

Lot 11 Water Pumps (in commercial buildings, drinking water pumping, food industry, agriculture).

Lot 11 Pumps: Working draft April 2007

Chapter 5

Report to European Commission

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STATUS

This is a working draft only designed to facilitate development of the methodology with providers of data. Accordingly, there are several points that are unresolved within this version. Feedback from other stakeholders is therefore not formally requested on this version, as it is only “work in progress”, but any comments would be welcome.

There are no significant changes in this section since the Interim report.

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5 Definition of base case

This chapter gives the results of the MEEUP analysis on the selected pumps. The results of this therefore become the basecase for all environmental emissions and financial costs in all phases of the product life. It is against this basecase information that any technical improvements and the impact of any proposed measures will be assessed.

The Environmental Impact Assessment (EIA) is presented in three ways in the MEEUP model:

- Per product.
- For total products sold per year.
- For total stock of products.

In addition, there is a financial Life Cycle Cost analysis table.

For each pump, a small and large basecase has been modelled, which are the basis of the per product EIA analysis.

The EIA analysis of the total products sold and stock is based on the average basecase model.

The conclusion of this section is that of all the environmental impacts, energy is clearly the dominant factor. The implication of this is that the focus of analysis in this report and of recommendations on implementing measures, should be on energy alone.

STATUS – ADDITIONAL MODEL OUTPUTS WILL BE COMPLETED ONCE THE NEW AVERAGE BASECASE MODEL APPROACH HAS BEEN FINALISED.

5.1 Base-case Environmental Impact Assessment

This section presents the EIAs for all of the base-case models. This shows the environmental impact of each input, split into production, distribution and use phase.

5.1.1 EIA for End Suction Close Coupled Pumps

EIA per product for End Suction Close Coupled Pump (Small)

Nr	Life cycle Impact per product:						Date	Author			
0	ESCC 25 m3/h at 32m Model A						38968	HWF			
Life Cycle phases -->											
Resources Use and Emissions		PRODUCTION			DISTRIBU-	USE	END-OF-LIFE*			TOTAL	
		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g		1000			900	100	1000	0	
2	TecPlastics	g		0			0	0	0	0	
3	Ferro	g		15200			1216	13984	15200	0	
4	Non-ferro	g		0			0	0	0	0	
5	Coating	g		100			8	92	100	0	
6	Electronics	g		0			0	0	0	0	
7	Misc.	g		4100			328	3772	4100	0	
	Total weight	g		20400			2452	17948	20400	0	
							see note!				
Other Resources & Waste		debet credit									
8	Total Energy (GER)	MJ	444	90	534	309	1089174	173	19	54	1090071
9	of w hich, electricity (in primary MJ)	MJ	42	54	96	1	1088809	0	0	0	1088905
10	Water (process)	ltr	160	1	151	0	72589	0	0	0	72739
11	Water (cooling)	ltr	145	25	170	0	2903490	0	2	-2	2903658
12	Waste, non-haz./ landfill	g	5924	283	6208	176	1262473	2001	1	2000	1270856
13	Waste, hazardous/ incinerated	g	7	0	7	3	25089	900	0	900	25999
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	29	5	34	20	47543	13	9	4	47601
15	Ozone Depletion, emissions	mg R-11eq.	negligible								
16	Acidification, emissions	g SO2 eq.	131	22	152	59	280397	26	11	15	280623
17	Volatile Organic Compounds (VOC)	g	2	0	2	4	416	1	0	0	423
18	Persistent Organic Pollutants (POP)	ng i-Teq	93	0	93	1	7138	14	0	14	7246
19	Heavy Metals	mg Ni eq.	206	0	206	9	18760	49	0	49	19024
	PAHs	mg Ni eq.	0	0	0	11	2223	0	0	0	2234
20	Particulate Matter (PM, dust)	g	208	3	211	650	7314	224	0	224	8399
Emissions (Water)											
21	Heavy Metals	mg Hg/20	16	0	16	0	7021	14	0	14	7153
22	Eutrophication	g PO4	5	0	5	0	34	1	0	1	39
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

