Circulation pumps: recommendations

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1. Summary

The most energy efficient circulator pumps (class A) have a variable speed drive and a permanent magnet motor. In order to increase the efficiency of the circulation system, circulator pumps should not only be of class A, but also be correctly sized. Most installed pumps are oversized. The electricity saving potential across the EU-27 is more than 30 TWh per year. Starting in 2013, inefficient pumps will be phased out in the EU.

2. Best available technology (BAT) and market situation

The most efficient circulator pumps have a variable speed drive and a permanent magnet motor. These pumps reach Energy Efficiency Index (EEI) values of as little as 0.2.
The correct sizing - avoiding the installation of an oversized pump - however is as important as the efficiency of the pump itself.
Topten.eu displays all class A (EEI < 0.4) circulators on the European market. The number of class A models available in Europe at different flow rates is shown below (Tab. 1). Pumps with an EEI < 0.27 fulfil the minimum efficiency required by the ecodesign regulation from 2013, those with an EEI < 0.23 are already fit for the 2015 requirement.

Capacity (m^3/h)	**Number of class A models (EEI < 0.4)**	**EEI < 0.27**	**EEI < 0.23**
< 1.85 m^3/h	7	6	4
1.85 – 2.35 m^3/h	4	3	1
> 2.35 m^3/h	12	5	3
Total	**23**	**14**	**8**

Tab. 1: Class A circulators on the European market. Source: www.topten.eu

Today, all important manufacturers have efficient permanent motor pumps in their product range. The Intelligent Energy Europe (IEE) project Energy Plus Pumps from 2005 to 2008 played an important role in getting there.

3. Energy consumption and saving potentials

In the EU-27, the electricity consumption by circulators for heating purposes in buildings amounts to more than 50 TWh per year. This is caused by over 100 Million circulators, most of them with a power input below 250 W. They are responsible for 5 to 10 % of private household's electricity bill. The energy used by circulator pumps is equal to about 2 % of the overall electricity consumption of the EU and causes CO_2 emissions of more than 30 million tons per year.
A typical circulator used in European heating systems has a power input of 60 to 90 W. Several studies show that this is far oversized. Installation contractors tend to install a big pump so as to receive no complaints from their customers; the contractors do not have to pay the electricity bill. If the hydraulic balance were correct in a heating system, which is not the case under normal circumstances, even a smaller pump of 25 to 35 W (class B to D, old technology) would be sufficient. The new technology of pumps with a variable speed drive results in an additional reduction in annual electricity use by 60 % or more (fig. 1).

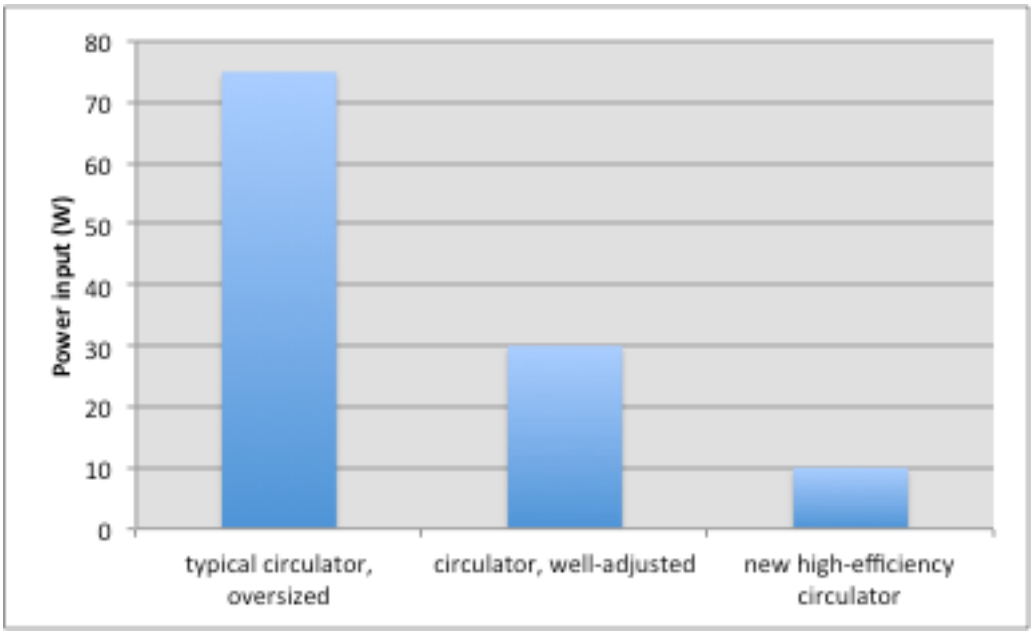

Figure 1: Power input of oversized (typical), correctly sized and permanent magnet motor circulators

Once these energy efficient pumps are the new technology standard for circulators, a reduction in annual electricity use by circulators of 60 % or more can be achieved (fig. 2). This is more than 30 TWh/year across the EU-27.

