



Israel Electric Corporation moves towards smarter maintenance

Using sophisticated data models to predict and pre-empt turbine failures at its power plants

Smart is...

Using advanced modeling techniques to identify root causes and predict failures before they happen.

Israel Electric Corporation (IEC) generates 95 percent of Israel's electricity. To meet peak demand, its turbines need to run at full capacity – so it is vital to keep them online and running efficiently.

IEC uses predictive maintenance and other technologies to model the behavior of its turbines and monitor their performance in real time. When anomalies are detected, it can quickly trigger maintenance resources to fix problems before outages occur or efficiencies are reduced.

When your company is responsible for generating 95 percent of the country's electricity and your power plants need to operate at full capacity to meet peak demand, how can you ensure a reliable, high-quality supply for all citizens at all times?

This was the challenge facing Israel Electric Corporation (IEC), the primary electricity provider in Israel, which is responsible for building, maintaining and operating the country's power infrastructure.

With the help of IBM predictive analytics software, IEC has found the solution.

Setting the scene

To meet the needs of 2.5 million consumers in an era when Israel's demand for electricity is growing at more than three percent per year, IEC needs to keep its 17 power stations online and operating efficiently at all times.

The need for reliable generation is particularly critical during periods of peak demand – for example, during extremes of hot or cold weather. At these times, the company's generators must be 100 percent operational to avoid brownouts or blackouts, because there is not enough spare capacity in the grid to compensate if one of them fails.

Analyzing thousands of data-points

Currently, the majority of the 12,500 MW of electricity generated by IEC comes from coal-fired, oil-fired, oil/gas-fired and combined cycles power stations, but the company also operates gas turbines at seven of its sites, which contribute 2,390 MW to the total output.

Erez Daly, Manager of the Gas Turbines and Combine Cycles department at IEC, comments: "The turbines in our gas power stations are very complex machines, which are full of sensors that help us manage them. They generate a huge amount of data – in one case, our control system collects 500 data-points from analog sensors, and another 700 from digital sensors.



Business benefits

- Estimated to reduce costs by up to 20 percent by avoiding the need to restart turbines after an outage – an expensive process.
 - Saved approximately USD 75,000 in fuel costs per turbine by identifying inefficient fuel usage.
 - Increased the efficiency of maintenance schedules, costs and resources, resulting in fewer outages and higher customer satisfaction.
 - Provides early warning of certain types of failure up to 30 hours before they occur, instead of 30 minutes.
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“We realized that if we could harness this information to gain a better understanding of how each of our turbines behaves, we could detect the warning signs when they were running inefficiently or about to fail. We just needed a system that was capable of mining the data.”

Finding a way forward

At this point, IEC’s enterprise business intelligence (EBI) project team entered the scene. Part of the company’s IT masterplan under the leadership of Deputy CEO Yosi Schneck, the EBI project aims to promote the use of analytics to support and enhance all areas of IEC’s business.

Arnon Baron, Project Management Officer for EBI at IEC, explains: “When we first became involved, the turbines team was writing SQL queries to examine the data. We started to help by building structured reports and graphs that made it easier for them to perform diagnostics – but we wanted to go further and introduce predictive capabilities too.

“That is when we decided to use IBM® SPSS® tools to realize the real value of the data – and when the turbine team saw the kinds of outputs that predictive modeling could provide, they were very enthusiastic. From our perspective in the EBI team, this was the victory moment, because we knew that we could deliver a solution that would really help them work more effectively.”

Sophisticated analysis of machine behavior

With the help of Genius Systems, an IBM Business Partner, the IEC team used IBM SPSS Modeler to perform cluster analyses of the data from each of the turbines and create a model of their “normal” behavior during start-up, steady-state and shut-down. With the baselines for each individual unit established, the team was able to compare their performance and begin identifying common problems.

Smarter Energy

Powering predictive maintenance



Instrumented

The predictive models work with data from across the power grid, including turbine components and usage meters.



Interconnected

The analytics solution provides a comprehensive view of power generation trends over time, drawing connections between production capacity, equipment performance, energy consumption and external events.