EIA per product for End Suction Close Coupled Pump (Large)

Table . Life Cycle Impact (per unit) of ESCC 125 m3/h at 32m Model A

Nr	Life cycle Impact per product:	Date	Author
0	ESCC 125 m3/h at 32m Model A	38966	HWF

Life Cycle phases -->	Resources Use and Emissions	PRODUCTION			DISTRIBUTION	USE	END-OF-LIFE*			TOTAL	
		Material	Manuf.	Total			Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g			3000			2700	300	3000	0
2	TecPlastics	g			0			0	0	0	0
3	Ferro	g			108600			8688	99912	108600	0
4	Non-ferro	g			0			0	0	0	0
5	Coating	g			200			16	184	200	0
6	Electronics	g			0			0	0	0	0
7	Misc.	g			7100			568	6532	7100	0
	Total weight	g			118900			11972	106928	118900	0
Other Resources & Waste		see note! debet credit									
8	Total Energy (GER)	MJ	1934	447	2381	839	4748678	834	284	550	4752448
9	of which, electricity (in primary MJ)	MJ	144	269	414	2	4747936	0	1	-1	4748350
10	Water (process)	ltr	702	4	706	0	316536	0	1	-1	317241
11	Water (cooling)	ltr	641	127	768	0	12661160	0	6	-6	12661921
12	Waste, non-haz./ landfill	g	39370	1411	40781	431	5505366	11662	4	11658	5558235
13	Waste, hazardous/ incinerated	g	18	0	18	9	109406	2700	1	2699	112132
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	163	25	188	51	207255	62	20	42	207535
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	742	107	849	155	1222657	123	26	97	1223758
17	Volatile Organic Compounds (VOC)	g	14	0	14	12	1800	3	0	3	1829
18	Persistent Organic Pollutants (POP)	ng i-Teq	663	1	664	2	31127	80	0	80	31874
19	Heavy Metals	mg Ni eq.	1182	2	1183	22	81624	239	0	239	83069
	PAHs	mg Ni eq.	2	0	2	28	9510	0	0	0	9540
20	Particulate Matter (PM, dust)	g	1486	17	1503	1983	28775	1084	1	1083	33344
Emissions (Water)											
21	Heavy Metals	mg Hg/20	663	0	663	1	30620	69	0	69	31353
22	Eutrophication	g PO4	21	0	21	0	146	4	0	4	172
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

5.1.2 EIA per product for End Suction Own Bearings Pumps

EIA per product for End Suction Own Bearings Pump (Small)

Nr	Life cycle impact per product:					Date	Author				
0	ESOB 25 m3/h at 32m Model A					38966	HWF				
Life Cycle phases -->											
Resources Use and Emissions		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL	
		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total		
Materials											
		unit									
1	Bulk Plastics	g			500		450	50	500	0	
2	TecPlastics	g			0		0	0	0	0	
3	Ferro	g			39100		3128	35972	39100	0	
4	Non-ferro	g			0		0	0	0	0	
5	Coating	g			50		4	46	50	0	
6	Electronics	g			0		0	0	0	0	
7	Misc.	g			4100		328	3772	4100	0	
	Total weight	g			43750		3910	39840	43750	0	
see note!											
Other Resources & Waste											
							debit	credit			
8	Total Energy (GER)	MJ	1037	225	1262	174	580755	270	119	151	582341
9	of w hich, electricity (in primary MJ)	MJ	111	135	246	0	580022	0	0	0	580268
10	Water (process)	ltr	766	2	768	0	38676	0	0	0	39444
11	Water (cooling)	ltr	228	64	292	0	1546723	0	1	-1	1547014
12	Waste, non-haz./ landfill	g	1823	71	19542	110	672696	4291	1	4290	696638
13	Waste, hazardous/ incinerated	g	3	0	3	2	13365	450	0	450	13821
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	93	13	105	12	25369	20	9	11	25497
15	Ozone Depletion, emissions	mg R-11eq.					negligible				
16	Acidification, emissions	g SO2 eq.	61	54	672	34	149418	40	11	29	150153
17	Volatile Organic Compounds (VOC)	g	5	0	5	2	230	1	0	1	238
18	Persistent Organic Pollutants (POP)	ng i-Teq	250	1	251	1	3804	30	0	30	4086
19	Heavy Metals	mg Ni eq.	1409	2	1412	6	10121	78	0	78	11616
	PAHs	mg Ni eq.	1	0	1	7	1299	0	0	0	1306
20	Particulate Matter (PM, dust)	g	493	8	502	308	5841	351	0	351	7002
Emissions (Water)											
21	Heavy Metals	mg Hg/20	81	0	813	0	3748	22	0	22	4584
22	Eutrophication	g PO4	23	0	23	0	18	1	0	1	43
23	Persistent Organic Pollutants (POP)	ng i-Teq					negligible				

