This is very different from reducing the motor duty by altering its speed. This is because the power consumption is intimately related to the torque/speed characteristics of the system. These considerations are beyond the scope of this study.

### **Weighting performance at different loads**

Because a motor/fan/pump will on average spend most of its life operating at part load/flow), part flow operation is often more critical from an energy perspective. Fans/pumps can be designed to have different part flow characteristics, and so if we ignore part flow operation in our analysis, then we might inadvertently encourage the design of products optimised for a duty at which they are little used, at the expense of the more typical part flow operating point.

We are therefore calculating a "weighted average" energy consumption produced by summing the annual energy consumption at the different flows selected above. For each product we have assumed weighting factors to give the proportion of operating time at each condition. This will be done in using the existing test standards as far as possible and with calculation methods developed within the study. The used standards and calculation methods will be described in detail in the study and agreed with stakeholders.

## **2 How the four sub-studies fit together – calculation of energy savings**

### **2.1 Overview**

Because the products within this Lot are sometimes sold together within a single product, it is vital that energy consumption and savings data is carefully counted.

A common rule of thumb is that “electric motor systems account for 2/3rds of the electricity consumption in industry”, but in this study care must be taken over the exact interpretation of this phrase. While true, only a small proportion of this energy is actually used in the motor, (ie, lost), the bulk (say 90%) is actually transmitted through it and converted into mechanical energy that is actually used by the load that it is driving, for instance a fan or a pump.

Strictly, the bulk of this mechanical energy (say 70%) is in turn transmitted through the fan or pump to the fluid system, and it is this fluid system that actually does the work that leads eventually to the power being absorbed.

So, the scope for reducing energy losses is restricted to the small amounts actually lost in each product in the energy transmission and conversion chain. In the case of a motor with 90% efficiency, an apparently small improvement in efficiency of 2% would actually equate to a 20% reduction in the losses, which is a significant gain.

The danger is that if energy savings in the fan/pump are related back to the electrical input, ie they include the motor part of the energy chain, then the energy consumption of the motor is going to be counted twice. For some products, the fan/pump and motor are part of the single product, and so this is a particular issue.

### **2.2 Definition of motor energy consumption used in the motor study**

The convention used is that for motors, the energy consumption is ALL of the electricity used by them – ie measured electrical power drawn from the mains supply. (This also has the advantage that it enables comparisons with other studies to be made).

### **2.3 Products that include an integrated motor of a type that is analysed within the study**

Wherever possible, the energy consumption and savings of fan/pumps is analysed in terms of the mechanical power. The MEEUP model is designed to cope with this, as the savings in emissions are based on the assumption that the product is driven by an electric motor.

As an example, a mechanical load of 10kW on a motor might result in an electrical load of 12kW, with the difference of 2kW being the losses in the (assumed) motor.

There may be occasions where it is also desirable for the fan/pump + motor to have show the motor energy savings, for example if it is being compared with a product that has an integrated motor of a type not in the study. In these cases, it is permissible to also show the related motor energy savings in the fan/pump study, but it must be made very clear that this has occurred in order that motor energy savings are not double counted.

### **2.4 Products that include an integrated motor of a type that is not analysed within the study**

This mainly applies to very small motors within domestic appliances, such as those used in small ventilation fans or circulators, where it is very unlikely that any implementing measures would be applicable. In addition, these are not products that are studied separately within the motors study. Because the motor energy consumption of these products is not considered within the motor study, there is no danger of double counting these energy savings.

## **APPENDIX 1 Minutes of stakeholder meetings.**

### **Minutes from First stakeholder meeting of Lot EuP Lot 11 DG Tren, Brussels, 29 June 2006**

#### **Attendees**

Justin Brock	AEA
Hugh Falkner	AEA (Chair)
Charles Gaisford	AEA
Anibal De Almeida	University Of Coimbra
Peter Radgen	Fraunhofer ISI
Julia Oberschmidt	Fraunhofer ISI
Ioannis Leontaris	Fraunhofer ISI
Bill Cory	Independent Consultant
David Reeves	Independent consultant
Frank Ennenbach	ABS Group
Conrad U.Brunner	A+B International
John Bower	Flowserve
Guy Van Doorslaer	Europump
Geoff Lockwood	ebmpapst
Markus Teepe	Wilo
Thomas Damm	VDMA
Steve Schofield	BPMA
Philippe Riviere	Mines Paris
Bernhard Sattler	CEMEP
Hans De Keulenaer	European Copper Institute
Andrew Stephenson	Baldor
Peter Zwanzier	Siemens/ CEMEP
Philippe Thiery	Leroy Somer
Helle Nystrup	Grundfos
Jorg Kohl	Dena
John Fraser	Circulating Pumps
Friedrich Klutsch	VDMA
Robert Dodane	Salmson
Neil Jones	Flakt Woods
Ismo Gronroos-Saikkala	European Commission
Andras Toth	European Commission

#### **Welcome and Introduction – Hugh Falkner**

### **The EuP Studies General – Hugh Falkner**

A General presentation was given on the EuP directive and methodology to be followed as part of the study – Visit the Ecomotors website or click [here](#)

Discussion was held on how to deal with systems – It was made clear that the remit of this study only covers individual products. One of the initial objectives is to agree on where the product finishes and the system starts. Ismo advised that there are mechanisms within the EC for taking forward any good ideas for dealing with the system and requested that any such ideas be sent directly to him to be considered for taking forward.

Steve Schofield asked how different proposals to the EC would affect work on this EuP study. Ismo advised that it would have no effect on the current study, however if taken forward could be used in parallel with any implementing measures arising from the outcomes of this study.

### **Presentation on Motors 1st inception report – Anibal de Almeida**

Visit the Ecomotors website or click [here](#)

Steve Schofield questioned the motor statistics quoted in the presentation advising that they didn't stack up with the Europump statistics that had been collated and requested that these could be looked into further.

Geoff Lockwood questioned whether we should be looking at motors combined with pumps and fans. It was advised that the project group had not yet finalised how to deal with fans and pumps with an integrated motor.

### **Presentation on Fans 1st inception report – Peter Radgen**

Visit the Ecomotors website or click [here](#)

Conrad Brunner stated that the operating data for fans is going to be crucial to the model with load factors, load types and lifetime making big differences. This was agreed and a discussion on how this data should best be collated followed.

### **Presentation on Circulators 1st inception report – Charles Gaisford**

Visit the Ecomotors website or click [here](#)

### **Presentation on Pumps 1st inception report – Hugh Falkner**

Visit the Ecomotors website or click [here](#)

Conrad Bruuner questioned whether it had been decided to exclude integrated VSDs within the study. Hugh advised that this was being looked into by the project team, however felt that it would probably be concluded that VSDs come outside the remit of the project, however conceded that general information on VSDs would need to be covered in one section of the report.

John Bower questioned how the resultant implementing measures would be policed. It was advised that the EC would be setting and making decision on policing implementing measures on completion of the study.

## **Pumps and Circulators Breakout Session – Hugh Falkner and Charles Gaisford**

### **Attendees:**

Hugh Falkner	AEA (chair)
Charles Gaisford	AEA
David Reeves	Independent Consultant
Guy van Doorslaer	Europump
Steve Schofield	BPMA/Europump
John Fraser	Circulating Pumps
Robert Dodane	Salmson
Markus Teepe	Wilo
Frank Ennenbach	abs pumps
John Bower	Flowserve
Peter Zwanziger	Siemens/CEMEP
Helle Nystrup	Grundfos

### **Pumps**

#### **Principal changes requested to the draft Pumps Report**

##### **Section 1.2.1 - Harmonised Standards – Performance testing**

Para. 1. It is noted that ISO 9906-1999 is being revised.

Para. 4. Remove the reference to Europump in the sentence that states shipped product may differ from catalogue efficiencies.

##### **Section 1.3.1 – Existing relevant environmental legislation**

Expand on section concerning WEEE, with the consensus from pump manufacturers being that it does not impact pumps.

**Fig 2.2 – 2.3** Update figures to agree with Annex 4. In particular check sales of DN<15mm pumps (should be 6M).

**Fig 2.5** - For both ESOB and ESCC types it was agreed that the lower duties should be based on a 2-pole motor with a reduced port size (EN 733 – 40 – 160). This corresponds to 25m<sup>3</sup>/h at 32m.

**Submersible multistage water pumps.** Eurostats suggest sales for 1998 of 185,000 units in the EC. This is considerably less than the 530,000 units pa suggested by Europump. It would be interesting to understand the likely reason(s) for this discrepancy, but it is noted that it is unlikely that there would be adequate grounds to exclude these models on the basis of volumes being below the 200,000pa indicative threshold.

**Multistage water pumps** should be included. We will review catalogue data and suggest representative duties.

There was a question regarding the commonality of parts between cold and hot water multistage pumps. It was understood that any differences would only be minor – we would welcome confirmation of this point.

