ABSTRACT

DSOs are increasingly expected and motivated to improve the environmental impact of their assets. The tendering process provides a key opportunity to take responsibility. The integration of circular economy in the assets of a DSO is challenging. Cooperation with vendors is essential. Liander uses its purchasing power to stimulate its vendors to develop more circular products. This paper describes why, how and the lessons learned. This is illustrated by some examples of achieved results.

DEFINITION OF CIRCULARITY

By improving circularity of assets, Liander specifically means:

- Making optimal use of assets already in its possession (assets should be robust, maintainable, repairable, re-usable);
- Purchasing assets which contain recycled material;
- Minimising the amount of waste and maximising high value recycling of remaining waste.

Liander has set the goal of purchasing at least 40% of its primary (network-related) assets circularly by 2020. An asset is regarded circular if it contains recycled resources and can itself be recycled into a useful resource at the end of its lifespan, see figure 2.

Figure 1: UN Sustainable Development Goals

Liander’s ambition is to become a ‘circular’ DSO. It wants to handle its assets responsibly to ensure they remain available, sustainable and affordable, today and in the future. To achieve these goals Liander needs the expertise and influence of its suppliers. It shifts its focus in tenders from price towards a more balanced scorecard, equally weighing aspects as quality and durability.

Figure 2: definition of circular asset

MATERIAL PASSPORT

Liander requires a resource or material passport (MPP) of their suppliers. This way, the material content of the asset, the % of recycled raw material used, and the % of recyclability after use are recorded. It additionally gives an overview of the supply chain up to tier 2 suppliers. The goal of the MMP is to stimulate dialogue between Liander, its suppliers and the underlying supply chain, in order to create a transparent and ‘fair’ supply chain. It indicates the current status within the supply chain and aids identifying potential opportunities for improvement. Furthermore, it works as an archive supporting the waste recycling process at the end of the lifespan and records the potential financial recycling value of the material.

The MPP used by Liander is a low cost, easy to use, format. It was developed by a supplier (AVK) together with Liander and KIWA certification. Liander supplies a format and a manual on why and how to fill in the format.
The MPP is accepted as an official document by Liander’s accountant (Deloitte Accountants). The MPP’s are used as input for ‘Liander Circularity Score’ in Liander’s annual report. The MPP is foremost a source of inspiration; it triggers thought and discussion downstream the value chain, figure 3. The MPP is thus an essential first step in how to make an asset more circular.

INCORPORATING SUSTAINABILITY IN TENDERS

Liander purchases in an international, mainly European, market. Sustainable products and production are still in the early stages of development. Knowledge, standards and legislation varies among countries. European rules, standards and systems to support circular purchasing are not yet in place. Except for the transformer market where the European Union Legislation 548/2014 sets the standards about eco-design of new transformers.

Since circular purchasing is still in its infancy, Liander chooses to have an open approach instead of selecting by specific measures/actions. This gives all vendors equal opportunities. Liander wants to start a change of mindset, e.g. a start of a common journey to make the asset and asset production chain more sustainable. To ensure that it will not be without obligations, all promises, agreements and ambitions are audited and laid down in the contract.

Depending on the product market combination Liander gives a substantial value to the sustainability scores. This can be in the range 20-40%. Where there is a good insight in market prices Liander uses a maximum price. This way the sustainability performance and ambitions can have a significant impact on the outcome of the tender.

RESULTS

PVC casing for electricity cables, made of recycled gas pipes

In the Netherlands natural gas is the standard source for heating houses. Renewal projects within the gas grid produce a steady flow of used pipes. By law, these pipes have to be collected in order to be recycled. For PVC very little recycling applications exist. PipeLife developed a casing for electricity cables made of recycled gas pipe materials. The casing can also be recycled and used as raw material for high quality sewage tubes. This can be done several times, expanding the useful lifetime of the basic material with 700 years. At no extra cost, because of the non-existing value of the PVC recycled material. This way, recycled PVC was introduced both in de Dutch electricity and sewage market. The product was selected as showcase for the 'Dutch Circular Plastics pilot', initiated by the Dutch government.

