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From Planes to WWTPs

Wastewater technology finds inspiration in surprising places

Often, a technology's initial application is only the beginning of its usefulness. After a technology is proven in one industry, another may adapt it to suit its needs. As wastewater treatment professionals look to improve efficiencies, some are turning to technologies that originated far afield from wastewater treatment — in aerospace, for instance.

Airplanes and the activated sludge process might not seem to have much in common. But turbo blowers adapted from the aerospace and defense industries can help reduce the costs of supplying oxygen to biological reactors, which can use 50% to 90% of the energy consumed in an activated sludge treatment system.

"If you look at the layout of our blower, it has the same layout as a turbofan jet engine," said Omar Hammoud, president of APG–Neuros (Montreal), a turbo blower manufacturer. The turbo blower lubricates impeller rotation with air instead of oil, according to Hammoud.

The key to oil-free lubrication is a technology application called an airfoil bearing. As a high-speed electric motor turns the impeller and pulls air through the blower, the airfoil bearing, relying on the principle of hydrodynamic pressure, creates a thin cushion of air between the shaft and bearing surfaces.

"There's no friction," said John Fountas, a principal engineer at CH2M Hill (Englewood, Colo.). The shaft holding the impeller has no contact with the volute, he said. Fountas worked on a project to install turbo blowers at the James River Wastewater Treatment Plant in Newport News, Va.

The advantages to frictionless operation include increased energy efficiency, low vibration and noise, greatly reduced maintenance needs, and a small footprint, Hammoud said.

A side-by-side comparison of a traditional blower and a turbo blower in Franklin, N.H., showed a 30% to 40% energy savings with the turbo blower, Hammoud said. In addition to reducing power consumption, turbo blowers also can reduce "installed power," he said.

For example, a 75-kW (100-hp) turbo blower can replace a 112-kW (150-hp) unit. In a plant with four such blowers, switching to turbo blowers reduces installed power from 450 kW (600 hp) to 300 kW (400 hp), Hammoud said, potentially resulting in credits from the electric utility.

Additionally, these blowers are "as quiet as a car," Fountas said. They produce less than 80 decibels of noise without an optional inlet silencer, according to the Neuros Web site.

The units also are small, compared to their traditional counterparts. For example, a 225-kW (300-hp) turbo blower requires a 1.2-m × 1.8-m (4-ft × 6-ft) footprint, or one-half to one-quarter the amount of space needed by a traditional 225-kW blower, Fountas said.

For the James River plant, a life-cycle analysis of the turbo blower, single-stage blower, positive-displacement blower, and multistage centrifugal blower showed that the turbo blower came out far ahead, Fountas said. The capital cost for the turbo blowers will be a little more, but they will pay for themselves in a few years, he said.

The James River Wastewater Treatment Plant (Newport News, Va.) uses a turbo blower adapted from jet engine technology.

Fountas said maintaining low costs is a driving factor for most wastewater treatment plant projects, but higher up-front capital costs are acceptable, within reason, for lower life-cycle costs.

"If you ask treatment plant operators, they're also definitely looking for reliability and ease of maintenance," Fountas said. "And this turbo blower is exactly that."

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APG-Neuros Inc.
3200 Cours Le Corbusier, Boisbriand,
Quebec, J7G 3E8, CANADA
Tel: 1 (450)939-0799 Fax: 1 (450)939-2115
Email: Info@apg-neuros.com