The revised table of pump types and duties is shown below:

Style	Standard (where applicable)	Selected Duties
End Suction Own Bearings (ESOB)	EN 733:1995, 10 bar rating	1.) 25 m <sup>3</sup> /h at 32m (EN 733-40-160) – 2,900 rpm 2.) 125 m <sup>3</sup> /h at 32m (EN 733-100-315) – 1,450 rpm
End Suction Close Coupled (ESCC)	None applicable, and so suggest base duties on EN 733:1995	1.) 25 m <sup>3</sup> /h at 32m (EN 733-40-160) – 2,900rpm 2.) 125 m <sup>3</sup> /h at 32m (EN 733-100-315) – 1,450 rpm
Submersible Multistage	None applicable, so have based selection on typical available product	1.) 2.5m <sup>3</sup> /h at 70m 2.) 8m <sup>3</sup> /h at 60m
Multistage Water		To be selected by reference to manufacturers catalogues

**Appendix 3** will be revised to brought into line with the published Europump pump efficiency guide.

## Circulators

### Principal changes requested to the draft Circulators Report

#### Section 1.1 Product Classification

Include a footnote describing the term 'P1'. Explain that it relates to 'electrical input'.

Explain that the term 'efficiency' in the context of wet running circulators refers to the overall efficiency of both the motor and the pump.

### **Section 1.2.1 Harmonised Standards – Performance Testing**

It is noted that an additional standard is being developed, EN 1151-3, for Variable Speed Circulators.

### **Section 1.2.3 Harmonised Standards – Health and Safety**

*EN 60 335-2-51: 1997 Particular requirements for stationary circulator pumps for heating and service water applications.*

This standard was revised in 2003.

### **Section 1.3 Existing Relevant Environmental Legislation inside and outside the EU, existing self regulation**

*To be revised.*

#### **Other:**

#### **Selection of circulators for the base case model.**

It was agreed that further information about the market share by size of circulator and by 'stand alone' or 'integrated within the boiler' is required before a final selection of circulator could be made for the basecase reference model.

It is likely that there will be 3 models:

- a) Circulator stand alone <250W
- b) Circulator integrated in the boiler <250W
- c) Circulator stand alone >250W and <2500W

*Currently it is thought that the most popular size is in the 61W – 70W range.*

#### **Further information requested of Europump:**

1) Information indicating the split of market share between circulators used in heating applications and those used in cooling applications.

2) Information about, or a draft copy of the section in the revision to the test standard EN 9906 that relates to small pumps down to 200W in size.

3) Information about, or a draft copy of the new standard EN 1151-3 Variable speed driven circulators.

4) In order to determine which are the most popular circulator groups (by size) and agree upon base case models (an urgent requirement), we would like to receive the best estimate of the sales of circulators split by input power. Up to 150W it would be useful to have quite a detailed split in order to justify the choice of basecase reference models, with much wider power bands up to the maximum of 2,500W.

If possible, information about the split between stand alone circulators and circulators integrated into the boiler is requested.

- 5) Based on the data supplied in 4) a further split as follows is requested.
- a) Split by performance label (as per classification scheme)
  - b) Split by heating or cooling application
  - c) Split by country (EU-25). (Less urgent request)

### **Next Steps**

Europump has invited a representative of the study group to attend the afternoon of their next meeting on August 23<sup>rd</sup> at Diamont building, Brussels, in order to discuss next actions. We are very grateful for this opportunity, and can confirm that Hugh Falkner will be attending this meeting.

The full model is now downloadable from the [www.ecomotors.org](http://www.ecomotors.org) web-site. An additional worksheet will be added to this to allow for the analysis of equipment at different efficiencies. A 2-page document listing the data requested is also now available on the web-site.

### **Statement on Confidentiality**

All data will be treated in confidence by the study group, and will only be looked at in its non-aggregated form by Hugh Falkner, Charles Gaisford and David Reeves. All published results will be clear of references to individual manufacturers or models.

## **Fans Breakout Session – Peter Radgen**

### **Attendees:**

Peter Radgen	Fraunhofer ISI (chair)
Julia Oberschmidt	Fraunhofer ISI
Ioannis Leontaris	Fraunhofer ISI
Bill Cory	Independent Consultant
Geoff Lockwood	ebm-papst UK Ltd
Thomas Damm	VDMA
Neil Jones	Fläkt Woods
Ismo Grönroos-Saikkala	European Commission

### **Section 1.2 and 1.3 (Standards and Legislation)**

#### **Standards:**

There will be a new Annex for ISO 5801 (Annex E: Efficiency of impeller only) soon.

Another new standard EN14461 is available with specifications for fans regarding the machinery directive.

#### **European Legislation:**

Uncertainty if Energy Performance of Buildings Directive (EPBD) will have relevant impact on fan efficiency in building applications.

Machinery directive is applicable to fans (due to moving parts).

Low Voltage Directive (LVD) is applicable to smaller fans with single phase motor (motor/fan integrated units).

Apart from European legislation/standards, also legislation/standards outside EU (USA, Australia, China etc.) should be checked. Furthermore, a stronger focus on eco-design and life cycle is required, i.e. also environmental legislation must be identified which is not only addressing energy efficiency.

### **Section 2 (Economics and Market)**

Fan manufacturers could possibly provide additional data on market figures which are nevertheless confidential and could therefore not be used directly in the report.

More Stakeholders in particular concerned with fans must be involved, especially the main players in the European fan industry from Italy (Nikotra) and Spain (Soler & Palau).

**Section 2.1.5 (Selection of fans to be investigated)**

The suggested selection of fan types to be investigated was basically agreed on, even though other fan types should maybe be considered in addition, such as:

- Forward-curved centrifugal single box extract fans for ventilation of 1 or 2 rooms (e.g. toilets, multiple kitchen extract fans etc.)
- Big window fans\* used in pubs, clubs, take-aways (350 mm single phase 100 W)
- Partition fans\* are equally important as ducted axial flow, esp. in agricultural applications  
 → it has to be checked if agricultural applications are within the scope of the study (non-residential buildings)

[\* Window and partition fans are typically plate mounted, direct driven axial fans with flat or curved sheet metal blades (nowadays more and more aerofoil) and free inlet/outlet. Partition fans are usually larger than window fans.]

Some additions/changes to table 12 were required. The revised table is shown below:

Type	Size/electrical supply	Comments
ducted axial flow	500 mm 0.5 kW 240 V single phase 50 Hz AC	General purpose ventilation, held by stockists for immediate dispatch
open inlet axial/propeller fan	800 mm 2.2 kW 380/440 V three phase 50 Hz AC	Used in multiple by OEMs for roof mounted chillers in air conditioning, blade designs for minimum noise
backward-bladed DIDW <sup>1</sup> fan for belt drive	250 mm to 1,000 mm 1 to 75 kW	Incorporated in Air Handling Units for supply typically up to 2 kPa and 30m <sup>3</sup> /s
DIDW forward-curved centrifugal with inside/outside direct drive motor	133 mm to 160 mm 50 kW	widely used for fan coil units
Centrifugal fans (forward- and backward-aerofoil bladed)	come in geometrically similar sizes with impellers 250 mm to 630 mm	Axial and centrifugal fans should conform with the dimensions specified in ISO 13351

<sup>1</sup> Double Inlet Double Width

Other comments on selected fan types:

- For open inlet axial/propeller fan (6-pole) also a lot of 8-, 12-pole used because of low noise level; 12-pole more efficient in use than 6-pole with attenuator
- In AHU also plug fans (centrifugal without casing) became popular in the last 2 to 3 years
- Backward-bladed DIDW fan typically with single V-belt (twin V-belt when power goes up); trend to plug fans

Furthermore there was a discussion on **motors** used for fans as well as on issues concerning systems with **integrated fan/motor**:

- Market share of DC motors estimated 5-10% and rising
- Fans with integrated motor since 1955; integrated EC motor since 1996
- Many fan manufacturers produce packaged units with motor and fan; some manufacturers produce integrated motor/fan-units
- AC induction integrated up to 5.5 kW, DC up to 3 kW (e.g. produced by Ziehl-Abegg, Rosenberg, Gebhard, EBM)
- Prices of Variable Frequency Drives (VFD) decreasing (because of cost reductions in electronic equipment)
- VFD has to be considered as one option; within this study fans with VFD could be considered "Best Available Technology" (BAT) while induction motor would be the "Base case"
- **Fans with integrated motor cannot be analysed by separating fan and motor**  
➔ for reasons of comparability other fans also have to be analysed including the motor

#### **Other issues**

- Renewed interest in natural ventilation
- Forward-curved fans generally used in significant numbers because of cheap prices
- Differences between national markets to be taken into account (e.g. depending on noise regulations, traditional behaviour etc.)
- Maintenance usually not carried out as suggested by manufacturer
- installation and cabling cost are an important parameter when selecting a fan system

## **Motors Breakout Session – Anibal de Almeida**

### **Attendees**

Aniabal de Almeida	University of Coimbra (Chair)
Justin Brock	Future Energy Solutions
Conrad Brunner	A+B International
Berhard Sattler	ZVEI/ CEMEP
Andrew Stephenson	Baldor
Peter Zwanziger	Siemens/CEMEP
Philippe Thiery	Leroy Somer

These minutes describe the conclusions in the dedicated meeting covering motors.

