SIEMENS

Automotive and transportation

Premium Car Maker

Reducing lifecycle energy consumption of car engines with Plant Simulation

Product

Tecnomatix

Business challenges

Manufacture energy-efficient car engines

Make components for different engine types on one line

Optimize production line for reduced energy usage

Maintain output, improve flexibility

Keys to success

Use Plant Simulation energy analysis functionality

Feed simulation model with measured values

Simulate production scenarios

Reprogram PLCs to introduce auto start-stop functionality in production machines

Results

Saved 3 million kilowatt hours of electricity per year with no hardware investment

Identified additional optimization potential

Saving 3 million kilowatt hours of electricity per year in one production line following energy simulation using Tecnomatix

Energy efficiency as a key goal

Buyers of premium cars and SUVs require these vehicles to provide them with both exciting and problem-free driving experiences while at the same time advancing energy efficiency. This is not limited to the fuel efficiency during operation; it also includes the energy required in the original production.

Car makers typically manufacture most of the core parts and components of their engines in-house. Crankcase, crankshaft, cylinder head and connecting rods are lathed, milled, drilled, ground and honed on sophisticated production and transfer lines in plants such as BMW Motoren GmbH, the biggest engine plant within the BMW Group located in Steyr, Austria, about three hours' drive from the Munich, Germany headquarters.

Faster to market with virtual factories

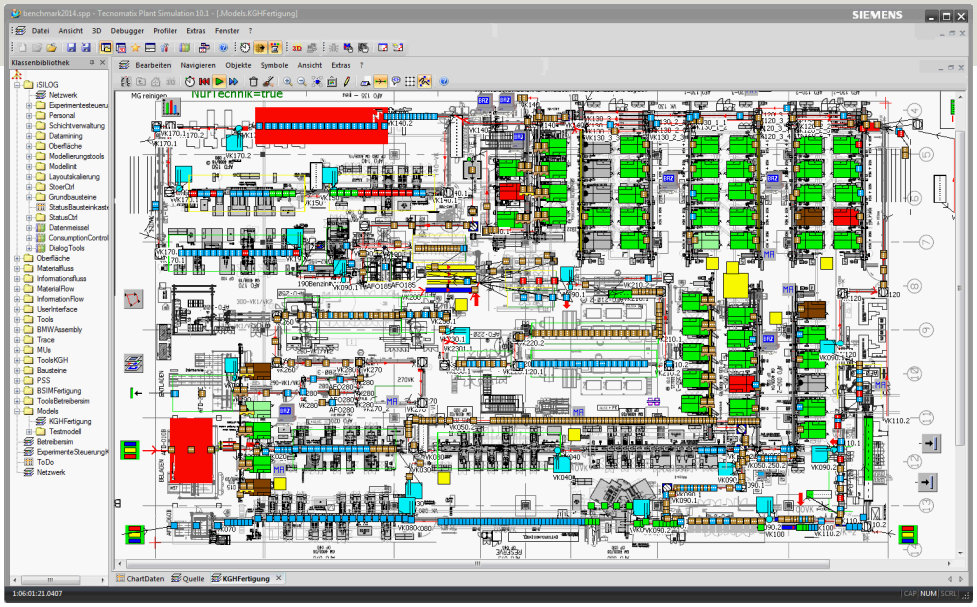
Production and assembly planning specialists carefully design, review and test the production process in a virtual

Specialized production lines for automotive parts are often modified to accommodate a growing variety of engine parts.

Results *(continued)*

Reduced eco-footprint by 550 tons of CO_2 equivalents per year

Scaled down lifecycle energy consumption of cars and SUVs



Automotive part production lines are designed and optimized as virtual models and can be analyzed for energy savings using new energy simulation capabilities of Plant Simulation.

Using Tecnomatix, car-makers design and simulate complete production lines with machine tools and robot cells as well as material handling and transport systems. This gives them an opportunity to improve the production process by re-arranging factory floor layouts, thus accelerating production cycles and saving investment costs through optimized tool and machine utilization.

representation of each line before it is actually built. For this purpose, manufacturing engineers throughout the group use the Tecnomatix® portfolio from Siemens PLM Software for plant simulation.

Using this sophisticated software suite, they design and simulate complete production lines complete with machine tools and robot cells as well as material handling and transport systems. This gives them an opportunity to improve the production process by re-arranging factory floor layouts, thus accelerating production cycles and saving investment costs through optimized tool and machine utilization. The Plant Simulation solution in the Tecnomatix portfolio is the leading simulation software among German car makers and features a kit of drive train parts developed by the German car maker's association Verband der Automobilindustrie e.V. (VDA). In Steyr, it is used for planning personnel as well as machinery, covering 100 percent of the plant.

As new production lines are designed in parallel with the development process of the product to be produced there, planning in the virtual world using Plant Simulation has effectively doubled the innovation rate in the automotive industry. While it took an average of five to six years to get a new generation of engines to market in the 1980s, it takes only about three years now.

Requirement changes

Another thing that has changed dramatically in recent years is the number of versions in which cars are available. What used to be mass production has turned into a business based on custom configuration. There is also a much greater variety of engines, with a trend to lower volumes and fewer cylinders prompted by fuel-efficiency considerations and facilitated by advanced engine design.

