Applying the MEEUP methodology to pumps – *background information for interest only*

The MEEUP Methodology report explains the derivation of the spreadsheet model – it is very detailed but worth reading if you want to find out more about the background to it. Both this and the spreadsheet model are now available on the www.ecomotors.org web-site. In view of the detailed nature of the inputs requested to the model, we hope that the following commentary makes it easier to understand exactly what is required, and what items can just be ignored.

Pump Efficiency

The basic MEEUP model does not allow for the input of load:duration data at the resolution that is required to model assumed real life operation of pumps or circulators. We will therefore add an additional worksheet that calculates a single value for the annual energy consumption, which can then be fed manually into the main worksheet in row 212 as total annual energy consumption (kWh pa).

For pumps, we are additionally asking for the efficiency of the selected pump, (at full diameter impeller), at 50%, 75%, 100% and 125% of flow. Also, the actual efficiency of the pump at the selected duty, (as in the earlier SAVE study).

The additional spreadsheet will also take account of the decrease in efficiency due to wear.

We will consult with Europump to agree on an "average" distribution of time spent at each of the duties above, also the average annual running hours.

Commentary on the inputs to the MEEUP spreadsheet model (v5.0)

Materials

Pos nr	MATERIALS Extraction & Production Description of component	Weight in g	Category Click &select	Material or Process select Category first !
1	Top shell	250.0	1-BlkPlastics	**27-Al diecast**
2	Terminal cover	30.0	4-Non-ferro	**27-Al diecast**
3	Windings	180.0	4-Non-ferro	**28-Cu winding wire**
4	Laminations	170.0	3-Ferro	**22-St tube/profile**
5	Capacitor	50.0	6-Electronics	**44-big caps & coils**
6	gland	20.0	1-BlkPlastics	**2-HDPE**
7	Terminal block	5.0	1-BlkPlastics	**2-HDPE**
8	coating	1.0	5-Coating	**39-powder coating**

For each item, the weight and category is entered using the drop-down selector, (7 options). For each category there is then a further drop down box to give a more precise definition of product. The most relevant materials are shown at the end of this section.

This should include packaging. There are many ways to approach this, but for consistency, we are using the following conventions:

- It includes all packaging used to ship the product from final assembly up to final installation on site, or up to the time when it is integrated into another product. For example, a motor supplier would just include the pallet used to ship it to the pump manufacturer.

- Only include the packaging attributable to the product itself. For example the pump supplier would only include the packaging used on pumps sold alone, even if most of their output is for complete pumpsets.

- To avoid duplication, the packaging used for components that make up the product is not included.

- Wood is not an available constructional material. Therefore please just keep a separate note of this.

A big question is how accurate this breakdown needs to be. Unfortunately there are no firm answers, but instead some guiding principals that should be followed when unsure:

- The more important a parameter is, the more care should be taken. So for products in this Lot where lifetime energy consumption is likely to dominate, accuracy of energy efficiency data is of primary importance.

- The outcome of the models is to show the difference in eco-impact between different products, and so effort should be focussed on the differences. For example, the additional active material and casing length needed to make a more efficient motor, or the difference in cost in providing a better surface finish to an impeller.

- Where a product has several items of the same material, then there is no need to spend too long getting precise values of the very smallest items, as errors here will not have a significant impact on the overall eco impact. For example, the mass of a terminal box cover is only small compared to the housing of a motor. Fixings could all be entered as one amalgamated value per material.

- Materials which have “eco-peaks” are of particular interest – these include refrigerants, mercury, gold etc. Fortunately the products in this Lot are unlikely to incorporate these products.

For products such as motors where there is likely to be a considerable amount of the product replaced during life, then the weight of this (copper windings, slot liner and bearings for a motor) should be included in the material stage. However, it is important that product lifetime and consumables (spares) consumption are estimated on a common basis. We therefore propose to seek consensus from stakeholders on average figures, from which we will have a baseline from which to consider how different products vary from this average.

In order to minimise later work, at this stage please just add for each relevant item – "SPARE – Winding" etc, giving the weight for a single replacement item. Later we can alter this to reflect the actual lifetime consumption of that component.

The model is necessarily general, and so we should note if there are any aspects of the pump are not properly taken account of.