EIA per product for End Suction Own Bearings Pump (Large)

Nr	Life cycle Impact per product:					Date	Author				
0	ESOB 125 m3/h at 32m Model A					38966	HWF				
Life Cycle phases -->		PRODUCTION			DISTRIBUTION	USE	END-OF-LIFE*		TOTAL		
Resources Use and Emissions		Material	Manuf.	Total			Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g		1000			900	100	1000	0	
2	TecPlastics	g		0			0	0	0	0	
3	Ferro	g		176200			14096	16204	176200	0	
4	Non-ferro	g		0			0	0	0	0	
5	Coating	g		100			8	92	100	0	
6	Electronics	g		0			0	0	0	0	
7	Misc.	g		7100			568	6532	7100	0	
	Total weight	g		184400			1572	168828	184400	0	
Other Resources & Waste		see note!									
8	Total Energy (GER)	MJ	270	587	3297	391	5353426	1069	194	875	5357989
9	of w hich, electricity (in primary MJ)	MJ	174	353	527	1	5353157	0	0	0	5353685
10	Water (process)	ltr	199	5	1204	0	356889	0	0	0	358093
11	Water (cooling)	ltr	787	166	953	0	14275082	0	2	-2	14276032
12	Waste, non-haz./ landfill	g	64385	1857	66241	215	6207338	18085	1	18084	6291879
13	Waste, hazardous/ incinerated	g	7	0	7	4	123352	900	0	900	124263
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	258	33	290	25	233630	80	14	66	234010
15	Ozone Depletion, emissions	mg R-11eq.	negligible								
16	Acidification, emissions	g SO2 eq.	1235	141	1376	74	1378469	157	18	139	1380057
17	Volatile Organic Compounds (VOC)	g	22	0	22	5	2020	4	0	4	2051
18	Persistent Organic Pollutants (POP)	ng i-Teq	1078	1	1079	1	35098	124	0	124	36304
19	Heavy Metals	mg Ni eq.	2135	3	2138	11	91913	311	0	311	94374
	PAHs	mg Ni eq.	3	0	3	14	10598	0	0	0	10614
20	Particulate Matter (PM, dust)	g	2395	22	2417	855	30349	1892	0	1391	35012
Emissions (Water)											
21	Heavy Metals	mg Hg/20	1203	0	1203	0	34528	89	0	89	35820
22	Eutrophication	g PO4	35	0	35	0	165	5	0	5	205
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

5.1.3 EIA per product for Submersible Multistage Pumps

Submersible Multistage Pump (Small)