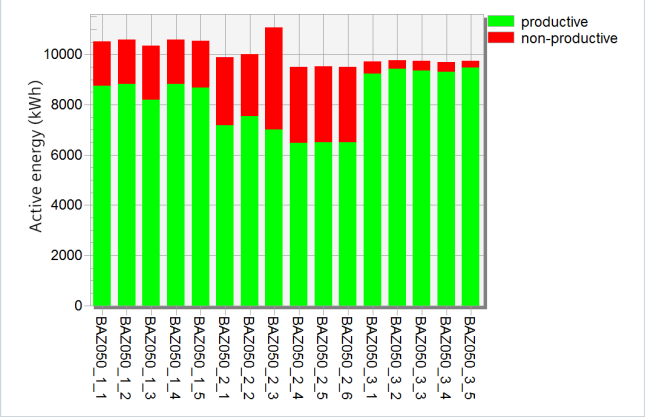
As more versions obviously mean lower quantities of each, not every new component's introduction results in the creation of a whole new production line. Existing production lines are kept up to changing requirements and at the most advanced state of production technology by replacing or adding machining centers. Two years ago in Steyr, a line producing crankcases had been modified to handle a growing demand for smaller engines. Many new machining centers were added. The high-pressure pumps in the basement needed to address this new challenge in order to supply sufficient cooling lubricant. At the same time, within the production line equipment dedicated to components for 6-cylinder engines was not used to capacity.

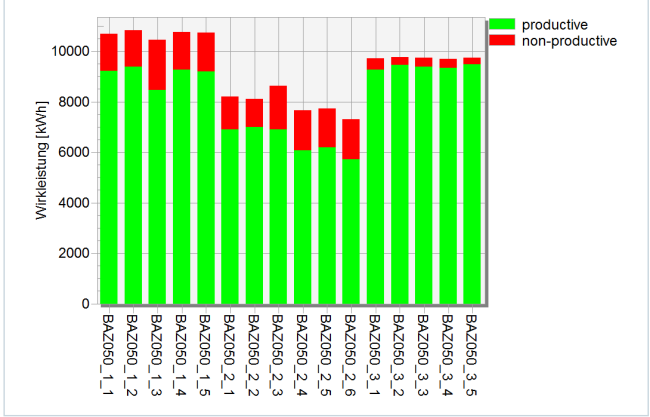
Optimizing energy efficiency at no extra cost

At about the same time, a new release of the Plant Simulation software became available, featuring new energy analysis capabilities that extended the traditional usage range of plant simulation models for optimizing throughput, relieving bottlenecks and minimizing work-in-process. Available without additional fees in all license configurations, the software provides dialog boxes for setting wattage values for various modes of operation such as working, setup, operational, standby or off for all simulation entities, as well as the time required for changing from one state to the next.

With this additional information, the simulation model can be used to reveal load imbalances, optimize individual machine utilization or streamline parts logistics. Using this capability, energy savings can be easy to achieve, as even simple measures such as actively changing to standby rather than awaiting the timeout often show remarkable results. Learning about this new software functionality, it immediately occurred to the engine process technology and simulation experts in Steyr that this should allow them to transfer proven energy-saving strategies, such as the auto start-stop function, from the car to the factory floor.

In the simulation model, modifications of the existing PLC programming of machines within the line were predicted to return energy savings amounting to 1.66 million kilowatt hours of electricity on the shop floor. That is exactly what resulted after in-house maintenance technicians reprogrammed the PLCs.





Using Plant Simulation software from Siemens PLM Software's Tecnomatix portfolio can improve the overall energy efficiency of car engines by lowering the energy required for its production. These energy savings are predominantly achieved by reducing energy supplied during non-productive phases.

Solutions/Services

Tecnomatix
www.siemens.com/tecnomatix

Customer's primary business

BMW Motoren GmbH is the BMW Group's biggest engine plant and diesel competence center.
www.bmw-plant-steyr.com

Customer location

Steyr
Austria

Implementing the auto start-stop function in the crankcase line as an energy-saving measure not only led to a total energy reduction by 3 million kilowatt hours of electricity per year, but it also showed a favorable side-effect: if machines or supply pumps are turned off while they are not needed, this also reduces noise.

Substantial energy reduction

In the existing model of the line created using Plant Simulation, all that it takes to get a valid energy simulation is to map the information on the power consumption of each machine in the line with the production stages in the process control system, and to add it as a list to the existing simulation model. As the energy simulation functionality is a standard feature of the package, getting presentable results took only two weeks, requiring no investment in software. Based on the energy simulation, in which the car engine makers were assisted by German simulation service provider iSILOG GmbH, various scenarios were tested in the virtual production environment model created using Plant Simulation.

In the simulation model, modifications of the existing programmable logic controller (PLC) programming of machines within the line were predicted to return energy savings amounting to 1.66 million kilowatt hours of electricity on the shop floor. That is exactly what resulted after in-house maintenance technicians reprogrammed the PLCs.

As an idling machine does not need to be supplied with cooling lubricants, another 1.4 million kilowatt hours of electricity were saved by turning off some of the high-pressure pumps at the media supply installations. Implementing the auto start-stop function in the crankcase line as an energy-saving measure not only led to a total energy reduction by 3 million kilowatt hours of electricity per year, but it also showed a favorable side-effect: if machines or supply pumps are turned off while they are not needed, this also reduces noise.

Around the globe, there is a huge potential for reductions in energy consumption of virtually every machining line in the automotive industry that would truly make a difference if implemented.

Plant Simulation is the leading simulation software among German carmakers and features a kit of drive train parts developed by the German carmaker's association VDA.

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