BarcoVision
In Pursuit of Productivity

Energy monitoring: a must for textile companies

For decades, the textile industry has applied the principles of process monitoring to their production machines. As such, textile machines are networked to MES (Manufacturing Execution System) systems to monitor in real time production, quality, speed, stop levels, downtimes and production efficiency.

Today it is no longer sufficient to optimize output, quality and production planning, also energy consumption is becoming a very important factor in the operating cost of a textile plant. A sudden increase in the energy consumption of a production run can push an order easily in the red figures. With ever rising energy prices and increasing environmental legislation, efficient energy management has become a very critical success factor to run a profitable business in today's global economy.

In order to help textile companies with these new challenges, BMS-BarcoVision has extended its existing MES applications with an EnergyMaster module. Following the principle of Monitoring and Targeting (M&T), it maps the different energy consumptions (electricity, gas, compressed air, water, steam, effluent, CO_2 emission) for further analysis and optimization. The integration of these energy parameters with the other MES applications, such as monitoring of spinning, weaving, dyeing and finishing machines provides a perfect insight in the relation between energy consumption and production.

Which objectives are targeted with EnergyMaster?

By monitoring the energy consumption the company gets answers on important questions such as:

- Which machines or departments are the largest energy users?
- What is causing our peak consumption?
- What about the power factor (cos phi) of our company?
- What about the energy consumption fluctuation of a machine or department over time?
- What is the energy consumption by style and product?
- What is the remnant energy consumption when production is shut down?
- What abnormal consumptions occur and when?

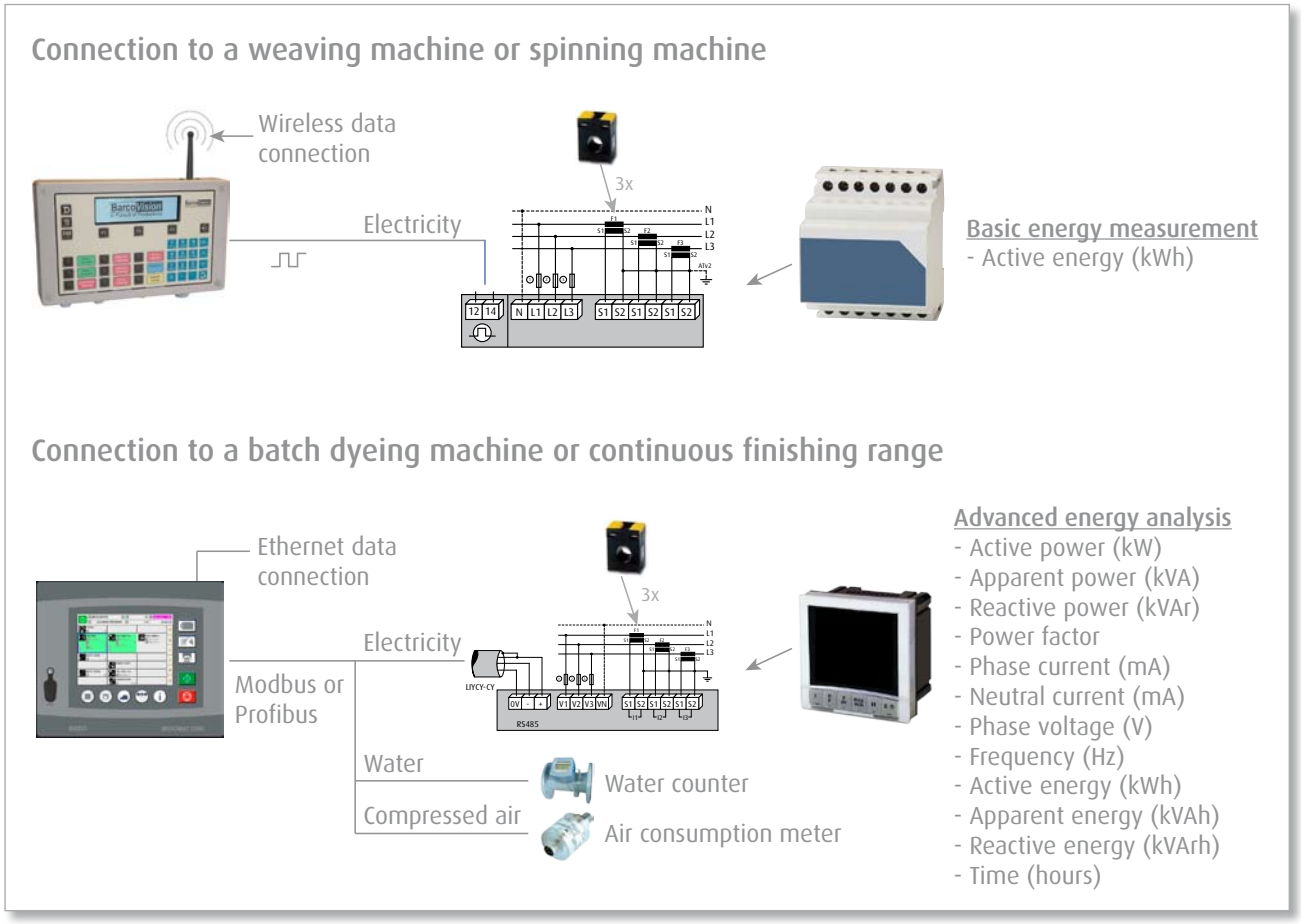
Automatic alerts to managers on exceptional energy consumption via e-mail or text messages, allows for a quick reaction and to realize immediate savings. The use of energy monitoring creates an "energy awareness culture" within the company for all employees. EnergyMaster is the perfect tool for a company to achieve its Energy Efficiency Plan goals.

