Ferdi Yilmaz

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SAVING WATER IN POWER STATIONS

A new cooling system design for coal-fired power stations could reduce the amount of water used in energy generation by as much as 16 per cent, says Deakin University engineering student Ferdi Yilmaz.

Typically, a coal-fired power station burns coal to heat water in a boiler to create superheated steam. The steam is then fed through turbines to generate electricity.

As the steam cools to water vapour it is condensed and recirculated through the boiling system. Cool water is circulated through the condenser to extract the heat from the steam as it condenses. The condenser water then has to be cooled back down in a cooling tower, and it is at this point that water is lost to evaporation. Make-up water then has to be added to the system to keep the cooling water volumes at optimal levels.

"As much as 100 000 megalitres of make-up water per year is required by the Victorian power industry for cooling, equivalent to 40 000 Olympic-size swimming pools," says Ferdi. "And this doesn't take into account other losses in the power generation cycle."

To overcome this problem, Ferdi has designed a system to cool the water before it enters the cooling tower. His hybrid system uses a hydrogen heat pump to convert the heat energy in the water to a more useful form of energy that can potentially be used elsewhere in the power plant, and an air-cooled pre-cooler similar to the radiator in a car engine but on a much larger scale.

"If the water is cooler when it enters the cooling tower, whilst maintaining the existing exiting water temperature, then less evaporation occurs and less make-up water is required," he explains. "As little as a 2°C drop could save the Victorian brown coal power industry 17 500 megalitres of water a year."

Ferdi's system has been analysed in simulations but has yet to be tested in a real power station. He is working with industry partner Alcoa to develop the computer model for the Anglesea Power Station.

"We first need to identify the costs and the benefits of the system – for example, how long would it take to recoup the costs of installing such a system?" he says. "And we would need to develop components suitable for power station use."

In the meantime, Ferdi plans to look at another aspect of water use and energy efficiency in power plants – the steam cycle.

REFERENCES

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