### **General product definition Motors 1–150 kW**

An initial discussion was based on the overview presented in first general meeting of the morning which lead to the following conclusions:

- Type of Motor - AC Induction Motors largely dominate energy use in that power range; DC motors are a small shrinking fraction of the market
- Number of Phases - 3 PHASE AC induction motors largely dominate integral hp market; Single phase motors represent a small part of the electricity consumption in that power range;
- Power range 1–150 kW is quoted in the terms of reference, but a lower bound of 0.75 kW and an upper bound such as 200 kW was discussed to take into account standard power sizes and market sales in both power boundaries.

### **The next iteration was a to define more precisely the Motor Type, Power range and Models**

Agreed in the discussion:

- 1-Motor type: General purpose 3-phase induction motors,
- 2-Number of poles: 2, 4 and 6 pole
- 3-Power range 0.75-200 kW, for 2 and 4 pole motors  
0.75-132 kW, for 6 pole

The power lower limit for the 6 pole motor is due to the required frame size (six pole 200 kW motors require a larger frame size)

- 4- Number of poles: 2;4 and 6
- 5- Voltage: 400 V,
- 6- Frequency: 50 Hz

- 7- Single-speed
- 8- Continuous duty

### **Discussion on General purpose Induction motors**

- General purpose Induction motors have by far the large sales and energy consumption; foot, face and flange mounted motors (covered by Motor Standard EN 50347) need to be considered.
- The integration of special induction motors in the analysis ( e.g. explosion proof, high humidity applications) will be assessed with the stakeholders.

### **Definition of Basecase for the Products under consideration**

Selection of average EU representative model(s), or construction of average EU model(s) characteristics from several important product-subcategories in the product group.

Agreed in the discussion:

- Base case: EFF2 -average of range for each power level

- Models for analysis

4 pole modes (more than 50% of sales) are going to be used in the analysis

two options - 1.5, 7.5, 75 and 132 kW or

- 1.5, 11 and 90 kW

If data available, analysis of 4 models would be desirable

### **Definition of the Best Available Technology**

Agreed in the discussion:

-Best available technology (BAT):

Eff1, with two options:

-Average of all motors in each power level

-Premium levels (15% lower losses than minimum EFF1 performance)

### **Best Next Available Technologies (BNAT)**

Different technological options to be discussed with the stakeholders

## Minutes For Eup (Lot 11) Pumps Second Stakeholder Meeting

**Tuesday 21 November 2006**

**Venue:** Education Centre (BIZ), Research and Technology Center, WILO AG, Nortkirchenstrasse 100, 44263 Dortmund, Germany

### Attendees

John Fraser	Circulating Pumps
John Bower	Floserve
Jurgen Bach	Grundfoss
Horst-George Schmalfluss	Independent
Ismo Gronroos-Saikkala	European Commission
Armia Marko	Wilo
Otello Zaccarelli	Caprari
Frank Hatner	ABS
Manfred Bartoschek	KSB
Friedrich Klutsch	VDMA
Peter Knapp	Sterling SIHI
Helle Nystrup	Grundfoss
Robert Dodane	Salmson
Niels Bidstrup	Grundfos
Julia Oberschmidt	Fraunhofer ISI
Markus Teepe	Wilo
Hugh Falkner	AEA
Charles Gaisford	AEA

### Apologies

David Reeves	Independent Consultant
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These minutes record the main issues and outcomes discussed at this second stakeholder meeting. The details of this meeting were posted on the study web-site in advance of this meeting, and an e-mail sent to all registered stakeholders to alert them to these web-site updates. The discussion and questions raised were based on the contents of the second report also posted on this web-site in advance of the meeting. Please click [here](#) for details.

Between the first and second formal stakeholder meetings, Hugh Falkner also attended two meetings at the request of the Europump “Energy” Joint Working Group at which additional technical input to the study was received.

### Key Decisions and Actions

## **Definition of Products**

It is considered that a pump is a product if it is sold alone or is part of an easily separable combined product (motor + pump).

Where the motor and hydraulics can not be split, then this is a product ('integrated product'). For the study, this applies to the submersible pump only.

*Note that this represents a change in position from the v2.0 report, where the latter was considered as two separate products.*

## **ROHS (Restriction of Hazardous Substance Directive 2002/95/EC) and WEEE (Waste Electrical and Electronic Equipment) Directive 2002/96/EC)**

The initial view of the study group was that pumps are excluded from the WEEE directive, and this view was agreed with by Europump. There being no objections raised to this interpretation, AEA will write up a final statement detailing how this conclusion is arrived at.

But more importantly, the study should also show which products use ROHS proscribed substances. The MEEUP model will highlight these.

## **4" and 6" submersible (borehole) pumps**

It was considered that 6" borehole pumps could be seen as a practical and more efficient alternative to the much more common 4" borehole pumps. We should therefore analyse them as a separate product.

A suggested scheme for labelling and minimum standards for these pumps was suggested for discussion by Jurgen Bach, (although this did not represent the Europump position). While this was a useful contribution, full MEEUP analysis needs to be undertaken in order to understand the suitability of this scheme, and so it will not be considered any further at this time.

## **In line volute pumps**

The suction inlet side of these pumps is significantly different to those of end suction types, and so at this stage they should be analysed separately. This is because if the MEEUP analysis shows that there are significant differences in performance, it might be unreasonable for both types to have identical eco-impact criteria in terms of any design options.

## **Statistics**

There are many items of statistics currently missing. Once stakeholders have confirmed that they have submitted their final agreed data, AEA will complete the remainder of this phase of the work. *Stakeholders are asked to do this by end December 2006 in order that this stage of the study can be closed off.* AEA will propose a full data set for the next stakeholder meeting.

## **International standards**

Korean standards to be forwarded to AEA by Europump.

Chinese standards to be circulated by AEA.

Please would all stakeholders inform AEA of any other existing or planned standards relating to pump efficiency or eco impact that they are aware of. Additionally, AEA will continue to complement these efforts by speaking to contacts / organisations in other countries.

## **Result of initial MEEUP runs**

These results (included in the annexes to the report) demonstrated that it is the IN USE phase, ie energy efficiency, that dominates the eco impact of pumps. On this basis, the data collection on pumps should be focused on energy efficiency considerations. *Further analysis will be done by AEA to establish what further data on production and end of life data is needed (eg BOMs). If there are any pumps with unusual materials (eg particularly high or low masses or ROHS proscribed substances) then this should certainly be analysed further.*

## **Pump data collection**

The proposed Europump efficiency classification scheme was presented and discussed. In that it considers operation away from BEP, and efficiencies are related to specific speed, it is regarded as offering a possible approach. However, it is not possible to evaluate the suggestion until the MEEUP analysis has been completed.

The MEEUP analysis requires the input of total energy use, rather than just an efficiency figure. It is accepted that it is important to look not just at 100% flow performance, but also at a reduced and higher flow as well. AEA had earlier suggested 50, 75 100 and 125% as an initial proposal. Europump has suggested 75, 100 and 110%. To get final agreement on the points to be considered, agreement must be reached on what constitutes a “typical” flow profile.

The idea of a simple weighting scheme to attempt to give the relative importance of operation at these different points was accepted. But in order to do this, a methodology must be developed so that the actual power consumption at off-BEP conditions can be calculated.

It was noted that although pumps do sometimes operate at very low flows, this is not so important in defining the efficiency of a pump because:

- The hydraulic power is small.
- The efficiency:flow curve in practice follows a fairly steady line between say 50% and 0% flow, hence performance at very low flows is not essential for distinguishing one pump from others.

It was noted that in practice a “flat” efficiency:flow profile is to be preferred over a “peaky” curve, but not at any 'peak' reduction cost.

It is accepted that constructing a single value of weightings of time at each flow, and of a single system curve, is an approximation, (as is any modelling), that may not represent any particular real life situation. However, it will give us a common basis on which to compare different pumps. The impact of these approximations can where necessary be quantified by undertaking sensitivity analysis on key parameters.

AEA will undertake further analysis and then propose a final suggestion relating to this model. Any stakeholder inputs on this are welcome – *please submit any information that may help with this by end December 2006.*

### **Data collection methodology**

Europump has offered to collect this technical data (ie pump Bill of Materials and performance data) for the study, which will enable the data to be “neutralised”(ie made impossible to trace back to individual pumps/manufacturers). This is acceptable and welcomed, on the basis that the method is agreed in advance, all work is completely transparent, and that sample pump data can be audited. *To complement this data, AEA will provide data from non-Europump members following the same neutralised basis.*

### **Impeller diameter**

The ongoing assumption has been that we should only consider pumps with full impeller, but it is recognised that this does not represent market reality. Considering reduced impeller diameter pumps would lead to a huge increase in the number of pumps to be analysed, and would have the effect of lowering the efficiency spread by a few percent.

*On the following basis we should collect data primarily on maximum impeller pumps:*

- Pumps are designed around maximum impeller diameters, and so in terms of improving the efficiency of pumps this is a reasonable thing to do.
- Users should be encouraged to select the best pump for their particular duty – it is likely that if they are offered a pump with a very small impeller, then they can find a more efficient pump that has a fuller impeller from a different supplier. However, this information is not always transparent to the customer.
- *The study group should analyse the impact on efficiency of reduced impeller diameter. The report can then state what the “typical” reduction in efficiency is due to the sale and use of pumps with a reduced impeller.*

It is noted that the next Europump JWG meeting is December 6<sup>th</sup>. Accordingly, please comment on these draft minutes in advance of this date.

