TROX® TECHNIK
The art of handling air

50 % COST SAVING BY USING THE CORRECT FILTERS

Fans in room air conditioning systems (AHU systems) require electrical energy, not least to overcome the flow resistance of integrated particulate air filters. It should be possible to save energy by using energy-efficient filters which offer less resistance than standard filters. Or that's the theory. To verify this in practice, TROX carried out a yearlong test to measure and compare.

F7 pocket filters were tested in two virtually identical large AHU systems in a production building of a manufacturer of films and industrial adhesive tapes. One system was operated with standard synthetic filters (melt-blown), while the second system was fitted with TROX NanoWave® filters. The flow resistance of the filters in each system was measured at weekly intervals. The volume flow rates were 34,400 m3/h and 32,300 m3/h, respectively, so the systems were comparable. The running time of each plant was 8,760 h/a (cf. Table 1). The plant location has atmospheric outdoor air with normal levels of contaminants.

The contamination of the outdoor air is affected by the geographical situation. The close surroundings include both natural sources of contaminants, such as woodland and arable land, and anthropogenous sources, such as commercial and industrial sites, motorways and urban areas.

Therefore, alongside the emissions produced by the production facility itself, a classification of AUL 2 (“contaminated" as defined in VDI 3803 or “dust and gases" as defined in VDI 6022) or ODA 2 (“high concentration of dust or fine dust and/or gaseous pollutants" as defined in EN 13779) can be assumed.

		Plant 1	Plant 2
Art		Supply air	
Operating volume flow rate	m³/h	34.400	32.300
Operating time	h/a	8.760	
Filter class	EN779	F7	
Number of filters	Stück	12	
Filter size	mm	592 x 592	
Pocket size	mm	600	
Number of pockets	Stück	8	
Nominal volume flow rate	m³/h	3.400	
Operating volume flow rate	m³/h	2.867	2.692
Nom. flow rate / Op. flow rate	%	84	79

Table 1: Comparison of West and East test systems

NanoWave® filter

Synthetic filter (melt-blown)

First, the cost of acquisition was determined for the two filter sets. Here, the price of the NanoWave® set was considerably higher than the price of the filter set made from synthetic material (melt-blown). This meant additional initial costs of around 50%.

The test began at the start of September 2015 with a first comparative measurement. At that point, the resistance of the standard filter, at 107 Pa, was already well above that of the NanoWave® filter, at 52 Pa. It was to be expected that the resistance in both systems would increase the longer the filters were in service. A total of 51 measurements was carried out. After half the running time, the values were 150 Pa for the standard filter compared to 61 Pa for the NanoWave® variant. This already indicated a considerable energy saving.

The final measurements at the end of the test showed clear differences: the NanoWave® filter (76 Pa) exhibited a differential pressure of just under 60% compared to the standard filter (180 Pa); the average differential pressure over the running time was 146.9 Pa for the standard filter and just 61.8 Pa for the NanoWave® (cf. Fig. 1).