List of primary material categories available in the model:

LDPE
HDPE
LLDPE
PP
PS
EPS
HI-PS
PVC
SAN
ABS
PA 6
PC
PMMA
Epoxy
Rigid PUR
Flex PUR
Talcum filler
E-glass fibre
Aramid fibre
all plastic parts
St sheet galv.
St tube/profile
Cast iron
Ferrite
Stainless 18/8 coil
Al sheet/extrusion
Al diecast
Cu winding wire
Cu wire
Cu tube/sheet
CuZn38 cast
ZnAl4 cast
MgZn5 cast
foundries Fe/Cu/Zn
foundries Al
sheetmetal plant
sheetmetal scrap
pre-coating coil
powder coating
Cu/Ni/Cr plating
Au/Pt/Pd per g
LCD per m2 scrn
CRT per m2 scrn
big caps & coils
slots / ext. ports
large IC
small IC
SMD/ LED's avg.
PWB 1/2 lay 3.75kg/m2
PWB 6 lay 4.5 kg/m2
PWB 6 lay 2 kg/m2
Solder SnAg4Cu0.5
PWB assembly
Glass for lamps
Bitumen
Cardboard
Office paper
Concrete

Manufacturing

These values are all fixed except for the proportion of scrap sheet metal. For now, the default of 25% is assumed.

Distribution

Pos nr	DISTRIBUTION (incl. Final Assembly) Description		Answer	Category index (fixed)	
208	Is it an ICT or Consumer Electronics product <15 kg ?		NO	59	0
209	Is it an installed appliance (e.g. boiler)?		YES	60	1
				62	0
210	Volume of packaged final product in m^3	in m3	0.01	63	1
				64	0

For consistency, we state that the product is an installed product. (This sets the model to land rather than air-based distribution).

The volume is just the final packaged volume associated with the product, and it relates to the energy used in distributing the product (transport and storage).

Use Phase

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	13	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	250	kWh	250
213	On-mode: No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. Of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. Of hours / year	0	#	
	TOTAL over Product Life	3.25	MWh (=000 kWh)	65

The only factor that needs entering here is the (average) product life. Annual energy consumption is calculated on the additional worksheet.

Heat Power Output

This is not applicable to the products in Lot 11.

Consumables

	Consumables (excl, spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	0	kg/ year	85-None
223	Auxilliary material 2 (Click & select)	0	kg/ year	85-None
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

As this excludes spare parts, the only item that we think is relevant is lubricant consumption. We need to be consistent on this, and so for now we will leave this as 0g. Instead we will seek stakeholder consensus on this.

Maintenance, Repairs, Service

	Maintenance, Repairs, Service			
225	No. of km over Product-Life	30	km / Product Life	86
226	Spare parts (fixed, 1% of product materials & manuf.)	7	g	

The first factor is the total distance travelled by the service engineer over the product life.

The second is the total mass of spare parts. As this can be significant, we also leave this at 0g, and instead add the spares (what in the pump industry may also be thought of as consumables) to the materials section as already described, where they can be identified more precisely.

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	42	5%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	273	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	28	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	3	1%	4
235	Plastics: Materials Recycling (please edit% only)	25	9%	4
236	Plastics: Thermal Recycling (please edit% only)	248	90%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	25	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	362		fixed

Substances released during product life and landfill is not an issue with these products, as they do not contain mercury or refrigerants.

Disposal: environmental costs. The only editable function here is the proportion going to landfill. It is suggested that we stick with the default value of 5%, which is based on what is thought as being the most likely post-WEEE scenario. While WEEE does not apparently apply to any of the products, it is thought that this is a reasonable figure given the very high proportion of metals in these products.

Re-use, recycling. Again, suggested defaults are given, that can be altered if wished. However, for metals, the convention used in this methodology is that credit is only given if the designer deliberately chooses to use non-virgin materials, and hence the default is very low.

For consistency, it is suggested that these values are all agree on an industry-wide basis.

Economics

nr	INPUTS FOR EU-Totals & economic Life Cycle Costs Description		unit
A	Product Life	13	years
B	Annual sales	12000000	mln. Units/year
C	EU Stock	150000000	mln. Units
D	Product price	100	Euro/unit
E	Installation/acquisition costs (if any)	10	Euro/ unit
F	Fuel rate (gas, oil, wood)		Euro/GJ
G	Electricity rate	0.1	Euro/kWh
H	Water rate		Euro/m3
I	Aux. 1: None		Euro/kg
J	Aux. 2 :None		Euro/kg

K	Aux. 3: None		Euro/kg
L	Repair & maintenance costs		Euro/ unit
M	Discount rate (interest minus inflation)	**5.0%**	%
N	Present Worth Factor (PWF) (calculated automatically)	**9.39**	(years)
O	Overall Improvement Ratio STOCK vs. NEW, Use Phase	**1.00**	

A-C. These are considered separately, and so do not need to be filled in.
D-E. The product and installation/acquisition price is the average price paid by the final consumer. For a component this will include an amount proportional to the mark-up on the product to which it is fitted.
F-H. These are considered separately for all products in Lot 11.
I-K. This is the cost of the auxiliaries specified earlier, (eg lubricants).
L. The repair and maintenance costs include all costs (labour, shipping, taxes, spare parts)
M-O These should not be altered. (The improvement ratio relates to the typical improvement in efficiency when replacing an old product with a new product. It concerns product evolution, not the deterioration in product efficiency over time).