Measuring energy consumption

In order to achieve energy management, consumption meters need to be installed. In some departments meters can be placed in the power switch panel to measure the consumption of a group of machines, but high energy consumption machines such as dyeing, finishing, OE spinning machines should be equipped with individual meters.

These simple meters allow measuring the active energy consumption. Such a meter typically consists of three coils, one per phase, connected to the electrical wires. The meter then converts the signals of the three coils into consumption pulses. These pulses are counted by the BarcoVision Data Units and passed on in real time to the MES system, exactly like stop times and production and quality data are transmitted.

In many cases, these Data Units are already present at the machine to detect and transmit production and quality data to the BarcoVision MES systems. As such, energy data can be transmitted via the existing network to the PC server of the BarcoVision system. With recently installed systems, the data is transmitted wirelessly utilizing the Bluetooth protocol.



▲ Fig. 1: A Data Unit can be extended with an energy meter. The production and quality data of the machine are passed on together with the energy consumption data to the BarcoVision MES system. In the dye house, Sedomat controllers are used for the process controls; these can also be extended with meters for power, compressed air and water consumption.

Reporting

The EnergyMaster system comes with a set of predefined reports, such as:

Counter reports

These are graphs which map the meter data. The consumption measured per meter is charted in a graphical way. With such a report the main meter of the plant can be monitored (Fig. 2).

Consumer reports

Several consumption meters can be grouped together into one department. As such, spinning, weaving, dyeing and administration can be defined as a specific consumer. The consumer reports are graphic reports which show the consumption of a certain department. The user can also select the time period for each group of machines. Line or bar charts can be selected. These reports can be used to trace abnormal peak consumption, to eliminate abnormal consumption and for example to evaluate if reduced night or weekend shifts makes sense, considering the higher energy consumption per unit of production.

History reports

This set of reports shows the energy consumption for a specific machine, for a machine type, for a style or product, for a department or for the whole plant over a longer time period. These reports allow evaluating the energy component in the overall production cost of each product. Does the energy consumption remain constant when a certain style is produced or are there large fluctuations, which require further analysis?

Combination reports

In these reports, energy consumption is related to effective production. For example in the dye house energy consumption is reported by batch; in weaving energy consumption is reported per million picks and in spinning per 10,000 lbs produced. By analyzing this data by type of machine and by type of product, one can determine easily which machine is most energy efficient to produce a specific product or style.