Hugh Falkner 1 December 2006

## **Lot 11 ‘Circulators in Buildings’ Notes from: The Second Stakeholder Meeting**

### **Energy Using Product (EuP) Directive Preparatory Study**

**Held on:** Tuesday 21st November 2006

**Venue:** Education Centre (BIZ), Research and Technology Center,  
WILO AG, Nortkirchenstrasse 100, 44263 Dortmund, Germany

#### **Attendees**

Frank Ennenbach	ABS
Otello Zaccarelli	Caprari
John Fraser	Circulating Pumps
Ismo Gronroos-Saikkala	European Commission
Julia Oberschmidt	Fraunhofer ISI
John Bower	Flowserve
Jurgen Bach	Grundfos
Niels Bidstrup	Grundfos
Helle Nystrup	Grundfos
Horst-George Schmalfluss	Independent
Frank Hafner	KSB
Manfred Bartoschek	KSB
Robert Dodane	Salmson
Peter Knapp	Sterling SIHI
Friedrich Klutsch	VDMA
Armia Marko	Wilo
Markus Teepe	Wilo
Hugh Falkner	AEA
Charles Gaisford	AEA

These minutes record the main issues and outcomes discussed at this second stakeholder meeting. The details of this meeting were posted on the study web-site in advance of this meeting, and an e-mail sent to all registered stakeholders to alert them to these web-site updates. The discussion and questions raised were based on the contents of the second report also posted on this web-site in advance of the meeting - please click [here](#) for details

Between the first and second formal stakeholder meetings, Hugh Falkner also attended two meetings at the request of the Europump “Energy” Joint Working Group at which additional technical input to the study was received.

## **Key Decisions and Actions**

### **CH1 - Definition**

#### **Circulators applications:**

In the list of circulator applications the line ‘Drinking water’ circulation is to be removed from the list in favour of ‘Domestic hot water systems’.

#### **Glanded Circulators**

‘Glanded’ circulators are to be included within the ‘Water pumps’ study. This is because they are physically very different in construction, since the motor can be easily separated from the actual pump. They are also generally much larger in size. The EuP Directive does not give absolutely clear guidance to justify this categorisation, but the above reasons mean that it is sensible and reflects the differing market segments / applications that they are used in. In any case this decision to study these larger circulators in another part of the study will have no impact on the outcomes of the study.

#### **Boiler Integrated Circulators**

There was considerable debate about whether boiler integrated circulators should be included within the scope of the study; when interpreting the Lot 11 study definitions and Article 2 and Article 11 from the EuP Directive it can be seen that they must be analysed

There were concerns that the fans inside the boiler are not examined in the same way; they will however be considered within the EuP Lot 1 Boilers study, as part of a boiler. There was agreement that boiler integrated circulators will be studied as a separate base case and that the results of the study will be shared with the Lot 1 study team who are examining boilers. Further clarification about the definitions describing components and parts within the EuP Directive was requested, the study team will amend the report accordingly.

There was debate about how to separate a boiler integrated circulator from the rest of the components it is associated with; in some boilers the circulator and various valves are all integrated into the volute molding (manifold). It was agreed that this problem will be studied and a way forward proposed. *The initial eco analysis has indicated the greatest eco impact is likely to be due to electricity consumption. By comparison, the eco impact due to the material content of the manifold may not be significant. Therefore when analyzing the eco impact of different boiler integrated circulators the efficiency will likely dominate.*

### **Criteria defining the base cases:**

It was agreed that the table that summarises the criteria should be split into two, one for stand alone circulators and one for boiler integrated circulators.

For stand alone circulators the maximum size limitation of 2500W should be removed to allow for larger glandless circulators in the future.

### **Test Standards**

EN9906: - the latest version at Committee Draft level will be available at the end of January 2007; a copy will be supplied to the study team.

EN1151- 3: - development of this standard will start shortly and an initial draft will be made available to the study team, probably within one or two month's time.

### **Existing Legislation**

Legislation affecting circulators exists in Denmark, Germany and Spain, the names of the respective legislation was promised from stakeholders. AEA will complement the information through direct contacts with the relevant countries for relevant parts.

Legislation outside of Europe that relates to circulators is still unknown and stakeholders are welcome to advise the study team of any they may be aware of. AEA will contact relevant actors outside Europe in order to complement the picture.

## **CH2 Economic and Market Analysis**

### **Market statistics**

It was agreed that the Eurostats data is unreliable. But in the absence of any better data, we will use this. To this end the study team will continue to look for other sources of data. The study team have also requested market data from Europump, and will define further how this data should be split, E.g. by size, circulator type, and efficiency class. *Europump are asked to submit their revised data by end January 2007. For any missing data, the study team will revert to existing sources of information – it is important that this part of the study is closed off very soon.*

An examination of boiler stock will also serve as a useful cross reference in gauging the installed base of circulators. It is particularly important that this study is consistent with that of the boiler study, and so we anticipate using this boiler study as our key reference.

## **CH3 Consumer Behaviour and Local Infrastructure**

### **CH3.1 Real Life Efficiency**

The relationship between circulator efficiency and noise should be analysed.

## **CH4 & 5**

### **Load Profiles for Circulators**

For stand alone circulators the load profile should be similar or the same to that used in the Europump Circulator Classification Scheme.

For the boiler integrated circulators the load profile is to be researched and developed; the study team will be consulting stakeholders about this.

The running hours patterns for circulators will be derived from the different heating control regimes and will also account for regional climatic variations. *(It should be noted that this is different from the Europump circulator scheme, which only compares relative energy performance and hence unlike this EuP study does not directly need to know actual running hours.)*

## **CH6**

### **Technical Analysis BAT**

A future request will be made to stakeholders for BOMS for circulators that are considered to be typical Best Available Technology worldwide (BAT).

Charles Gaisford  
1<sup>st</sup> December 2006

## **Minutes of Second Stakeholder Meeting on Fans for Ventilation in Non-Residential Buildings**

**Tuesday 5 December 2006**

**Venue: VDMA, Lyonerstraße 18, 60528 Frankfurt, Germany**

**Attendees:** *see list of participants*  
(2006-12-05-EUP-Fans-Meeting-Participants-Business-cards.pdf)

The EuP Preparatory Study Lot 11 on electric motors focuses on four different interlinked energy-using products: electric motors, water pumps, circulators and fans for ventilation. These minutes record the main issues and outcomes discussed at the second stakeholder meeting on fans for ventilation in non-residential buildings. The details of this meeting were posted on the study web-site ([www.ecomotors.org](http://www.ecomotors.org)) in advance of this meeting, and an e-mail was sent to all registered stakeholders to alert them to these web-site updates. The discussion and questions raised were based on the contents of the second report also posted on this web-site in advance of the meeting – please click [here](#) for details.

In advance to the 2<sup>nd</sup> Stakeholder meeting several other meetings took place with Fraunhofer ISI and fan manufacturers to inform them about the project and the EuP activities in this context and about the additional information needed to complete the project. There were meetings with individual manufacturers as well as one meeting for German fan manufacturers organized by VDMA, where Fraunhofer ISI has been present. Furthermore, at IKK trade fare Fraunhofer ISI talked to manufacturers from China, Taiwan, UK, Spain, Italy, Slovenia, Denmark and Turkey.

### **KEY ISSUES AND ACTIONS**

(see also slides "EuP Preparatory Study Lot 11 fans for ventilation in non-residential buildings")

#### **Definition of the product (p. 9)**

Stakeholders ask why we have to consider only the fan without the motor and whether this is the correct interpretation of the directive, as a proper environmental impact assessment of the fan without the motor would not be possible. Some manufacturers state that in their view the fan is only working when it is driven (usually by an electric motor) and therefore only fan wheel+motor+drive is considered to be a useful product in the sense of the EuP Directive. This product with its electrical energy input and its primary functional

parameters flow and pressure increase can be analysed with the methodology to be applied in the preparatory study.

At the meeting stakeholders discussed how many fans are sold without motor. The study will provide an answer to this on the basis of which the decision will be taken on whether to consider the fan alone or not. There are some manufacturers who sell some of their fans without motor (e.g. FläktWoods: fans for AHUs; GebhardtVentilatoren: fans for belt-drive; Punker: specialised in fan wheels). Even though stakeholders couldn't give numbers on share of fan sales without motor there was a common understanding that this represents only a minor share of the market.

Manufacturers want to have a system related approach including the equipment downstream the fan wheel (ducting, silencer, filter, etc.) (due to the strong relationship between the product and the system) rather than a product related approach. However, as the EuP directive focuses on products and parts, not on systems, this study can take into account only parts upstream the fan wheel up to the electricity grid.