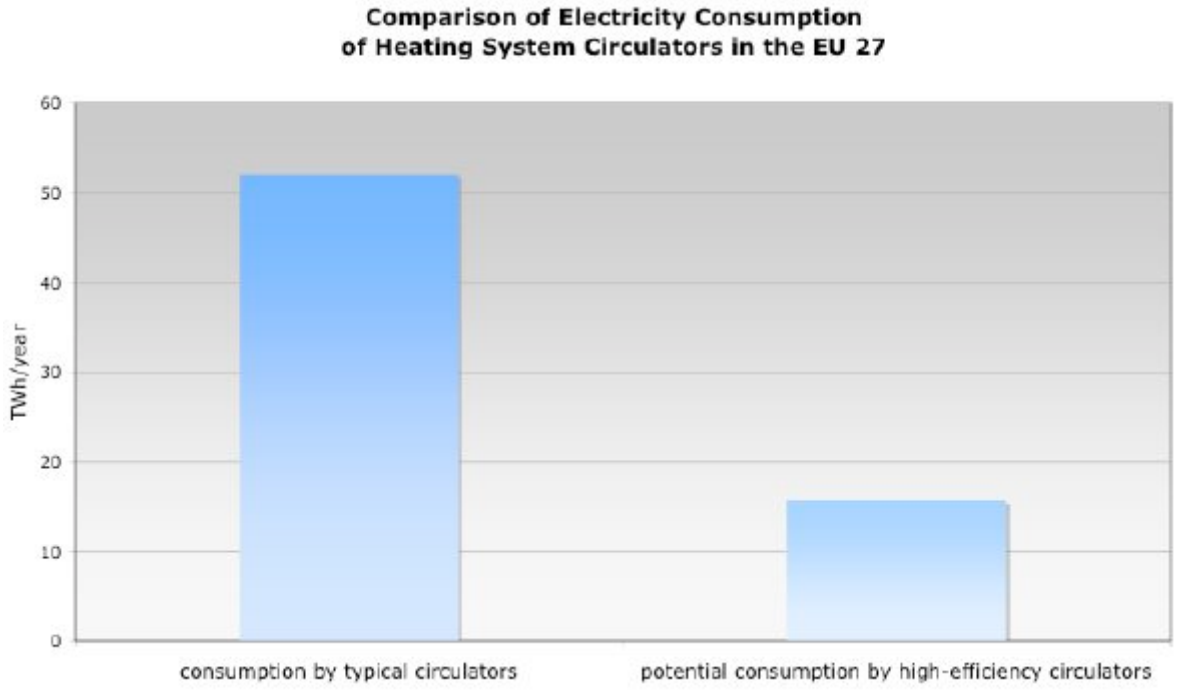

Figure 2: Electricity consumption by circulators in the EU – today and in a BAT-scenario

4. Political instruments and initiatives

Minimum efficiency requirements
In July 2009 the ecodesign regulation 'for glandless standalone circulators and glandless circulators integrated in products' was adopted. It will become effective in January 2013, when glandless standalone circulators will need to have an Energy Efficiency Index (EEI) of not more than 0.27. Tier 2 will become effective in January 2015: then all circulators (standalone and integrated) will need to have an EEI of 0.23 or less. This means that from 2015 only variable speed circulators with a permanent-magnet motor are allowed on the market.

Energy Label
Europump, the European pump manufacturer association, launched a voluntary energy label in 2005. 13 pump manufacturers signed the voluntary agreement to improve the energy performance of stand-alone circulators and to label their products. The classification scheme is shown below.

Class	Energy Efficiency Index (EEI)
A	EEI < 0.4
B	0.4 ≤ EEI < 0.6
C	0.6 ≤ EEI < 0.8
D	0.8 ≤ EEI < 1.0
E	1.0 ≤ EEI < 1.2
F	1.2 ≤ EEI < 1.4
G	1.4 ≤ EEI

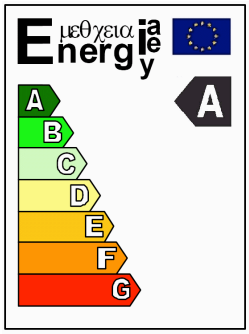

Fig. 3: Classification scheme and layout of the Europump Energy Label

Fix speed circulators are in class D or E, pumps with a variable speed drive reach better classes. The most energy efficient pumps with permanent magnet motor and a variable speed drive are in class A.

5. Recommendations

- Check sizing of the existing pump by reading its electric power consumption declaration on the nameplate. The W value should not exceed 1 to 2 ‰ (thousandth parts!) of the maximum thermal power of the boiler (e.g. 15 kW boiler: pump power consumption should be 15 to 30 W; a new class A pump would run at 5 W).
- Changing the pump of a heating system that runs well may be too expensive, but in case of any replacement or reparation measures a new class A pump – well sized – should be ordered. Heating units should include a class A equivalent pump.
- The settings of the heating control should provide switching off the pump when no heat is required (summer, night).

Replacement is cost-effective: Prices of class A pumps at present are still higher than of conventional pumps. Anyhow, the huge electricity cost reduction will compensate for the price difference within 3 to 15 years operating time, depending on power reduction, size and yearly operating period. For medium-sized circulators in office and other larger buildings class A pumps are highly profitable due to the resulting absolute power reduction.

6. Links and References

EU-Commission regulation on Ecodesign requirements for circulators. July 2009:
http://www.topten.info/uploads/File/Regulation_circulators.pdf

Europump Energy-Label, Classification scheme:
http://www.topten.info/uploads/File/Classification_of_Circulators_final__ver._5.0_.pdf

Europump: www.europump.eu

Preparatory study EuP Lot 11: Circulators in buildings. April 2008.