# Turnkey Fan Efficiency Upgrade

Fred Preis and Frank Logeat, AirStream, and Layne Bureau, Lafarge Exshaw, Canada, briefly outline the fan upgrade project at the Exshaw plant.

## Background

In late 2005, Lafarge contacted AirStream to solve problems bing encountered with a kiln fan at its 3600 tpd plant in Exshaw, Alberta, Canada. AirStream is an engineering company specialising in improving the efficiency, wear rates, dust buildup and performance of fans.

## The challenge

Initial discussions identified the following problems with the kiln fan:

1. High operating cost due to a low fan efficiency.
2. Limited future production capacity due to the inability of the fan to reach its design performance without motor overload.
3. Kiln downtime caused by buildup on the upper (leading) blade surfaces of hard slate-like material, which required frequent cleaning using sand blast or injection of material into the upstream duct.

The kiln fan was driven by a 3915 kW motor and controlled using a variable frequency drive. The fan ran at 96% of full speed, and at 750 °F with short periods up to 800 °F.

The AirStream rotor.

## The guarantee

AirStream carried out an investigation in the spring of 2006, looking at all factors including system effects, and proposed a turnkey project with a guaranteed simple payback of 1.26 years. Project costs were kept down due to AirStream's upgrade technology, which allowed the reuse of the existing fan housing, inlet boxes, duct connections, coupling, bearings and motor.

## The project

In late 2007, AirStream supplied and installed a new rotor in the existing fan housing. Additionally, a fan system effect was corrected by modifying a duct elbow near the fan's inlet

Immediately after startup, plant operators noticed that motor power had dropped by 24% and fan speed was much lower. After several months of successful running, Lafarge conducted tests to verify the performance of the AirStream rotor. The new rotor had a much higher efficiency, significantly reducing the power consumption by 633 kW at the present production rate.

The frequent buildup of slate-like material on the blade surfaces has been reduced. The small amount of light dust that accumulated on the underside of the blades could easily be removed with compressed air. Lafarge was pleased, as the frequency of fan shutdown for cleaning was reduced by a factor of three. Plant personnel and AirStream are working together to further improve the impeller's resistance to buildup, and improvements are planned for 2009.

The project exceeded expectations: the actual simple payback was 1.06 years compared with the guaranteed 1.26 years. As a result, other Lafarge plants in North America have selected AirStream to upgrade their process fans.

Tables 1 and 2 summarise the project parameters.

**Table 1. February 2006 – Performance of old non-AirStream fan rotor**

| | Tested conditions | | Adjusted for comparison* | |
|---|---|---|---|---|
| | **Dirty shelf** | **Clean shelf** | **Dirty shelf** | **Clean shelf** |
| Volume flow ($m^3/h$) | 572 256 | 591 960 | 575 626 | 596 515 |
| Pressure (kPa) | 8.90 | 8.90 | 8.90 | 9.04 |
| Speed (RPM) | 1151 | 1151 | 1158 | 1160 |
| Motor input power (kW) | 2446.5 | 2463.0 | 2596.6 | 2684.6 |
| *Airflow was adjusted for comparison with AirStream's August 2007 test results. | | | | |

**Table 2. August 2007 – Perrmance of new AirStream fan rotor**

| | Tested conditions | | Test average |
|---|---|---|---|
| | **Dirty shelf** | **Clean shelf** | |
| Volume flow ($m^3/h$) | 575 626 | 596 515 | 586 071 |
| Pressure (kPa) | 9.32 | 9.69 | 9.51 |
| Speed (RPM) | 1075 | 1100 | 1088 |
| Motor input power (kW) | 2000 | 2015 | 2008 |
| Power needed by old rotor (kW) | 2596.6 | 2684.6 | 2641 |
| **Power use reduction kW** | **596** | **669** | **633** |
| **Payback (years)** | **1.12** | **0.99** | **1.06** |
| The AirStream rotor's simple payback was 1.06 years, compared with the guaranteed of 1.26 years | | | |