**Action:** *To clarify the situation, the project team will publish a position paper on product definition based on the Directive and the MEEUP methodology for final comments from stakeholders before the end of January. This will describe what "the product", "the part" and "the component" is. System issues (e.g. components downstream the fan wheel) will be discussed as a boundary issues in the methodology.*

**Action: Stakeholders** *have been asked to formulate in writing their individual position in this regard so that it could serve as an additional information input for the project team.*

#### **Approach to compare integrated and non-integrated products (p. 10)**

To some attendees it is unclear why we need a comparison between belt-driven, direct driven and integrated fans and why we are not just comparing products within these categories. However, as long as these products are providing the same primary functional parameter (service) as defined on page 22 in the 2<sup>nd</sup> inception report (October 2006), comparison must happen in line with the MEEUP methodology. Furthermore, the study will also provide insights to these technology related issues and other second functional parameter-level issues during the course of the study.

Most fan products are sold on the market together with the motor that will be used for it so that fan manufacturers can provide real data also on motor and transmission. As for some fan products this data is not known, i.e. when the fan wheel is sold alone, for comparison of these products assumptions are necessary. Therefore an approach was outlined by the study team to enable comparison of all fan products on the market, i.e. those sold together with motor and drive and those only sold as a fan wheel. Nevertheless, some

manufacturers are of the opinion that assumptions such as in this approach should not be made and that a comparison between product categories (integrated vs. non-integrated) would not be feasible.

The approach proposed was in particular criticised by stakeholders at the meeting because of its inaccuracy, using only a small number of default values. This problem could be however dealt with by a more detailed breakdown to different sizes (power ranges). *Dr. Anschütz (GebhardtVentilatoren, D) says he could supply some useful data on this.* AMCA also supplies related curves but these would be hard to justify experimentally. *Dr. Schnepf (Helios, D) says that there is some more reliable data on belt efficiency available.*

In view of possible obligatory measurement methods to be defined in the implementing measures of the EuP directive, manufacturers stated that besides default values such as defined in the proposed approach e.g. for belt efficiency, the use of the real values of the actual product under analysis should also be accepted, if these are known, i.e. when the fan-wheel and motor are sold together as one product. This has already been considered in the proposed methodology.

It is also emphasised by manufacturers that it would be dangerous to apply the proposed approach in the implementing measures as it would have big impacts on competition within the fans market.

It is mentioned that also for integrated products it would be possible to define the efficiency of the fan-wheel alone, i.e. it would theoretically be possible to compare only "the fan-wheel" of an integrated product without the motor to a fan wheel of a non-integrated product in terms of efficiency. However, then for integrated products it is still not clear which part of the material that is used by both, the fan and the motor, should be assigned to the fan and how the mechanical power would fit in the MEEUP methodology. Consequently, by stakeholders this is not considered to be a useful approach of analysing products in line with the MEEUP methodology.

### Test Standards (p. 12 f.)



**Action:** *Manufacturers are requested to give a feedback on the detailed standards list in the 2<sup>nd</sup> report. Also, comments on the SFP classes available are welcome and arguments whether these are an appropriate indication.*

The SFP (specific fan power) approach is strongly emphasised and recommended by some manufacturers. SFP can be defined for the fan wheel or for fan wheel +motor or for fan wheel +motor+drive or for fan wheel+motor+drive+filter etc. or even for the ventilation system of the whole building. In DIN EN 13779 (prEN) a method is shown to calculate the SFP for the fan wheel alone. Not all of the manufacturers are aware of this standard.

Some manufacturers are of the opinion that SFP is always defined at least for fan+motor+transmission.

It was mentioned by Mr. Siderius from Center Novem, that in the Netherlands particularly for agricultural fans there are useful standards available. The Danish ventilator scheme and its importance in practice was mentioned by manufacturers as to be technically sound.

### **Market trends (p. 24)**

Manufacturers say that there is rather a trend from forward to backward curved blades, not backward to aerofoil blades. Regarding use of plastics, in Scandinavia it is not allowed to use larger plastic parts in ventilation systems due to the risk of fire, i.e. trend to plastics is limited. Furthermore there is a trend to **plug fans**.

### **Frequency and characteristics of use (p. 26)**

Usage patterns should be defined for different climatic zones such as it has been done for the boilers (3 zones). For the fans study, only 2 zones within Europe could be sufficient (north (heating) / south (cooling)). Depending on region and type of building (application) running hours / load profiles can be very different. However none of the participants felt able to give indication which values we should use as best estimates. It has to be investigated if the climatic zones as defined for the boiler study (lot 1) could be a basis also for the fans study. The study team will identify and describe some standard use patterns as part of task 3 in the next updated inception report.

### **Economical product life, repair and maintenance (p. 29)**

Life-time depends on application, +- 10yrs on average was accepted as correct average lifetime, even if some might be in use much longer (up to 20yrs) if the fan / ventilation system continues working without problems at a smaller number of yearly operation hours. Life-time mainly depends on bearings, sometimes also corrosion is an issue. The decision for replacement instead of repair depends mainly on cost and reliability issues.

Frequency of cleaning depends on application; typically manufacturers recommend rather short cycles for maintenance. However, the fan is often part of a maintenance programme for the whole building.

The study team will back up this life-time assumption with references to existing studies and literature, if available, in order to be integrated into the next updated inception report.

### **Use phase – electricity consumption and fan efficiencies (p. 35 ff.)**

Stand-by consumption of EC-/VFD-fans is due to running the processor, estimated by manufacturers to be 1-3% of electricity consumption at full load, e.g. for a 1 kW fan/motor stand-by consumption is 7 W (example by Mr Albig, Ziehl-Abegg). VFD `s for induction motors seem to have however larger losses.

It is pointed out by manufacturers that there are also other issues of importance apart from efficiency. E.g. for fan coil units (FCUs) a change from forward to backward curved blades will increase capital cost as well as space requirements for installation, which would have an impact on building layout. There would also be impacts on noise levels. So there will be some limitations e.g. for replacing forward curved by backward curved centrifugal fans for this application.

The duty point of a product has also to be taken into account for the analysis, whereas the design duty (maximum required air exchange rate) is mostly unimportant. The number and level of duty points be consolidated in the next updated inception report based on the present proposals (see position paper) The values can be orientated also on values given in national standards such as the VDI Guideline (Draft VDI 6014)

The table with efficiencies for the different fan categories (p. 36) is criticised by manufacturers as efficiency is also dependent e.g. on motor power, pressure level, different speeds, different pitch angles. A structured base for comparison of efficiency values would be necessary.



**Action:** Comments/feedback from **stakeholders** is requested on the presented efficiencies to be used for calculation of electricity consumption. Information on individual products/trade marks will not be published in the report but only on an aggregated level. Also, the study team will back-up the efficiency data with references.

For full analysis of the use phase BOM + efficiency data from **manufacturers** is requested until end of January 2007. Each manufacturer should provide at least one BOM per product category as defined in chapter 1 of the study. Efficiency data should be given for the whole operating range ( $\Delta p$ ,  $v$ ).

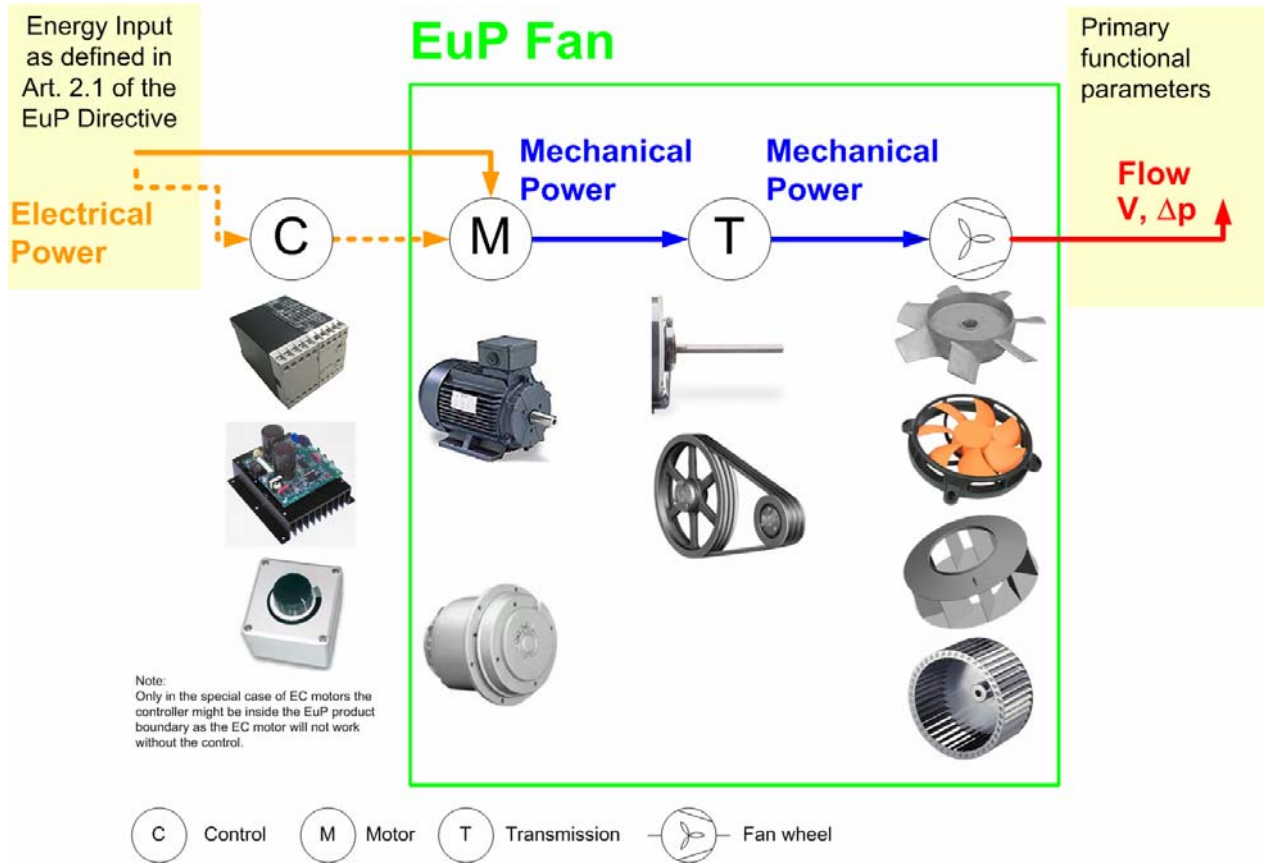
Manufactures said that there is more data available but to give more data input would not be easy e.g. due to the large variation of products available. *The study team will complement the BOM for those product categories for which information has not been received in order to assure a full-fledged updated inception report on this issue.*

