Damco Aluminium Delfzijl Cooperatie
U.A. (voorheen Klesch Aluminium)

we-CARE: we Create Awareness and Reduce Energy

Public Report

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Author: ir Rob Burghard

Attachment: Presentation we-CARE.pdf

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This report is the public version describing the results of the Early Adopter Project that enerGQ as technology supplier and fulfilling the role of secretary has executed in cooperation with the following partners:

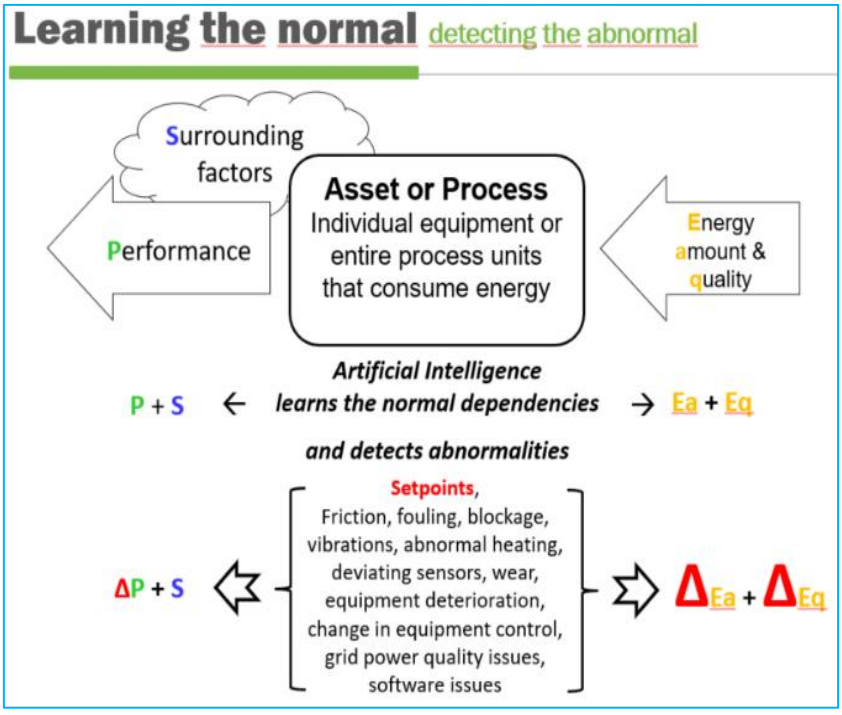
1. Klesch Aluminium Delfzijl – Receiver of the technology and support during the project.
2. Teijin Aramid te Arnhem - Receiver of the technology and support during the project.
3. RPC Promens te Zevenaar – Receiver of the technology and support during the project.
4. Institute for Sustainable Process Technology (ISPT) – Monitoring project and communication of results within the cooperation between industry, universities and knowledge centres focussed on the enhancement of innovations. (www.ispt.eu)

Summary of the assumptions, added values and project goals

Assumptions

Every process is there to deliver value. Better performance means higher value. Every process also consumes energy, whereby energy is viewed as a necessary input and cost. Unfortunately many industries have little insight in the energy performance of specific process units and equipment as this is not part of their routine or core business.

Energy however definitely also has a positive side that has to do directly with core business. It can tell a lot about how a process, a unit or individual equipment is performing, serving as a key to better performance. The illustration below shows how the technology works.



The energy amount **Ea** (and power quality **Eq**) vary most of the time normally with the performance **P** and surrounding factors **S** (for example a specific combination of Flow, pressure, temperature, quality, ambient temperature etc.).

The software learns the normal relationship between performance and energy in order to detect a anomalies **ΔP** at an early stage because they appear as deviating energy consumptions **ΔE** and are magnified with the help of CUSUM analysis.

The early detection makes corrective action possible ultimately leading to more process uptime and reduced specific energy consumption of the process and its parts.

In addition operational energy saving can be achieved by suggesting better setpoints within the normal window of operation.

The added values are:

1. Early anomaly detection enabling predictive solutions and prevent escalation, which makes corrective action possible, ultimately leading to more process uptime and reduced specific energy consumption of the process and its parts.

2. real time suggestions for better combinations of process set-points to the operators to further maximize process performance and minimize the specific energy consumption. The versatility of the enerGQ technology enables optimizing every process in accordance with the business conditions of the specific industry.
3. More awareness results in more knowledge about the process facilitating other innovations that ultimately require scale-up.