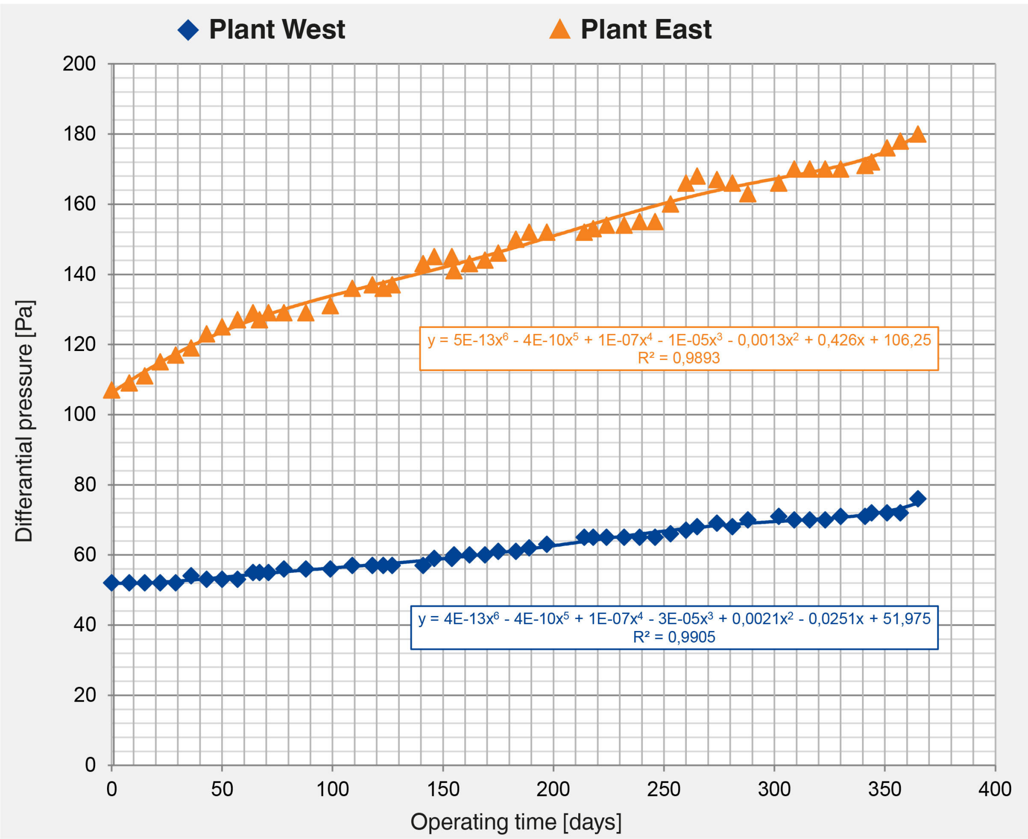

Fig. 1: Graph showing all recorded measurement data

It was now necessary to determine how much energy had been required by each system to overcome the differential pressure – or, to put it differently, to pass air through the filters. Using a formula which interrelates volume flow rate, operating time and fan efficiency, it is possible to calculate the energy requirement for every cubic metre of air moved. The result: over the running time, the NanoWave® pocket filter required around 0.3 kWh/a for each m3/h of operating volume flow rate. The synthetic filter consumed 0.71 kWh/a. This means that the TROX NanoWave® filter is around 58% more efficient.

Depending on the specific price of electricity, the energy costs for the systems could differ by a four-digit figure. The cost of materials as a proportion of the energy costs within the overall budget is so low that the costs for fitting this comparative system with TROX NanoWave® filters instead of synthetic pocket filters (melt-blown) were 51% lower.

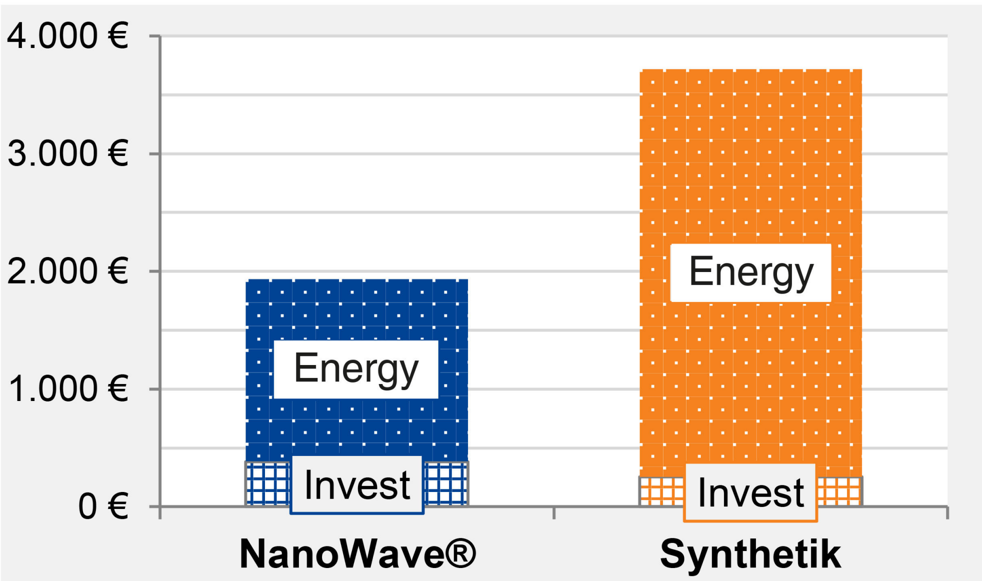

Fig. 2: Cost comparison: primary energy consumption and cost of acquisition (investment) for filters

If the fact that the NanoWave® filters have a longer service life than conventional filters is also taken into account, this difference is even greater.

Cost differences between filters of different energy efficiency classes can be calculated very easily using the LCC energy cost calculator for filters www.trox.de/lcc by entering the volume flow rate of an AHU system. The result shows you the annual energy costs in euros per energy efficiency class.

Influencing criteria for the power consumption and energy efficiency class of filters are, for example, the individual average annual dust pollution, the plant operating time and thus the loading duration of filters and the effective utilisation of installed filter areas.