### **SUMMARY AND CONCLUSIONS**

Overall, attendees gave a positive feedback on the meeting. The main issues discussed were the definition of the product, the possibilities of comparing integrated and non-integrated products, as well as analysis of the use phase.

**Action:** *It was agreed that the **study group** will compile a list of questions regarding the additional data needed, which will be distributed shortly among manufacturers.*

## ANNEX: DEFINITION OF THE FAN AS AN ENERGY USING PRODUCT (EUP)



## **EuP Preparatory Study Lot 11: Motors (sub-study) - Minutes Second Stakeholder Meeting**

**Venue: ZVEI, Stresemannallee 19, 60596 Frankfurt, Germany**

**Wednesday 6 December 2006**

### **Participants:**

Lorenzo Gorlin	ANIE Federazione
Hans-Paul Siderius	SenterNovem
Justin Brock	AEA Energy & Environment
Dr Hugh Falkner	AEA Energy & Environment
Dr. Peter Radgen	Fraunhofer
Claus Wieder	SEW Eurodrive
Julia Oberschmidt	Fraunhofer
Mikko Helinko	ABB
Brian Fletcher	Baldor
Andrew Stephenson	Baldor
Dan Hopkins	ebmpapst
Uwe Sigloch	ebmpapst
Bernhard Sattler	ZVEI
Dr. Ing. Peter Zwanziger	Siemens
Dr. Jörg Praczyk	WILO AG
Philippe Thiery	LEROY SOMER
Antoine de Fleurieu	Gimélec
Alain Buisson	LEROY SOMER
Anne-Marie Imrell	ABB
Elke Strobach Dipl.-Ing.	VEM motors
Henrik Pedersen	GRUNDFOS Management
Sergio Ferreira	European COPPER institute
Anibal T. de Almeida,	ISR-University of Coimbra

These minutes record the main issues and outcomes discussed at this second stakeholder meeting. The details of this meeting were posted on the study web-site in advance of this meeting, and an e-mail sent to all registered stakeholders to alert them to these web-site updates. The discussion and questions raised were based on the contents of the second report also posted on this web-site in advance of the meeting – please click [here](#) for details.

Between the first and second formal stakeholder meetings, Anibal De Almeida also attended the VEM Workshop Electrical Drives for Industrial Applications, held on September 12-13, Wernigerode, Germany, in which he made an invited

presentation on the EuP Motor study. During this meeting additional technical input to the study was received.

## **Key Decisions and Actions**

### **Definition of Products**

Based on the preliminary discussion held in the first Stakeholders Meeting, Brussels, 29<sup>th</sup> June, a more detailed discussion was carried out on the final definition of product categories, to take into account the conditions stated in the EuP Directive, particularly sales data and energy use. There is consensual agreement on the vast dominance and relevance of 3-phase induction motors. The EU motor market was presented based on data from relevant market studies and from CEMEP. From these sources and from other studies carried out both in the EU and in other parts of the world, is clear that the market is largely dominated by three-phase induction motors, which also consume the vast majority of the electricity consumption in the power range under consideration in this study.

However, the other small minority motor types will be also analysed in line with the MEEUP methodology, as far as they provide the same function, in terms of applications, market trends, energy use, and ecodesign analysis. Technologies which show energy efficiency advantages will be investigated in more detail.

**DC motors**, both of the conventional type with brushes (motor design invented 150 years ago), and new brushless motors (also called electronically commutated motors) were discussed. Existing statistics do not discriminate among brushed and brushless DC Motors. The former type has a fast shrinking market share due to serious reliability and maintenance problems, only being used in applications with a very small number of operating hours. The application of brushed DC Motors is highly fragmented over a large variety of customized old design applications. As a result of their obsolete nature, IEEE test standards no longer support this type of motor. By contrast, brushless motors are becoming increasingly dominant, although they have not yet reached the status of a general purpose standardized product. Although it is clear that the brushed DC motor only has a small and declining market share, it will also be analysed in order to demonstrate its eco-impact.

Brushless Permanent Magnet DC Motors (or EC Motors) have high efficiency, high torque/weight ratio, overcome the reliability limitations of conventional DC motors, cost has been decreasing and may become a key player particularly in the low power range. The reliability is excellent with lifetimes up to 100.000 hours. Because of their large savings potential these motors deserve to be analysed in detail in particular in the chapter dedicated to the best next available technologies.

**Action: Stakeholders, including manufacturers**

- Provide Bill of materials for a 1.1 and 11 kW brushless DC motor, including electronic controller, prices and efficiency.
- Provide Bill of materials for a 1.1 and 11 kW brushed DC motor, including electronic controller, prices and efficiency.

**Universal motors** (uses a commutator and brushes, having similar construction to a DC series wound motor) represent around 4% of integral horsepower market revenues, are mainly used in household/garden appliances (main appliances are regulated for the overall performance) and portable power tools. The application of universal motors is also highly fragmented over a large variety of customized applications. Universal motors can operate directly from the 230 V AC supply and rotate a very high speed (up to 30.000 RPM), leading to a large power density. Universal motors are still being used in because of their relatively large power to weight ratio, their speed can be controlled very simply, leading to low initial cost of the apparatus in which they are incorporated. They have low efficiency, short lifetime, being used in applications with a small number of operating hours (typically well below 100 hours per year). The study will show whether they represent sufficiently significant environmental impact to include/exclude them in/from the scope of the study based on the art.15 of the EuP directive. This argument was presented without raising disagreement.

However, because of the large numbers of universal motors still being made in the lower power range of this study (universal motors never exceed a few kW), an ecodesign analysis will be carried out on a typical application with a 1000 W motor to verify the level of their eco-impact.

**Action: Stakeholders, including manufacturers**

- Provide Bill of materials for a 1 kW universal motor, prices and efficiency curve.

**Synchronous motors** represent only 5% of the volume of motor revenues (even much less in terms of sales volume), their use being confined to higher power ratings (typically above 500 kW), due to slightly higher efficiency and power factor control capability. They are typically used in specialized customized applications in which very precise speed control is required. Because of above reasons, they do not seem be in the scope of the EuP directive. These arguments will be further substantiated in the report in order to confirm whether they will be included/excluded into the scope of the study. This was presented without raising disagreement.

**Single phase motors** represent a small share of the AC motors market (around 3%), are more expensive and less efficient than equivalent 3 phase

motors and they are mainly used in appliances in residential applications (regulated by other measures) and with maximum power of a few kW. The main reason for the use of single phase induction motors in the low power range is the lack of 3-phase supply, which occurs mostly in the residential sector. These motors typically have a small number of operating hours per year and their energy use is, accordingly, very reduced. The application of single-phase motors is also highly fragmented over a large variety of customized design applications (small machine tools, pumps, fans and compressors), with a very wide range of applications of operating hours.

A key issue appears to be the identification of applications of single-phase motors, in the power range under consideration, in which a large number of general purpose motors are used with a large number of operating hours. For such type of applications an ecodesign analysis will be carried out on 1.1 kW motor. A relevant issue is the comparison with other motors (e.g. a 3-phase induction motor or a brushless DC motor) with a similar power.

**Action: Stakeholders, including manufacturers**

- Identification of applications of single-phase motors, in the power range under consideration, in which a large number of general purpose motors are used with a large number of operating hours.
- Provide Bill of materials for a 1.1 kW single-phase motor, prices and efficiency curve.

**3-Phase Induction motors** represent 87% of the AC integral motor market revenues, have relatively low cost, they are very robust and have long lifetime.

Because of the standard power sizes and because of the ongoing IEC efficiency classification standard the power range general purpose induction motors (0.75-200 kW) will be considered in this study. The proposed **scope of the study will cover:**

- 3 phase A.C. squirrel cage induction motors in accordance to EN 60034-1
- Power range 0.75 to 200 kW (Limits of IEC Classification Standard)
- Rated frequency: 50Hz
- Rated voltage up to 1000 V
- Degree of protection: IP 54 or IP 55
- Cooling: TEFC "Totally Enclosed, Fan Cooled"
- Single-speed
- Continuous running duty, S1
- General purpose Induction motors (both foot, face and flange mounted)
- No special motors (e.g. explosion protection type "e", "d")

Recent progress on efficiency testing standards was presented and discussed. Recent developments of **IEC 60034-2 (CDV Ed.4/2, 2006), which allows** three

different test methods to obtain the motor efficiency and provide a level playing field for efficiency comparisons is a very welcome development. This revised standard can provide the basis for future motor efficiency policies.

