



## The added value of the Valmet DNA Integrated Operations solution in a small-scale virtual pipeline

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**Abstract:** In this study, we provide the measured operational performance improvement in the small-scale virtual pipeline (SSVP) supply chain. The improvement is based on the use of Valmet's Industrial Internet solution called Valmet DNA Integrated Operations at Gasum Oy. DNA Integrated Operations is a cloud-based application developed to support energy transmission customers, such as LNG, biogas and natural gas suppliers, to manage their supply chains more efficiently. The aim of the study was to find out the benefits Gasum has achieved so far with the solution. The study was based on data from DNA Integrated Operations and user experiences. A quantitative case study was chosen as the research approach in which interviews, observation and the analysis of data collected from the system were used as research methods. The results show clear benefits and cost savings achieved since the start of using DNA Integrated Operations.

**Keywords:** alternative fuels, small-scale virtual pipeline, supply chain control, integrated operation, automation

Valmet's aim is to become the best automation solution provider for alternative fuels. Both renewable fuels and liquefied natural gas (LNG) are part of Valmet's mission to convert renewable resources into sustainable results. Alternative fuels typically require one's own truck-based logistic system for transporting fuel, because gas pipelines do not connect all producers and end users. Supply chain control for alternative fuels is taken care of with the help of the Valmet DNA automation system, where DNA Integrated Operations is integrated as presented in Figure 1. DNA Integrated Operations is designed to connect all product data usefully, and the innovative tool presents everything needed to control the small-scale LNG supply chain simply and effectively [Ref. 1]. The same application can be used also for other industries, such as biogas, for instance. Valmet's software bundles all the data and shares it selectively with the right people. Communication between parties in the supply chain is easy without data overload.

Real-time data for each party is presented when and where needed as illustrated in Figure 2. Logistics

control means real-time delivery tracking. For instance, the mobile phone of the truck driver is integrated into Valmet's system. The driver can check where and when the deliveries are needed, how much gas to deliver to each location – and much more. In summary, DNA Integrated Operations enables the optimum use of a SSVP.

Benefits are:

- Real-time data availability
- Information can be seen whenever needed
- Accurate deliveries
- Sharing up to date information between relevant stakeholders
- Better control of logistics
- Efficient logistic plans
- Small-scale virtual pipeline

**Operational performance improvement in a small-scale virtual pipeline (SSVP) supply chain**

DNA Integrated Operations has been used by Gasum Oy for gas truck transportation in Finland since 2018.

The gas is transported by trucks to the filling stations using containers. DNA Integrated Operations is used to manage container logistics. One main functionality of DNA Integrated Operations is to forecast gas consumption, which creates the basis for optimum transport planning that aims at delivering containers as full as possible and retrieving containers at the lowest possible level. The operational performance of DNA Integrated Operations has been studied by the Häme University of Applied Sciences, and the study is based on interviews of the key users of the system as well as operational data stored by DNA Integrated Operations.

According to the study [Ref. 2], there are quite significant variations within one day and between different days in terms of gas consumption. These variations are considered by DNA Integrated Operations in forecasting gas consumption. DNA Integrated Operations also predicts scenarios for gas consumption in which future consumption would be maximum or minimum over the monitoring period. The study shows that gas refills have largely been timed evenly throughout the week, with the proportion of Sunday refills being relatively small, without having a significant effect on the Saturday or Monday gas remainders. The goal is naturally to avoid Sunday refills due to the higher costs of refills.

In the optimum situation, the gas container delivered to the filling station is fully loaded to 235 bar and the empty container retrieved corresponds to 20 bar at operating temperature. In this optimum case, the net delivery amount equals  $235 \text{ bar} - 20 \text{ bar} = 215 \text{ bar}$ . The net delivery amount is reduced from the optimum situation if less gas is delivered or more gas is retrieved. It is important to note that the filling station has backup storage for the gas. So, even if the container pressure drops below 20 bar, this does not automatically mean that consumers would not have gas available.

