

Ofwat Future Ideas Lab

Submit your ideas on how Ofwat could evolve the price review to meet the challenges faced by the water sector.

Idea

- Electric motor minimum efficiency policy

How can this help PR24 meet the challenges faced by the water sector

- Roughly 90% of electricity consumption within UK water companies is consumed by the use of electric motors. Electric motors drive most of the equipment needed to transfer and treat the water network (e.g. pumps, blowers, centrifuges, etc.)
- A company spending £65 million per year on energy will see £59 million per year spent on running electric motors alone.

High efficiency electric motor policy

Electricity costs are typically 97% of a motor's overall lifecycle costs, whereas initial purchase costs only represent 1-2% of these costs. High efficiency motors therefore provide an opportunity to lower lifecycle electricity costs as they are usually between 2 and 5% more efficient than standard models. The extra cost of a high efficiency motor is often quickly recouped in reduced energy costs, giving attractive payback (typically less than 4 years if the motor runs for more than 8 hours per day).

Furthermore, every time an electrical motor fails and is rewound, its efficiency reduces, resulting in increased energy costs. Therefore, it is often more cost effective (based on lifecycle costs) to replace the failed motor with a new high efficiency motor, rather than rewinding a failed motor.

To reduce energy consumption, water companies should adopt a total cost-of-ownership approach and implement the following policy for AC induction motors:

Minimum standard

All motors purchased need to meet the most recent WIMES standard (current version 3.03), which states that all motors between 0.75kW – 1,000kW need to meet the IE3 energy efficiency standard as a minimum and from the 1st of July 2023 all new motors in the range of 75kW – 200 kW need to meet the IE4 efficiency standard.

New installations

Given the expected total expenditure benefits, all motors purchased for new installations, including package plants, should be energy efficient and exceed the minimum standard set in WIMES, i.e. IE4 or IE5, if option is available.

Upon motor failure for motors less ≤ 75 kW

Repair if failure is due to a bearing failure and replace with a new energy efficient motor i.e. IE4 or IE5, if option is available, if the failed motor needs a rewind. There are two exceptions to this where an IE3 motor may be more cost effective.

- If going to IE4 means a larger frame size or footprint that would require additional civil or mechanical work to accommodate. This is more likely at sizes less than 11kW.

- If the motor is Direct Online started and going to IE4 increases the starting current such that it exceeded the rated capacity of the power supply. A power supply upgrade is unlikely but overcurrent protection settings may need to be increased.

High Efficiency Motor Policy 2 of 2

Upon motor failure for motors less > 75 kW

Total cost-of-ownership assessments must be undertaken for failed motors over 75kW to determine whether replacement with or rewind/repair is most appropriate. It's the supplier's responsibility to provide a quote for an energy efficient alternative (incl. required mechanical & electrical modifications to allow installation) and the potential energy savings that can be achieved. If simple payback is less than 4 years, the motor must be replaced rather than rewound.

In-service motors

In-service motors shall be considered for replacement with high efficiency motors using a total-cost-of-ownership analysis. Priority should be given where motors are highly loaded and have a high duty. Please ensure that the required motor management practices, procedures and budgets are in place to implement the policy.

Summary

Main aims:

- Reduction in energy consumption. TOTEX approach.
- Related CO2 emissions.
- Improved resilience.

Strategy aims:

- When possible, IE5 synchronous reluctance motors/drives for plant upgrades, replace instead of repair, new projects.
- Minimum efficiency of IE4 motors where IE5 is not possible and OEM supply.

EU directives Brexit & UK policy

The UK government position is that it will keep EU MEPS as a minimum standard for efficiency and where possible try to improve them. Therefore, the current situation (below) will be the minimum standard.

The UK government **CAN** improve the EU MEPS & now have to opportunity to do so. EU MEPS are not in-line with current products. IE2/3 efficiencies are expected where IE4/5 are readily available.

July 1, 2021 - Step 1

Motors

The regulation will cover 3-phase single-speed motors 50 Hz, 60 Hz, 50/60 Hz for direct-on-line operation with continuous duty defined as $S3 \geq 80\%$ and $S6 \geq 80\%$. It is important to note that the option of IE2 + VSD ceases.

IE3 efficiency level mandatory for motors:

- Rated output from 0.75 to 1000 kW
- Motors with protection types Ex ec, Ex d, Ex de, Ext
- Motors with IC418 cooling
- Brake motors with external brake

IE2 efficiency mandatory for 3-phase motors with rated output from 0.12 kW and below 0.75 kW.

Drives

IE2 efficiency class mandatory for AC drives.

The regulation will cover 3-phase standard drives (diode rectifier) from $0.12 \text{ kW} \leq P_n \leq 1,000 \text{ kW}$.

July 1, 2023 - Step 2

Motors

IE4 efficiency level mandatory for 3-phase motors: Rated output equal to or above 75 kW and equal or below 200 kW; with 2, 4 or 6 poles which are not brake motors nor Ex-motors.

IE3 requirements as from July 1, 2021.

IE2 efficiency level mandatory for motors:

- Ex eb increased safety motors from 0.12 to 1000 kW
- Single-phase motors from 0.12 to 1000 kW

Drives

No changes from July 1, 2021.