The underlying Early Adopter Project validates the enerGQ technology in three different industries: aluminium (Klesch), chemicals (Teijin) and plastics (Promens). The enerGQ intelligent monitoring and data analysis system is integrated in the three actual production processes. A new add-on solution makes the enerGQ system more pro-active towards the operators and recommends the combination of set points that will lead them towards the best possible energy performance with existing assets – Operational Energy Saving

Project goals

De following project goals have been formulated fort his project:

1. Further development of the enerGQ technology in three aspects so it can be easily utilized by the market:
    a. Plug & Play connectivity to existing process data storage at the client side.
    b. Pre-processing of data as feed to the new Deep Learning Module.
    c. Deep Learning Module as extension of the existing artificial intelligence algorithms.
2. The prove that the application of the enerGQ methodology works in different industrial branches.
3. The realization of an energy efficiency improvement of more than 25% with the operating companies.

Results, Bottlenecks and Applications Perspective

Results and bottlenecks

The project goals 1 and 2 have been realized to the extent that it was possible to demonstrate within the different environments.

Re 1a:

At the start of the project we knew that the data import from existing data sources is a challenge because there are many of them and in some cased they are aged. Teijin uses the state-of-the art OSI-PI system, a package enerGQ is familiar with in combination with the standard OPC-XML-DA interface from PI. The low cost interface OPC-XML-DA that was used to exchange the data was not the typical PI interface. After many modifications in the software on both sides we could get the data transfer to work and have set-up an FTP-server facilitating the export of process data CSV-files with a delay of 5 minutes (time interval was 1 minute) to the enerGQ cloud server. The energy data from installed enerGQ meters were transmitted via GPRS to the enerGQ cloud server.

In case of RPC Promens we have managed with the help of S&S Systems to create a one way data communication from the two extruders via GPRS-gateways to the cloud server of enerGQ.

In case of Klesch we developed an interface to communicate with the existing Oracle database with process data to a local server where the enerGQ application was installed, with secure access for

enerGQ for maintenance and support. Initially the communication between the enerGQ server and the Oracle database was running smoothly for a period of several months. Thereafter problems occurred (too many open connections) and also in this case the SFTP solution was implemented to facilitate the data transfer.

Re 1b:

Project goal 1b was realized successfully. Many different pre-processing functions that prepare the time series data for deep learning were implemented. We distinguished in the development of pre-processing functions for batch and continuous processes. The challenge that remains is the development of templates combining specific functions for particular process unit operations to reduce the number of hours for the client specific configurations enhancing the plug & play character of the solutions.

Re 1c:

Project goal 1c was realized successfully. The Deep Learning Module was developed as an add-on to the enerGQ software enabling enhanced learning of non-linear relations with limited data, enabling a much faster and more accurate learning.

Re 2:

Project goal 2 was realized successfully with the condition that the 'normal operation' occurs most of the time. This was not the case with the Teijin R&D environment, where we tried to get a working solution on the pilot plant where many experiments with changing process conditions were carried out. After realizing that there were not enough data to learn we have demonstrated the learning on the performance of the cooling unit and the total gas and total electricity consumption of the building. It turned out that the pilot plant consumes a relative small part of the total energy consumption.

Re 3:

Project goal 3 has been partly realized. For Teijin and Klesch Aluminium energy saving potential has of the objects investigated been shown (see sheets). Individual consumers such as the cooling with Teijin show very different consumptions under very similar conditions (see sheets 9 to 35). In case of RPC Promens many tests were performed on the extruder trying to save energy, trying to reduce motor power with additional electrical heating. From the monitoring we had to conclude that the nett energy of these 2 effects saving is close to zero (see sheets 36 to 41). RPC Promens however has an interest in utilizing the technology for the detection of anomalies thereby reducing the amount of waste in improving production efficiency. This requires an interval of 1 second instead of one minute, because the batch duration is a less than one minute.

Application perspectives

The area of application is huge. The technology is applicable to every existing asset, process unit, individual equipment that generates data and consumes energy. Not only industry, but also buildings, infrastructure and logistics are potential targets for ***significant (from 5% up to 30%) and fast operational energy saving*** filling in the need to generate additional energy saving under the ***Agreement on Energy for Sustainable Growth*** in the Netherlands. The technology can be implemented on a large scale in cooperation with sector specific knowledge and service partners.

The economic spin-off can also be huge in terms of the efficiency in the process of realizing energy saving and generating value with existing processes. Because the technology consists of software (and in case required monitoring hardware that meets all required standards) it can be easily exported to other countries inside the EU and on a global basis.

Current pilots based on the same technology are currently being done in the aviation and healthcare branch.

Publications

Project presentations were held at the NL-Guts day June 26, 2017, ISPT day November 14, 2017 and the RVO-projectenschouw January 26, 2018. The presentations and a copy of this report are free of charge and can be requested as PDF from enerGQ, by email to servicedesk@energq.com or by telephone 050-5248370 (Mr. Henk van der Wolde).