Based on the operational data, presented in Figure 3, we can see that the gas amount in the retrieved gas containers has reduced significantly from 7% in 2018

to 3% in 2020. Because of this development, one could think there is a risk that more containers are empty. However, the situation in the reality is the opposite. Typically, filling gas stations have two containers, so their combined pressure stays above 40 bar. According to Figure 4, we can see there has been a significant reduction in the number of containers with too low pressure, from almost 19% in 2018 to 4.5% in 2020. It is also worth mentioning that the filling stations do have backup storage. So in reality, there is never a situation when filling stations do not have gas available for users. In conclusion, we can state that the DNA Integrated Operations system has significantly improved supply chain control accuracy, which has a direct impact on the profitability of the alternative fuel business.

### Summary

DNA Integrated Operations has been developed to connect all product-related data and share it in real time with each party to aim at improving efficiency in the overall supply chain. DNA Integrated Operations has been in use by Gasum Oy since 2018. Operational data has been thoroughly analyzed. Based on this study, we can conclude there is a scientifically significant improvement in supply chain efficiency. The positive results and good experience have led also in the expansion of DNA Integrated Operations to cover Gasum's small-scale virtual pipeline operations in Sweden and Norway.

### References

1. Valmet DNA Integrated Operations: <https://www.valmet.com/more-industries/alternative-fuels/integrated-operations/>
2. Master thesis: "The added value of the Valmet DNA Integrated Operations solution in natural and biogas container logistics," Merja Huotarinen, Häme University of Applied Sciences, 2020, in Finnish. <https://www.theseus.fi/handle/10024/379564>

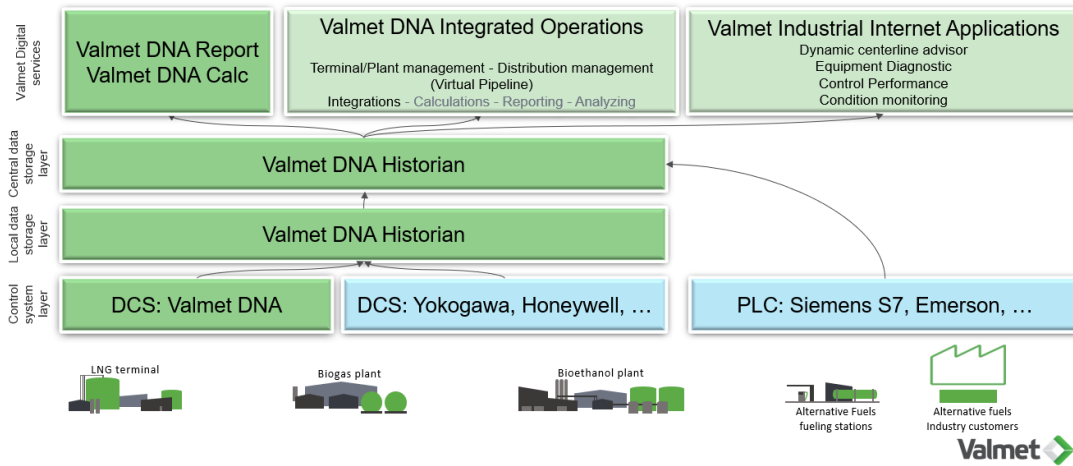


Figure 1: Valmet DNA Integrated Operations is part of the total offering of the automation solution.