Nr	Life cycle Impact per product:					Date	Author				
0	Multistage Submerisble SP8					38987	HWF				
Life Cycle phases -->											
Resources Use and Emissions		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL	
		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g			0		0	0	0	0	
2	TecPlastics	g			0		0	0	0	0	
3	Ferro	g			5215		417	4798	5215	0	
4	Non-ferro	g			0		0	0	0	0	
5	Coating	g			0		0	0	0	0	
6	Electronics	g			0		0	0	0	0	
7	Misc.	g			1350		108	1242	1350	0	
	Total weight	g			6565		525	6040	6565	0	
							see note!				
Other Resources & Waste							debit	credit			
8	Total Energy (GER)	MJ	361	80	441	106	269857	36	38	-3	270401
9	of w hich, electricity (in primary MJ)	MJ	53	48	101	0	269851	0	0	0	269952
10	Water (process)	ltr	404	1	405	0	17994	0	0	0	18399
11	Water (cooling)	ltr	44	22	66	0	719601	0	0	0	719667
12	Waste, non-haz./ landfill	g	5286	257	5542	78	312931	644	0	644	319195
13	Waste, hazardous/ incinerated	g	0	0	0	2	6218	0	0	0	6220
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	33	4	38	8	11777	3	3	0	11822
15	Ozone Depletion, emissions	mg R-11eq.	negligible								
16	Acidification, emissions	g SO2 eq.	294	19	313	22	69490	5	4	2	69826
17	Volatile Organic Compounds (VOC)	g	1	0	1	1	102	0	0	0	103
18	Persistent Organic Pollutants (POP)	ng i-Teq	40	1	41	0	1769	4	0	4	1815
19	Heavy Metals	mg Ni eq.	773	1	775	4	4638	11	0	11	5427
	PAHs	mg Ni eq.	0	0	0	4	532	0	0	0	537
20	Particulate Matter (PM, dust)	g	41	3	44	137	1493	47	0	47	1721
Emissions (Water)											
21	Heavy Metals	mg Hg/20	450	0	450	0	1744	3	0	3	2198
22	Eutrophication	g PO4	12	0	12	0	8	0	0	0	21
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

5.1.4 EIA per Product for Vertical Multistage Pumps

Lifetime EIA per product Vertical Multistage Pump (Small)

Nr	Life cycle Impact per product:						Date	Author			
0	Multistage Water Small (6 stages)						38987	HWF			
Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL	
Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g			100		90	10	100	0	
2	TecPlastics	g			100		90	10	100	0	
3	Ferro	g			6050		484	5566	6050	0	
4	Non-ferro	g			0		0	0	0	0	
5	Coating	g			0		0	0	0	0	
6	Electronics	g			0		0	0	0	0	
7	Misc.	g			1100		88	102	1100	0	
	Total weight	g			7350		752	6598	7350	0	
Other Resources & Waste		see note!									
							debit	credit			
8	Total Energy (GER)	MJ	426	100	526	119	139164	52	48	4	139814
9	of w hich, electricity (in primary MJ)	MJ	64	60	125	0	136753	0	0	0	136878
10	Water (process)	ltr	480	1	481	0	9122	0	0	0	9603
11	Water (cooling)	ltr	85	28	114	0	364673	0	0	0	364786
12	Waste, non-haz./ landfill	g	668	323	6492	84	158621	721	0	721	165917
13	Waste, hazardous/ incinerated	g	4	0	4	2	3151	180	0	180	3337
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	39	6	45	9	6154	4	4	0	6208
15	Ozone Depletion, emissions	mg R-11eq.	negligible								
16	Acidification, emissions	g SO2 eq.	344	24	368	24	35403	8	4	3	35799
17	Volatile Organic Compounds (VOC)	g	1	0	1	1	90	0	0	0	93
18	Persistent Organic Pollutants (POP)	ng i-Teq	47	1	47	0	897	5	0	5	950
19	Heavy Metals	mg Ni eq.	897	2	899	4	2875	15	0	15	3793
	PAHs	mg Ni eq.	2	0	2	5	789	0	0	0	796
20	Particulate Matter (PM, dust)	g	49	4	53	171	9573	68	0	68	9865
Emissions (Water)											
21	Heavy Metals	mg Hg/20	523	0	523	0	887	4	0	4	1414
22	Eutrophication	g PO4	15	0	15	0	4	0	0	0	20
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

5.1.5 Vertical Multistage Pump (Large)

Lifetime EIA per product Vertical Multistage Pump (Large)