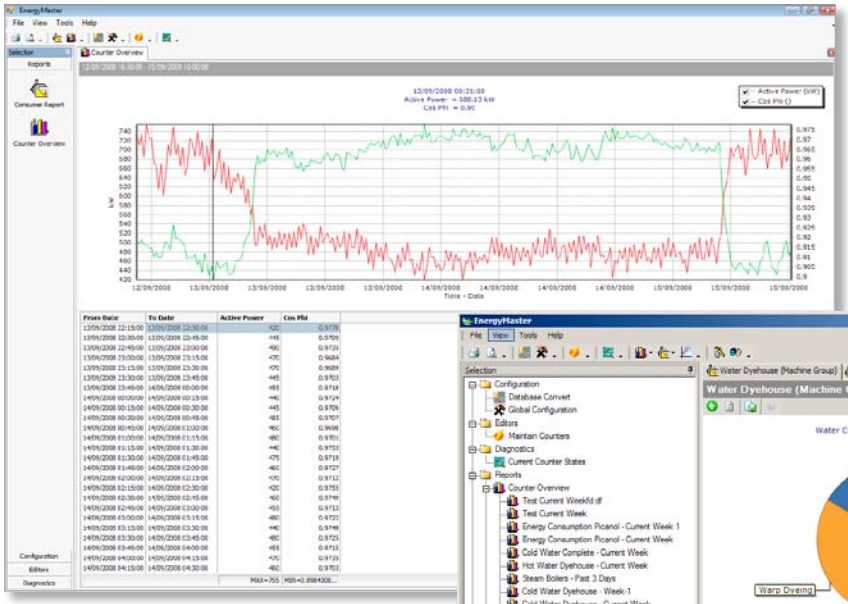


Fig. 2: Counter report of the main meter of the plant. The electricity consumption (active power) and the according power factor (cos phi) are reported every 15 minute interval. During the weekend fewer machines are in production and as a result the active power decreases and the power factor improves. The graph shows that the power factor always remains above 0.9, which indicates an acceptable situation. This graph also allows to evaluate the functioning of the condenser battery for improvement of the power factor.

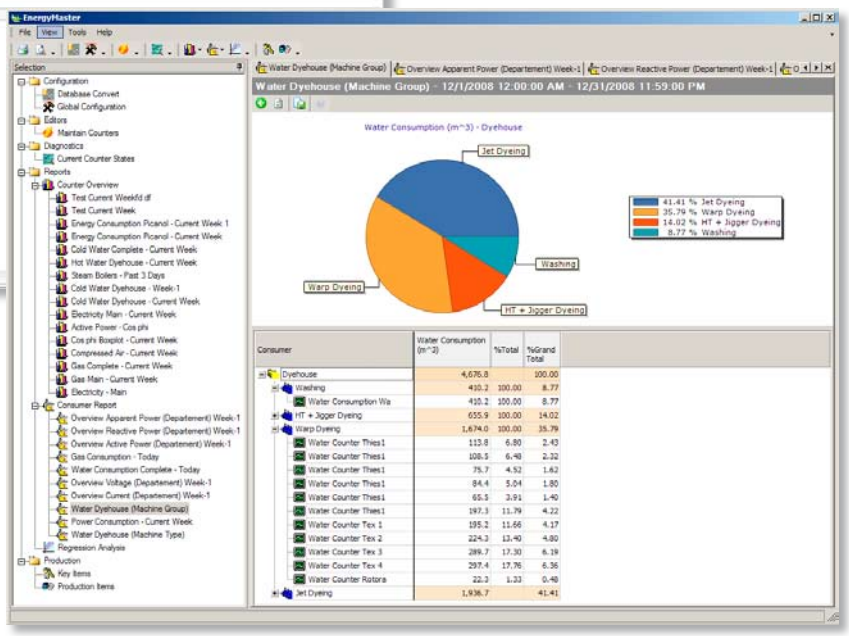


Fig. 3: Water consumption by department over a selected period of time. This type of reports helps to identify the largest consumers in the plant per type of energy and utility resource.

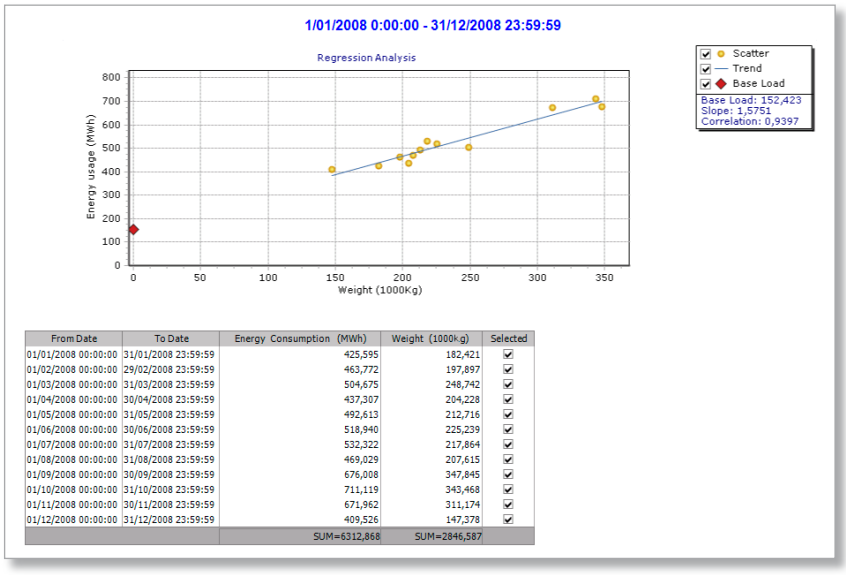
Energy monitoring standards

The reporting for energy consumption is well documented by the industry in many countries. For example in the UK, companies receive government subsidies if the installed energy monitoring software package includes a well defined set of reports. The BarcoVision EnergyMaster reporting package includes these industry standard reports, such as the PCL, SEC and CUSUM charts.