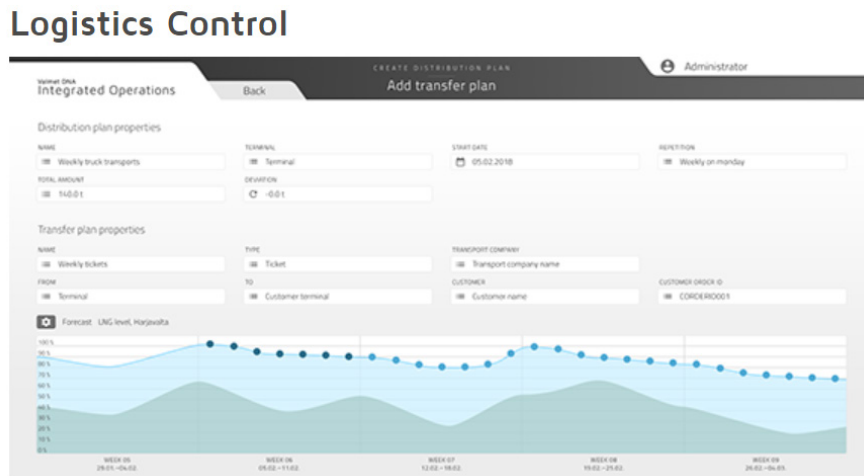


Figure 2: The whole procedure is easy to follow in the application's user interface.

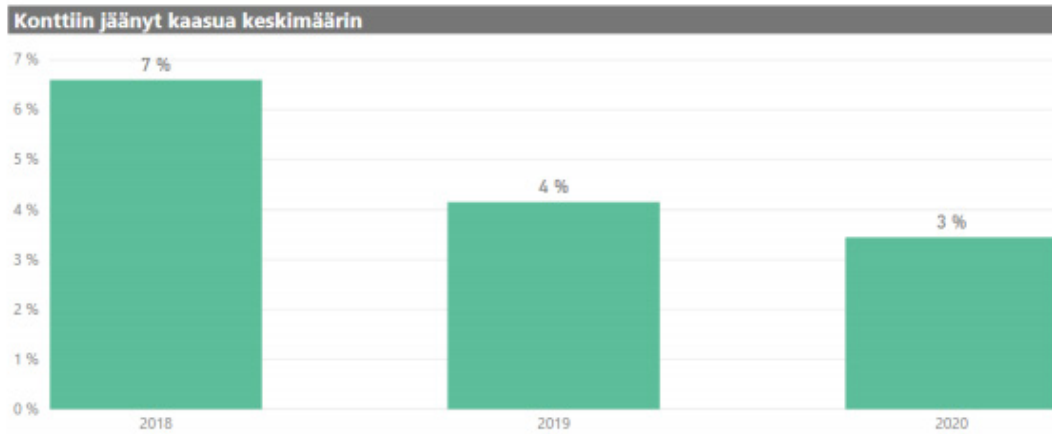


Figure 3: The development trend in gas remaining in containers from 2018–2020.

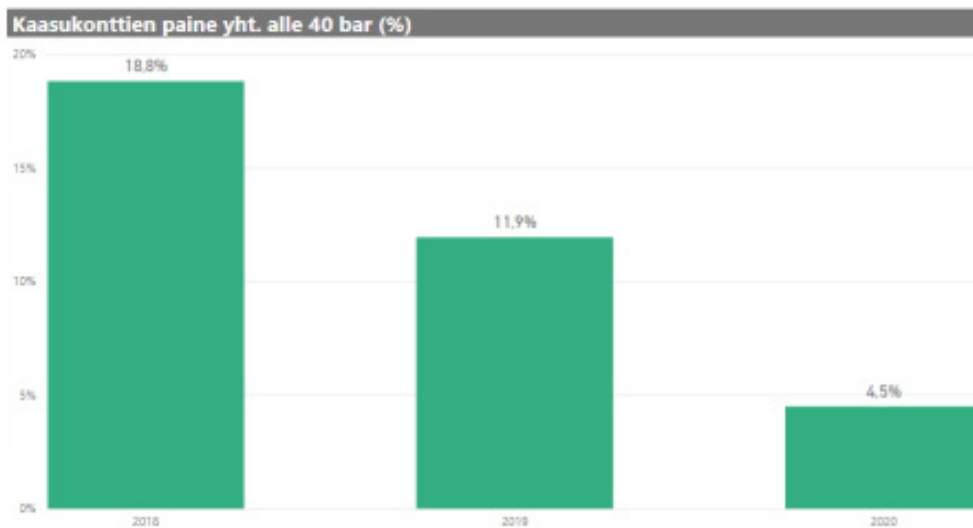


Figure 4: The pressure of gas containers to be replaced with a total of less than 40 bar in connection with container replacement from 2018–2020.