Nr	Life cycle Impact per product:					Date	Author				
0	Multistage Water Big (5 stages)					38987	HWF				
Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL	
Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total		
Materials		unit									
1	Bulk Plastics	g			100		90	10	100	0	
2	TecPlastics	g			100		90	10	100	0	
3	Ferro	g			8750		700	8050	8750	0	
4	Non-ferro	g			0		0	0	0	0	
5	Coating	g			0		0	0	0	0	
6	Electronics	g			0		0	0	0	0	
7	Misc.	g			1100		88	1012	1100	0	
	Total weight	g			10050		968	9082	10050	0	
Other Resources & Waste		see note!									
									debit	credit	
8	Total Energy (GER)	MJ	593	142	735	119	363950	67	58	9	364814
9	of w hich, electricity (in primary MJ)	MJ	91	85	176	0	361538	0	0	0	361713
10	Water (process)	ltr	685	1	686	0	24109	0	0	0	24795
11	Water (cooling)	ltr	108	40	148	0	964097	0	0	0	964245
12	Waste, non-haz./ landfill	g	8868	456	9325	84	419274	986	0	985	429668
13	Waste, hazardous/ incinerated	g	4	0	4	2	8331	180	0	180	8516
Emissions (Air)											
14	Greenhouse Gases in GWP100	kg CO2 eq.	56	8	64	9	15964	5	4	1	16037
15	Ozone Depletion, emissions	mg R-11eq.	negligible								
16	Acidification, emissions	g SO2 eq.	496	34	530	24	93287	10	5	5	93845
17	Volatile Organic Compounds (VOC)	g	1	0	1	1	175	0	0	0	178
18	Persistent Organic Pollutants (POP)	ng i-Teq	67	1	68	0	2370	7	0	7	2446
19	Heavy Metals	mg Ni eq.	1298	2	1300	4	6736	19	0	19	8059
	PAHs	mg Ni eq.	2	0	2	5	1232	0	0	0	1239
20	Particulate Matter (PM, dust)	g	70	5	76	171	10809	87	0	87	11143
Emissions (Water)											
21	Heavy Metals	mg Hg/20	756	0	756	0	2339	6	0	6	3100
22	Eutrophication	g PO4	22	0	22	0	11	0	0	0	33
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Life cycle cost and total annual expenditure

This section shows the Life Cycle costs for each product, in each case showing how the purchase price is only a small fraction of the total costs of ownership. Energy consumption stands out as being the dominant factor in each.

5.1.6 Life cycle costs per product and total annual expenditure for End Suction Close Coupled Pumps

Life cycle costs per product and total annual expenditure for End Suction Close Coupled Pump (Small)

To be done

Life cycle costs per product and total annual expenditure for End Suction Close Coupled Pump (Large)

To be done

5.1.7 Life cycle costs per product and total annual expenditure for End Suction Own Bearing Pumps

Life cycle costs per product and total annual expenditure for End Suction Own Bearing Pumps (Small)

To be done

Life cycle costs per product and total annual expenditure for End Suction Own Bearing Pumps (Large)

To be done

5.1.8 Life cycle costs per product and total annual expenditure for Submersible Multistage Pumps

Life cycle costs per product and total annual expenditure for Submersible Multistage Pumps (Small)

To be done

Life cycle costs per product and total annual expenditure for Submersible Multistage Pu To be done

mps (Large)

5.1.9 Life cycle costs per product and total annual expenditure for Vertical multistage Pumps

Life cycle costs per product and total annual expenditure for Vertical Multistage Pumps (Small)

To be done

Life cycle costs per product and total annual expenditure for Vertical Multistage Pumps (Large)

To be done

5.2 Analysis of results

NB Some changes are likely to this section as more detailed stock and running hours information becomes available, but it is not expected that the outcomes of the EIA will alter in any significant way.

The models showed that for all categories of air and water emissions except two, the USE phase dominates the total eco impact. The significance of this is that it verifies the widespread belief that it is the energy and to a much lesser extent the maintenance costs that dominate, and hence it is these factors that should be the focus of the study.