Fig. 4: Performance Characteristic Line (PCL)

Performance Characteristic Line (PCL)

The PCL is the result of a regression analysis between energy consumption and production output, as registered by the monitoring system. The PCL can be plotted for a machine, machine group or a complete department or plant and for energy resource monitored by the system. Based on this regression analysis, the base load is calculated, which is the energy consumption when there is no production at all. The slope of the line indicates the amount of energy needed to produce one unit of product. The PCL can also be used for targeting future energy consumptions based on production budgets.

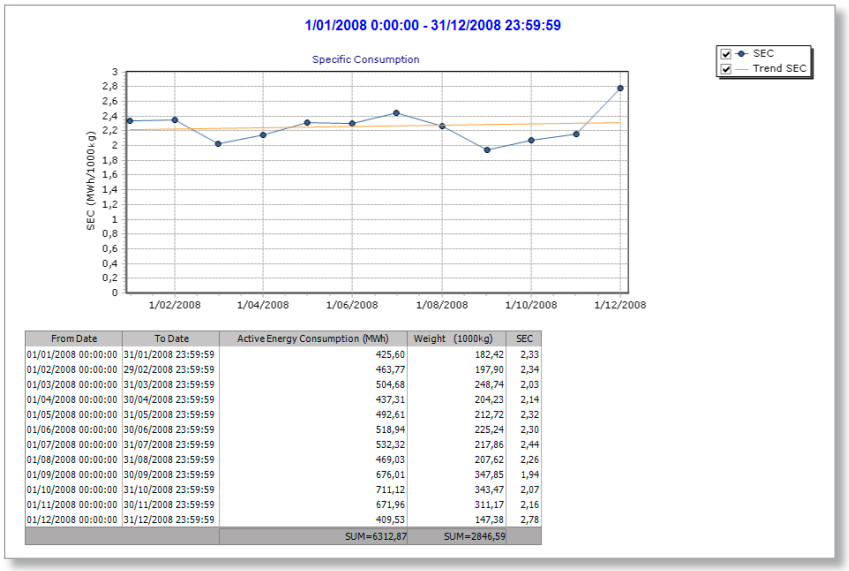


From Date	To Date	Energy Consumption (MWh)	Weight (1000kg)	Selected
01/01/2008 00:00:00	31/01/2008 23:59:59	425,595	182,421	☑
01/02/2008 00:00:00	29/02/2008 23:59:59	463,772	197,897	☑
01/03/2008 00:00:00	31/03/2008 23:59:59	504,675	248,742	☑
01/04/2008 00:00:00	30/04/2008 23:59:59	437,307	204,228	☑
01/05/2008 00:00:00	31/05/2008 23:59:59	492,613	212,716	☑
01/06/2008 00:00:00	30/06/2008 23:59:59	518,940	225,239	☑
01/07/2008 00:00:00	31/07/2008 23:59:59	532,322	217,864	☑
01/08/2008 00:00:00	31/08/2008 23:59:59	469,029	207,615	☑
01/09/2008 00:00:00	30/09/2008 23:59:59	676,008	347,845	☑
01/10/2008 00:00:00	31/10/2008 23:59:59	711,119	343,468	☑
01/11/2008 00:00:00	30/11/2008 23:59:59	671,962	311,174	☑
01/12/2008 00:00:00	31/12/2008 23:59:59	409,526	147,378	☑
		SUM=6312,868	SUM=2846,587	

Specific Energy Consumption (SEC)

A next graph of importance is the SEC, which stands for Specific Energy Consumption in terms of kWh per unit of production. A typical graph is the monthly evolution of the SEC, which allows to define whether the plant is gaining or losing energy efficiency.

