N. Schlumberger
Modelling energy performance

By modelling a stretch breaker of synthetic fibres, N. Schlumberger was able to analyse its energy performance. Key points: areas for improvement of the machine and the ability to predict energy consumption during operation.

What are the energy costs for producing a tonne of synthetic fibres? N. Schlumberger is now able to answer this question asked by some of its customers.

The results of the energy performance modelling for the stretch breaker were compared to the machine meter readings and the areas for improvement were exploited.

ADVANTAGE
Knowing the energy cost for every tonne produced.

How? By modelling one of its machines in order to measure its energy consumption during operation.

With a workforce of 200 employees, N. Schlumberger produces 160 machines every year for combing, recombing, spinning preparation, converting and stretch breaking of natural materials (wool, cashmere, linen, alpaca) or synthetic (polyester, acrylic, carbon fibre). The company designs machines uniquely for long fibres which represent 10% of the world textile market: a niche market.

Customers are based in China, Turkey, Italy, India, South America, etc. Their main requirements: the machine must be reliable, robust and productive, with spinning processes operating continuously. But these processes can also be very energy intensive. "*The European directive ERP (Energy related products) requires us to integrate motors with a certain level of performance, if we want to sell to Europe*," says Marc Domas, Manager of electrical research at N. Schlumberger. "*Some customers, notably in Italy and Turkey, are also beginning to question energy performance and want to know the energy cost per tonne produced."*

Examining its highest energy consuming machine
N. Schlumberger therefore decided to closely examine its highest energy consuming machine, in this case a stretch breaker for synthetic fibres, in order to find out more precisely the powers involved and to consider ways forward. A machine all the more interesting to study since it is multi-energy with electric, hydraulic and pneumatic power.

Under the Capme'up project, linked with a group of industrial textile machinery manufacturers, the company entrusted one of its stretch breakers to Cetim. As its name suggests, this machine is used to crack fibres, which are in the form of a strip of fabrics 10 to 20 cm wide with an average length identical to that of the wool with which they are mixed.

To do this, the strip passes through various rolls. By means of nipping, these rollers impose their speeds on to the textile. The speed differences between successive rollers cause the cracking. The different blocks of rollers are rotated by a single 75 kW electric motor, through a "house" mechanical transmission which redistributes the power to the many turning elements. To this is added a 48 kW heating plate used for certain materials, a water circuit to cool the cylinders and pneumatic valves to constrain the pressure rollers. In total, the installed power of all the electrical components reaches 136 kW.
"We had never carried out an energy performance modelling on this type of machine, whose uniqueness is in the multiplicity of its power routes", says Antoine Michon of Cetim. *"However, we do have expertise in instrumentation and modelling systems, and multi-disciplinary skills (mechanics, hydraulics engineers, electricians) required to draw up comprehensive energy balances."*

Note : Strengthening research and innovation for SMEs and Intermediate-sized businesses: this is the goal of the Capme'up consortium, formed by the association of the three institutes Carnot CEA List, Ifpen and Cetim.

To achieve this goal, Capme'up prospects targeted SMEs and intermediate-sized businesses offering to support their innovations. The consortium also makes three technology platforms available in growth areas: innovative non-destructive testing, robotics and system integration.

Analysing the behaviour of the machine

To best characterise the stretch breaker, a model of the full transmission chain is made from a system modelling software.

This multi-physical model integrates all the mechanical and electrical elements, frictions, control of the mission profile, etc. A virtual stretch breaker! In parallel, the real stretch breaker is instrumented to take physical measurements (torque, forces, temperature and electrical power) during a test run. These measurements can provide more precise information on the model.

If the modelling of the machine proves to be rather simple, because all the elements and design drawings are available, the characterisation of the fibre is more complicated.

It is necessary to test different types of materials to identify key usable parameters.
"With this modelling, we were able to analyse the complete behaviour of the machine", emphasises Antoine Michon. *"Much better than on a real machine where some areas are inaccessible for installing sensors".* Virtuality overcomes these physical constraints.

The model is first used to identify the power routes and losses through the transmission components. It is a case of drawing up an energy balance, driven by the stretch breaker in order to know where to focus effort on improving its energy efficiency. Unexpected phenomena are updated. For example, in some configurations, rollers driven by cable transform into energy generators.

"We now have a good basis for developing the machine without making mistakes", says Marc Domas.

The model is then used to study the behaviour of the stretch breaker for different materials and operating modes. This allows analysing the influence of certain settings, such as speed of the strip, on its operation.

"With modelling, we were able to operate the machine with materials that we had never used and in situations never encountered," emphasises Marc Domas. "*Without doing a real test, we are able to predict the consumption of the machine for operating points which had never been explored".* Which, can be a competitive advantage.
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