Despite this general conclusion, there were some factors where the In Use phase was not so dominant:

Eutrophication is the result of water borne emissions of chemicals such as phosphates. The database of emissions factors used by the model shows that for stainless steel this is 2,328 mg PO₄ equivalent per gramme of stainless steel. This is extremely high compared to cast iron, which is only 26 mg PO₄ equivalent per gramme of cast iron. It should also be noted that the only grade of stainless steel available in the model is the standard 18/8 grade as commonly used in kitchenware, which is assumed to be sufficiently close to the grade used in pumps.

This high value means that if the stainless steel shafts could either be made of a different material or have lower weight, then this would be a good thing. But this design detail is something that is largely independent of the efficiency. We can therefore state that "Any design options to encourage energy efficiency improvements would not lead to additional eutrophication".

It is noted that shafts are carefully designed to survive the worst case loads they can expect during installation and operation, and so there is practically little room for a reduction in weight.

Particulate Matter (PM) is essentially dust, which arises at all stages of the product life cycle. This is dominated by emissions from power generation during the use phase, but emissions from the other phases are also relevant.

The PM emissions arising from the Distribution phase will be mostly diesel fuel. This could be reduced by minimizing weight. Reducing volume would only have a minor impact.

Of the Production phase, PM emissions from materials are c. 100x greater than those from the actual manufacturing. These emissions are due to the mining and processing of the raw materials into the final finished cast iron/stainless steel. These are directly proportional to the weight.

The PM emissions arising from the Disposal phase are about half that of the production phase, and are again proportional to weight.

Product weight and efficiency

In all of the non-USE phases of the lifecycle eco-impact of the pump, it is the product weight that determines the PM and eutrophication emissions.

Weight is a key parameter that manufacturers will be striving to reduce anyway as a way of cost reduction. Designs are likely to have been near-optimised already, and so it is thought that there is little scope for reducing weight in any dramatic way.

In principle, policy options could include the setting of weight limits for each duty, but there are some good reasons why this is not thought advisable at this stage:

- It is hard to discern any clear link between product weight and efficiency. The greatest improvements in efficiency are in the design details rather than major changes in dimensions. By far the largest eco gains are from efficiency, and so by asking manufacturers to also make changes to the weight, such an option would impose an additional burden which would have comparatively little gain.
- The reduction in weight of existing products that could be feasible is only very small, say 20% at most, and so the overall change in eco impact even if this was achievable would be extremely modest compared to much smaller gains in efficiency.

Increasing the size of a pump can with some designs give rise to an improvement in the product efficiency. Because the emissions from the material content account for such a small amount of total lifecycle emissions, it could be stated that encouraging/allowing an increase in product weight is an acceptable way of increasing efficiency.

Conclusions

This analysis has shown that the eco impacts from the Production, Distribution and End-of-life phases are very small or insignificant compared to the USE phases. This is indeed one of the expected characteristics of an EUP product.

The only emissions that were at all significant in the non-USE phases were PM and eutrophication equivalent values. These are due to the use of cast iron and stainless steel, and are directly proportional to the weight used.

This means that the main determinant of the EIA of a pump is the USE phase. Consequently it is the energy efficiency that is the focus of the remainder of the analysis.

PART II – IMPROVEMENT POTENTIAL

STATUS: Only exploratory work has been done on this stage so far. Now that stages 1-5 are almost completed, the focus will switch to this work.

What we are after is BOMs (approximate only) and energy performance for each option.

6 Technical analysis BAT

This entails a technical analysis not of current products on the market but on currently available technology, expected to be introduced at product level within 2-3 years. It provides part of the input for the identification of part of the improvement potential (task 7), ie the part that relates to the best available technology.

Our current contention is that the any improvement in product performance between now and 2009 will only be small. However, beyond this there are some technologies that are of interest. These and any others will be categorised in the following MEEUP categories once further information is found on them:

6.1 State of the art in applied research for the product (prototype level)

TO BE EXPANDED

Pumps with intelligent controls

Several manufacturers supply pumps with a VSD connected directly to the pumpset. This makes the installation of a variable speed control both easier and often lower cost. Other pumpsets, may be supplied with a VSD connected through cables. By incorporating feedback from whatever parameter is important to control (eg temperature, flow or pressure), energy savings can be achieved. This is discussed in further detail in the section on variable speed control in the Motor study.