### **Environmental standards**

Relevant environmental standards were also discussed. The **WEEE Directive (Directive 2002/96/EC)** specifically states that large-scale stationary industrial electrical and electronic tools do not have to conform with this directive. This seems to imply that industrial motors are not covered. Additionally, because of its large scrap value, motors are recycled at the end of their lifetime. This argument was presented without raising disagreement.

### **RoHS Directive (Directive 2002/95/EC)**

This directive covers electric and electronic equipment as defined in the WEEE Directive, and therefore it seems to imply that industrial motors are not covered. Even so it was stated that motor manufacturers are taking measures in the direction of this directive, such as avoiding the use of lead based solder. In some situations, in which security and safety are a prime concern, manufacturers, may have to use small amounts hazardous materials.

### **Motor prices**

Motor prices early this decade showed a tendency to decrease, but recent increase in the price of raw materials may reverse that trend. EFF1 prices are typically 20-30% above EFF2 motors price. The motor market is characterized by large discounts, and therefore there is a large uncertainty in the motor prices.

#### **Action: Stakeholders, including manufacturers**

- For analysis in the study which are the typical prices (cost for the consumer) for 1.1 kW, 11 kW and 110 kW motors?
- -EFF2
- -EFF1
- -Equiv of NEMA Premium

### **Bill-of-Materials (BoMs)**

Bill-of-Materials (BoMs) - CEMEP has collected data from manufacturers and produced BoMs for the key materials for the following different motors: -EFF1 and EFF2 in the power range of 1.1 kW, 11 kW and 110 kW to cover the considered power range

#### **Action: Stakeholders, including manufacturers**

Is it desirable to have a further definition of the BOMs, regarding the materials listed below? In the positive case it may be useful to have an approximate breakdown on their material composition, in order to use this data in the model.

- Other steel
- Insulation materials
- Impregnation resin
- Packaging

## Production Phase

### Bill of Materials (consideration of spare parts of usage phase)

The VhK EcoReport assumes 1% of the total weight as spare parts. This is thought highly inadequate, as the situation regarding motor repair is more complex. After discussion it was considered that on average a motor was repaired two times, although the number of repairs is strongly dependent upon the power level (e.g. motors below 5 kW are not typically repaired in the EU).

#### **Action: Stakeholders, including manufacturers**

- For replacement windings and bearings does 2 times the weight of the windings and bearings seem appropriate to be considered in the medium and large power levels?
- Primary scrap production during sheet metal manufacturing - is the default value in the VHK model of 25% appropriate?

### Product specific inputs

Some of the default assumptions in the model deserve validation by relevant stakeholders

#### **Action: Stakeholders, including manufacturers**

Are the following default values appropriate?

- Landfill (fraction of products not recovered) – default 5%
- Plastics
  - Re-used/Closed loop recycling – default 1%
  - Material Recycling – default 10%
  - Thermal Recycling (non hazardous incineration optimised for energy recovery) – default 90%
- Metals recycling percentage 95%

### Best Next Available Technologies (BNAT)

There was a discussion on Best Next Available Technologies, which have not yet reached the status of general purpose product.

The following technologies appear to fit in the BNAT scope:

- BLDC Motors (previously addressed)
- SR Motors

Integrated VSD Motors are already an off-the-shelf general purpose product and their analysis was suggested because of their low but growing penetration. Their use is mainly advantageous on variable load applications.

***Action: Stakeholders, including manufacturers***

- Which power ranges to consider for each the technologies above mentioned? Which market niches appear as the most promising, and which are typical operating conditions in those applications?
- Are there any other technologies deserving to be considered as BNAT?
- Provide Bill of materials for a 1.1 kW and 11 kW Switched Reluctance motor, including electronic controller, prices and efficiency.
- Provide Bill of materials for a 1.1 kW and 11 kW Integrated VSD motor, including electronic controller, prices and efficiency.

Anibal T. De Almeida, December 12, 2006

## APPENDIX 2 - Registered stakeholders

### Area of interest – ALL

Name	Position	Organisation/ Company
Aimee McKane		US Laurence Berkeley Lab
Akihisha Ono		Yasukawa Electric
Andy Kuo	Director	Integrated Service Technology Inc.
Antoine de FLEURIEU	Deputy Chief Executive	GIMELEC
Cemep VSD Working Group		European Committee of Manufacturer of Electrical Machines and Power Electronics
Craig Updyke	Manager, Trade and Commercial	NEMA
Dieter-H. Hellmann	Professor	Technical University Kaiserslautern
Dr Andrew King	Lecturer	University of Bristol
Dr. Detlef Pauly	Project Manager	Siemens AG
Finn Josefsen	Engineer	Danish Energy Authority
Kevin Lane	Business consultant	AEA Group
Konstantin Kulterer		Austrian Energy Agency
Kurt Riesenber	Industry Director	NEMA
Lin Yei		Foundation of taiwan Industry service
Mark Ellis	Policy Analyst	International Energy Agency
Mark Kohorst	Sr. Manager, Environment	NEMA
Martin Charter		Stu
Michael Burger	Department Leader Test R&D Electronics	SEW Eurodrive
Miriam Gargesi		Emerson
Paul Watson	Engineering director	Control Techniques Dynamics
Pete Cunningham	MD	Chemquip Ltd.,
Peter Zwanziger		Siemens AG
Roland Brueniger	Program Manager	Swiss Federal Office of Energy
Shinji Tokumasu		Japan Business Council Europe (JBCE)
Steve Brambley	Deputy Director	GAMBICA
Uny	Adviser	Orgalime / Europump
William Buckson	Program Manager	NEMA

**Area of interest - Circulators**

<b>Name</b>	<b>Position</b>	<b>Organisation/ Company</b>
Albert Chen	Project Manager	Environment and Development Foundation
Amedeo Valente	Director of R&D and Engineering	ITT Lowara srl
David Seymour		Grundfos UK Ltd
Gary Wheatley		Wilo Salmson Pumps Ltd
Gunnar Hovstadius		Independent Pump Consultant
Guy can Doerslaer	General Secretary	Europump
Hans de Keulanaer	Manager - Electricity and Energy	European Copper Institute
John Fraser		Circulating Pumps Ltd
Ken Hall	Managing Director	Calpeda Limited
Neils Bidstrup		Grundfos
Nils Thorup		Grundfos
Peter Neilsen	Senior Expert	Danish Energy Authority
Philippe Riviere	Project Leader	ARMINES
Robert Kingfors	General Secretary of SWEPUMP	SWEPUMP - Swedish pump suppliers organisation
Stephanie Uny	Adviser	Orgalime / Europump
Steve Schofield		Europump
Thomas Bogner		Austrian Energy Agency
Thomas Schweisfurth		Wilo Pumps
Tommy Andersen	Tecnical Manager	T.Smedegaard

**Area of interest – Fans**

<b>Name</b>	<b>Position</b>	<b>Organisation/ Company</b>
Alan Macklin		Elta Fans
Albert Chen	Project Manager	Environment and Development Foundation
Anthony Breen	Development engineer	NuAire Ltd.
BERTHEAS RØmi	Environmental Engineer	Groupe SEB
Charles Gaisford	Motor Driven Systems Product Area Manager	UK Market Transformation Programme
Colin Biggs	Technical Director	Nuaire Ltd
Colin Broom		Applied Energy
Daniel Hopkins	Technical Manager	ebm-papst UK Ltd
Dario Brivio	Product Development Mgr.	Nicotra S.p.A.
Darren Bryant		Efficient Air Ltd
Dr. Berthold Liebig	Materials Engineer	ebmpapst Mulfingen GmbH &Co. KG
Geoff Lockwood		EBM Papst

Geoff Lockwood	Chairman	Fan Manufacturers Association, UK
Geoff Lockwood	Technical Director	Ebm-papst UK ltd
Gunnar Berg	Development Engineer	Swegon AB
Gunnar Wernstedt		
Hilario Tome	Managing Director	Soler & Palau
Iain Murray		Greenwood Fans
Ian Andrews		Nuaire
Ioannis Leontaris		
Jürgen Albig	Head of Product Management	Ziehl-Abegg AG Motors and Fans
Johannes Anshütz	R&D Manager	Gebhardt Ventilatoren
John Dorkins		Vent-Axia
Jorma Railio	Project Manager	FAMBSI
Magnus Everitt	Technical manager	Swedvent
Mats Sándor	Technical Manager	
Michael Duggan	Technical Manager	Fan Manufacturers Association (UK)
Mike Duggan		FETA
Neil Jones		Flakt Woods Limited
Paul Wenden	Business Development Director	Flakt Woods Limited
Philippe Riviere	Project Leader	ARMINES
Roger Mason		ABB
Ron Mulholland		Howden
Stephanie Uny	Adviser	Orgalime / Europump
Thomas Damm	Technical Manager	Air Handling Technology Association within VDMA