Fig. 5: Specific Energy Consumption (SEC)

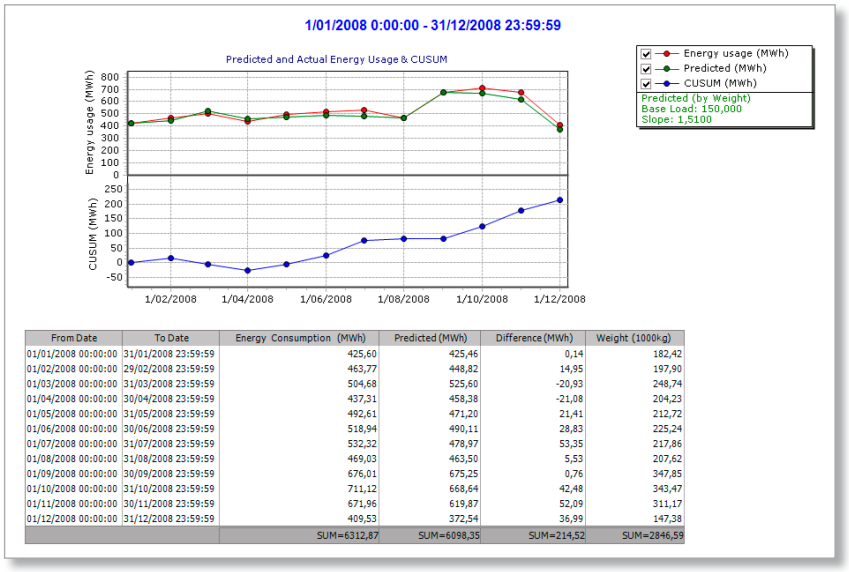


From Date	To Date	Active Energy Consumption (MWh)	Weight (1000kg)	SEC
01/01/2008 00:00:00	31/01/2008 23:59:59	425,60	182,42	2,33
01/02/2008 00:00:00	29/02/2008 23:59:59	463,77	197,90	2,34
01/03/2008 00:00:00	31/03/2008 23:59:59	504,68	248,74	2,03
01/04/2008 00:00:00	30/04/2008 23:59:59	437,31	204,23	2,14
01/05/2008 00:00:00	31/05/2008 23:59:59	492,61	212,72	2,32
01/06/2008 00:00:00	30/06/2008 23:59:59	518,94	225,24	2,30
01/07/2008 00:00:00	31/07/2008 23:59:59	532,32	217,86	2,44
01/08/2008 00:00:00	31/08/2008 23:59:59	469,03	207,62	2,26
01/09/2008 00:00:00	30/09/2008 23:59:59	676,01	347,85	1,94
01/10/2008 00:00:00	31/10/2008 23:59:59	711,12	343,47	2,07
01/11/2008 00:00:00	30/11/2008 23:59:59	671,96	311,17	2,16
01/12/2008 00:00:00	31/12/2008 23:59:59	409,53	147,38	2,78
		SUM=6312,87	SUM=2846,59	

Cumulative Sum of deviations (CUSUM)

A special type report is the CUSUM trend. This report allows comparing the real consumption versus budget. The gradient line in the trend graph allows immediate detection of a rising or decreasing trend in energy consumption. Such reports really help promote the energy awareness culture.

Fig. 6: Cumulative Sum chart (CUSUM) with actual and target consumption



From Date	To Date	Energy Consumption (MWh)	Predicted (MWh)	Difference (MWh)	Weight (1000kg)
01/01/2008 00:00:00	31/01/2008 23:59:59	425,60	425,46	0,14	182,42
01/02/2008 00:00:00	29/02/2008 23:59:59	463,77	448,82	14,95	197,90
01/03/2008 00:00:00	31/03/2008 23:59:59	504,68	525,60	-20,93	248,74
01/04/2008 00:00:00	30/04/2008 23:59:59	437,31	458,38	-21,08	204,23
01/05/2008 00:00:00	31/05/2008 23:59:59	492,61	471,20	21,41	212,72
01/06/2008 00:00:00	30/06/2008 23:59:59	518,94	490,11	28,83	225,24
01/07/2008 00:00:00	31/07/2008 23:59:59	532,32	478,97	53,35	217,86
01/08/2008 00:00:00	31/08/2008 23:59:59	469,03	463,50	5,53	207,62
01/09/2008 00:00:00	30/09/2008 23:59:59	676,01	675,25	0,76	347,85
01/10/2008 00:00:00	31/10/2008 23:59:59	711,12	668,64	42,48	343,47
01/11/2008 00:00:00	30/11/2008 23:59:59	671,96	619,87	52,09	311,17
01/12/2008 00:00:00	31/12/2008 23:59:59	409,53	372,54	36,99	147,38
		SUM=6312,87	SUM=6098,35	SUM=214,52	SUM=2846,59

Conclusion

With the addition of the EnergyMaster module, the BarcoVision MES systems are extended with the monitoring of an important cost factor. By taking advantage of the already present data collection network, data base and server configuration, the investment cost can be kept to the minimum while the monthly energy bill savings can be substantial by using the EnergyMaster module.

By defining an Energy Efficiency Plan with clear objectives, significant energy savings can be realized. EnergyMaster is the right software package to provide analysis and decision support for quick energy saving actions.

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