Pumps are also available which have built in diagnostics to identify possible causes of detected problems. This is useful in that it can both sound alarms and give maintenance staff ideas of what the technical problems might be. Early warning of problems can save cost and energy through making adjustments or repairs before failure of the pump.

The fitting of intelligent controls to pumps will give improved eco-performance in almost all applications, and so is to be welcomed. However, while strictly controls are outside the defined border of the pump, these developments will still be described as they may have knock-on impacts on the design of pumps.

Higher speed pumps

The use of electronic controls allows for pumps to be designed for optimal specific speed, without the constraints of conventional 2/4 pole induction motor speeds. In many cases this will allow for a physically smaller pump, which will use less material and so also have a lower eco-impact during the production phase.

Reciprocating pumps

Although there are many practical reasons why positive displacement pumps are inappropriate for the applications listed in terms of their secondary parameters, they do offer higher efficiencies, and so should be studied as a reference point for what is potentially achievable.

Reduced friction

Production techniques that can reduce surface friction will reduce hydraulic losses – it is a question of achieving this at acceptable cost and without impacting other secondary performance parameters such as lifetime.

Greater range coverage

If manufacturers were to invest more money in having a greater number of products per range, then a user would be able to select one nearer their actual design duty, hence having a more efficient solution.

6.2 State of the art at component level (prototype, test and field trial level)

Are there any that we should consider?

6.3 State of the art of best existing product technology outside the EU)

Are there any that we should consider?

7 Improvement Potential

The objectives of this section are to identify the design options, their monetary consequences in terms of Life Cycle Cost for consumer, their environmental costs and benefits and pinpointing the solution with the Least Life Cycle Costs (LLCC) and the Best Available Technology.

The assessment of monetary Life Cycle Costs is relevant to indicate whether design solutions might negatively or positively impact the total EU consumer's expenditure over the total product life (purchase, running costs etc). The distance between the LLCC and the BAT indicates – in a case a LLCC solution is set as a minimum target – the remaining space for product-differentiation (competition). The BAT indicates a medium-term target that would probably more subject to promotion measures than restrictive action. The BNAT (subtask 6.5) indicates long-term possibilities and helps to define the exact scope of possible measures.

This section will be started once the University of Darmstadt data gathering and analysis study is completed, expected June 2007. This comprehensive survey of the efficiency of existing pumps will provide a firm basis on which to define efficiency “classes” and hence enable the additional costs to be calculated. There is ongoing work to consider how such efficiency classes may be derived, which will be finalised once the analysis of pumps is completed.

7.1 Options

Identification and description of individual design options for environmental improvement.

7.2 Impacts

Quantitative assessment of the environmental improvement per option (using Eco Report).

7.3 Costs

Estimate of the costs of these options.

7.4 Analysis LLCC and BAT

7.5 Long term targets (BNAT) and systems analysis.

8 Scenario, Policy, Impact and Sensitivity analysis

This task summarises and totals the outcomes of all previous tasks. It looks at suitable means to achieve the potential eg implementing LLCC as a minimum and BAT as a promotional target, using legislative or voluntary agreements, labelling and promotion. It draws up scenarios 1990-2020 quantifying the improvements that can be achieved vs. a business as usual scenario and compares the outcomes with EU environmental targets, the societal costs if the environmental impact reduction would have to be achieved in another way etc.

It makes an estimate of the impact on consumers (purchasing power, societal costs) and industry (employment, profitability, competitiveness, investment level, etc) as described in Appendix 2 of the Directive, explicitly describing and taking into account the typical design cycle (platform change) in a product sector. Finally, in a sensitivity analysis of the main parameters it studies the robustness of the outcomes.

[This section will be started June 2007.](#)