### Area of interest – Motors

Name	Position	Organisation/ Company
AkE Westman		ABB
Alan Crudace	Works Manager	Electrical Repairs
Albert Chen	Project Manager	Environment and Development Foundation
Amedeo Valente	Director of R&D and Engineering	ITT Lowara srl
Andrew Stephenson		Baldor UK Ltd
Anne-Marie Imrell	Environmental coordinator	ABB AB, Sweden
Arfat Siddique	Research Scholar	IIT Delhi
Bernhard Sattler	Secret General	CEMEP LV AC Motors
BERTHEAS RÔmi	Environmental Engineer	Groupe SEB
Bob Went		ITT Flygt
Brian Austick	Product Specialist	ABB Ltd.
Brian Fletcher		Baldor UK Ltd
Charles Gaisford	Motor Driven Systems Product Area Manager	UK Market Transformation Programme
Chris Surey		Fairford

Clive Betts	Director	REMA
Conrad Brunner		SEEEM
Daniel Hopkins	Technical Manager	Ebm-papst UK Ltd
Derek Robinson		ABB Motors
Dolf Gielen		IEA-Int Energy Agency
Dr. Berthold Liebig	Materials Engineer	ebmpapst Mulfingen GmbH &Co. KG
Dr. J.Weiss		WTB Dr. J.Weiss, Ingenieurbüro f. Werkstoff-Technik, Qualitäts- und Umweltmanagement
E Jones		Holden and Brook
Eriks Zvaigzne		Brook Crompton
Francesco Parasiliti		University of L'Aquila, Italy
Geoff Brown		ABB
Geoff Lockwood	Chairman	Fan Manufacturers Association, UK
Geoff Lockwood	Technical Director	ebm-papst UK Ltd
Gianluca Donato	Environmental Specialist	ABB
Gilbert A. McCoy	Energy Systems Engineer	WSU Energy Program
Hans de Keulanaer	Manager - Electricity and Energy	European Copper Institute
Hans-Paul Siderius	Program Adviser	SenterNovem
Henrik Ørskov Pedersen	Technology manager - Motors	Grundfos
Hilario Tome	Managing Director	Soler & Palau
Ian Allan	Energy Efficiency Specialist	ABB Motors
Jean Candel	VP SALES&MKG	LEROY SOMER
Jürgen Albig	Head of Product Management	Ziehl-Abegg AG
Jurgen Sander	General Manager	CEMEP
Klee, Bernhard		ZVEI
Krzysztof Brzoza-Brzezina	Project manager of the project Polish Energy Efficient Motor Programme (PEMP)	Polish National Energy Conservation Agency (KAPE)
Lorenzo Gorlin	Technical Advisor Energy Area	ANIE federazione nazionale imprese elettrotecniche ed elettroniche
Martin Doppelbauer	Leiter Entwicklung Motoren	SEW Eurodrive GmbH & Co
Maurice Yates	Managing Director	ADVANCED ENERGY MONITORING SYSTEMS LTD
Nicolas Roubanis		EUROSTAT
Paolo Bertoldi		JRC EC
Paul Wenden	Business Development Director	Flakt Woods Limited
Phil Batley		Siemens
Philippe Riviere	Project Leader	ARMINES
Philippe Thiery	General Manager	Leroy somer
Roelof Timmer	Marketing Director	ABB
Sergio Ferreira	Electricity & Energy Project Manager	European Copper Institute

Shane Holt	Product Regulation	Australian Greenhouse
Stephanie Uny	Adviser	Orgalime / Europump
Stephen Williamson	Head of School of Electrical Engineering	University of Manchester
Steve Barker		Siemens
Sylvia Shepherd	Assistant Director - Lighting and Industrial Products	Australian Greenhouse Office
Szymon Liszka	Chairman of the Board	Polish Foundation for Energy Efficiency
Vasco Janeiro		EURELECTRIC
Werner Blass	Director Automation and Drives	ZVEI
Wilfried Dissen		Omron Europe BV

### Area of interest - Pumps

Name	Position	Organisation/ Company
Albert Chen	Project Manager	Environment and Development Foundation
Amedeo Valente	Director of R&D and Engineering	ITT Lowara srl
Bob Went		ITT Flygt
Charles Gaisford	Motor Driven Systems Product Area Manager	UK Market Transformation Programme
David Seymour		Grundfos UK Ltd
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Gilbert A. McCoy	Energy Systems Engineer	WSU Energy Program
Gunnar Hovstadius		Independent Pump Consultant
Guy can Doerslaer	General Secretary	Europump
Ken Hall	Managing Director	Calpeda Limited
Klee, Bernhard		ZVEI
Maurice Yates	Managing Director	ADVANCED ENERGY MONITORING SYSTEMS LTD
Nils Thorup		Grundfos
Robert Kingfors	General Secretary of SWEPUMP	SWEPUMP - Swedish pump suppliers organisation
stephanie uny	Adviser	Orgalime / Europump
Steve Schofield		Europump
Thomas Schweisfurth		Wilo Pumps
Werner Blass	Director Automation and Drives	ZVEI
A Stevens		WEG (UK)
Gerhard Ludwig		Univ of Darmstadt
John Bower		Flowserve
John Hughes	Senior Development Engineer	Mono Pumps Ltd
John Veness		BPMA
Jorma Railio	Project Manager	FAMBSI
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## **APPENDIX 3 - Report structure**

The following list gives the structure of Key parameters needed for Ecodesign of the EuP directive, Art 15. During the life of the project we shall address and document the findings on all of these points for all four of the products; pumps, circulators, motors and fans. (Based on Figure 1 of the Final MEEuP Methodology Report, 28.11.2005).

### **Detailed breakdown of the MEEUP Methodology being followed in this study:**

#### **1. Product definition, Standards and Legislation**

- 1.1 Product definition (classification, definition of primary and secondary functional parameters).
- 1.2 Inputs on relevant harmonized standards for performance testing/energy use/health and safety.
- 1.3 Existing relevant environmental legislation inside and outside EU, existing self regulation.

#### **2. Economics and Market**

- 2.1 Macro data on EU trade, production and apparent consumption.
- 2.2 Micro market data on prices, sales, installed products, established for reference years in the past (1990), present (most recent) and future (2010 – 2020, stock model calculations).
- 2.3 Market trends in product features and key parameters (eg energy use, product weight) of best products.
- 2.4 Consumer expenditure: Rates, tariffs, prices, multiplier product costs/consumer prices.

#### **3. Consumer Analysis and Local Infrastructure**

- 3.1 Real load efficiency (vs. nominal)
- 3.2 Temperature/timer settings
- 3.3 Dosage of aux. inputs during use.
- 3.4 Economical Product Life (=in practice)
- 3.5 End-of-Life actual behaviour (present fractions to recycling, re-use , disposal, etc)
- 3.6 Best Practice in Sustainable product use
- 3.7 Local infrastructure (energy, water, telecom, physical distribution, etc)

#### **4. Technical Analysis of Existing Products**

- 4.1 Bills of Materials and key manufacturing parameters
- 4.2 Analysis of energy and resources use during product life; basic design rules and practice
- 4.3 Technical Product Life (technical durability)  
Maintenance and repair

- 4.4 End-of-life; technical potential for recycling, re-use, etc.
- 4.5 System analysis; Trade-offs and interactions with environmental and functional parameters outside the direct product scope.

## **5. Definition of Basecase**

- 5.1 Selection of average EU representative model or construction of average EU model characteristics from several important product-subcategories in the product group.
- 5.2 Definition of STANDARD BASECASE, ie the environmental impact, functionality and Life Cycle Costs for a reference year measured according to harmonised test standards (that would also be used for compliance testing.)
- 5.3 Definition of REAL-LIFE BASECASE, ie the (estimated) environmental impact, functionality and Life Cycle Costs in real life for a reference year with actual consumer behaviour and ambient conditions.

## **6. Technical Analysis Best Available Technology (BAT)**

- 6.1 State of the Art in applied research of the product (prototype level)
- 6.2 State of the art at component level (prototype, test and field trial level)
- 6.3 State of the art of best existing production technology globally (extra-EU)

## **7. Improvement Potential**

- 7.1 Identification of design options
- 7.2 Their monetary costs (extra production cost\*multiplier = end-use price increase) and – if any – benefits (lower operating expense)
- 7.3 Their environmental benefits and – if any – adverse environmental trade-offs.
- 7.4 Ranking of options according to Life Cycle Costs/Payback Period and identification of point of LLCC, with its environmental improvement potential.
- 7.5 Assessment of (cluster of) options with the highest absolute environmental saving potential: the so-called Best Available Technology BAT, with its environmental improvement potential.

## **8. Policy, Impact and Sensitivity Analysis**

- 8.1 Policy and scenario analyses: Assessment of what is “significant”, “appropriate”, etc. and what policy measures are appropriate, what would be the gain over “business as usual” etc.
- 8.2 Impact analysis industry and consumers: investment level, appropriate timing (in line with platform change)
- 8.3 Sensitivity analysis; test of the robustness of the “significant environmental aspects”, varying base

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