Intelligent

By analyzing the patterns of circumstances surrounding past power outages, IEC can predict and prevent future failures. The company can not only prepare for known consumption peaks, such as those caused by extreme weather conditions, but also react quickly to unexpected problems when the warning signs appear.

Solution components

Software

- IBM® SPSS® Analytical Decision Management
- IBM SPSS Collaboration & Deployment Services
- IBM SPSS Modeler
- IBM SPSS Statistics

IBM Business Partner

- Genius Systems
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“The SPSS Modeler solution developed with the help of Genius Systems is a critical step towards identifying and reducing significant fuel expenses in every single unit, saving as much as USD 75,000 per turbine per year.”

— Eitan Rindenau, Performance Engineer,
Gas Turbines team, Israel Electric Company

“We have been working with the Genius team for more than six years now, and they are an excellent partner,” says Daly. “They have helped us build models that are precisely tailored to the needs of our turbines – but using an approach that is flexible enough to be applied to almost any industrial equipment.”

Enhancing performance and fuel efficiency

The IEC and Genius team has worked on a number of valuable projects that have helped to transform the way the company manages its turbines. For example, it has been able to establish a set of key performance indicators (KPIs) that accurately reflect the performance of each turbine under a variety of different conditions.

“Because each of the turbines is different, and behaves differently depending on workload and other conditions, a simple comparison of data-points would not be effective,” explains Daly. “Instead, we used neural network techniques to calculate expected values for each unit, and we compare them with the actual values on a daily basis. If we detect a large variance, our control engineers are alerted immediately.”

One of the most important KPIs is fuel consumption. Eitan Rindenau, a Performance Engineer on the Gas Turbines team at IEC, comments: “Extraneous fuel consumption is nothing but a waste of money. The SPSS Modeler solution developed with the help of Genius Systems is a critical step towards identifying and reducing significant fuel expenses in every single unit, saving as much as USD 75,000 per turbine per year.”

Improving safety

The predictive capabilities of the modeling solution also help to increase safety. “Our turbines have an alarm built-in by the manufacturer which is triggered 30 minutes before a major failure,” says Daly. “But with our data we can predict such an event 30 hours before it happens – so we have much more time to intervene and prevent it from happening, and to make sure that all of our employees are well out of harm’s way.”

Moving towards preventive maintenance

Better root-cause analysis of past component failures enables IEC to move from a break-fix maintenance model to a more preventive approach.

“By analyzing the behavior of each turbine before and during previous failures, we can identify patterns that help us predict when a certain component needs replacement,” says Daly. “This means we can avoid outages and expensive repairs by fixing problems before they happen. It also allows us to schedule maintenance at the most convenient times, instead of having to take a turbine offline during a peak period.”

Dr. Moshe Shavit, CTO for Gas Turbines at IEC, adds: “Using IBM’s analytical tools has brought us significant savings, both by reducing the time taken to understand faults and by cutting the dollars spent on turbine failures and downtime.”

Wider adoption of predictive analytics

These analytics solutions are currently monitored by the performance teams in IEC's laboratories, and they will soon be available to control room staff as well. The company is in the process of rolling out SPSS Collaboration & Deployment Services, which will provide a live feed of the data to a dedicated screen in the control room, enabling 24/7 monitoring.

"Our success with predictive analytics has been noticed by other parts of the company, and we think there is potential for SPSS to help in areas such as cyber security, the smart grid and smart metering too," concludes Daly. "We're confident that our partnership with Genius Systems and IBM will help us continue to develop innovative solutions that help us run our business and serve our customers more effectively."

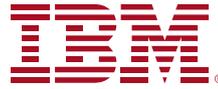
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Business Analytics solutions enable companies to identify and visualize trends and patterns in areas, such as customer analytics, that can have a profound effect on business performance. They can compare scenarios, anticipate potential threats and opportunities, better plan, budget and forecast resources, balance risks against expected returns and work to meet regulatory requirements. By making analytics widely available, organizations can align tactical and strategic decision-making to achieve business goals.

For more information

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