Fair meter

The Fair meter was Liander’s first step in sustainable purchasing. Liander was inspired by the Dutch NGO: Fairphone. Selection was done using a fair ladder: focus laid upon the improvements possible during the period of contract.

The fair ladder steps are, see figure 4:

**Energy and Emission**: Relates to energy use and emissions measured over the complete process of meter production.

**Resources and Raw Materials**: Relates to the responsible use of materials applicable to the process from design to second life applications.

**Fair Materials**: Relates to the use of materials (potentially) originating from conflict regions / sources.

**Labour**: Relates to the use of fair labour conditions throughout the complete value chain.

![Figure 4: The Fair meter ladder](image-url)

**Energy Use**: Relates to the amount of energy consumed by the meter during its lifetime.

**Software / Data**: Relates to transparency and safety & security regarding the use of data and software in the meter.
Transparency: Relates to the extent to which suppliers are prompted to provide transparency and insight regarding all fair aspects mentioned under ‘process’ and ‘product’.

Liander, Landis+Gyr, Flonidan and Iskraemeco worked as a team for several years. This resulted in large design and material changes. The Fair meter 2018 is much lighter, contains fewer parts, uses less energy and contains recycled plastic. Less parts means also less production costs. Furthermore, the water usage and CO₂ emissions during production are reduced significantly, see figure 5.

Figure 5: Fair meter development results

Figure 6: the ECO MV cable: use of recycled plastic for outer skin, reduced copper shield and recycled aluminium in the core

**ECO Medium Voltage cables**

Liander used a contract extension to ask their medium voltage (10 & 20 kV) cable suppliers to set up a material passport (MPP) and to study the use of recycled materials. Both TKF and Prysmian took on this challenge. This resulted in the design and production of a 240AL and 630AL medium voltage cable with less material (reduced copper shield), use of recycled aluminium in the core, and an outer skin made of recycled plastic, see figure 6.

QCP (Quality Circular Polymers) provided the recycled plastic. This company produces recycled plastic raw materials of high quality for high quality products. Its main source of plastic is standard collection of household plastics in the Netherlands. This way a plastic cycle was created: from the household back to the electricity cable in the street. Even better: domestic waste is upgraded into high quality plastic raw materials. A second pilot (2019) will use remnants of cable production as a source of raw material.

Two cables are produced and are now part of Liander’s network since 2018. One of the cables is used for the loading station for electrical busses near Schiphol Airport. The customer Connexxion (a bus company) welcomed this: green transport, using green energy through an ECO cable connection, currently is the perfect proposition in the commercial transportation market.

**Introducing sustainability in transformers**

Liander buys 435,000 kg of mineral oil annually. This oil is mostly used in transformers and switchgear. Nowadays, there are alternative oils on the market. Natural esters made from plants and, since recently, re-refined oil. The question Liander had was: is it technically safe to switch to an alternative, more sustainable oil. And which alternative is the most sustainable. We have made this question part of the procurement of power transformers involving winners Siemens and Tironi. Separately Liander asked the Belgian Research Institute Laborelec for advice.

Both Laborelec and Siemens confirmed that in 2019 there will be one international standard for both new and recycled mineral oil. Laboratory tests performed by Siemens show the quality of the recycled oil. Natural ester oils have already been used for a couple of years, which makes it a viable option as well.

A Life Cycle analysis (LCA) made by the University of Modena, commissioned by transformer supplier Tironi, compares the effect of mineral oil with natural ester oil. This study shows that the life cycle damage of the natural oil is higher than that of the mineral oil (4.68 times). This is mainly due to detrimental effects on land occupation,
global warming and respiratory inorganics. The Laborelec LCA compares the environmental impact of new mineral oil versus re-refined oil. The result shows that the environmental impact of re-refined oil is smaller than new oil. It is important though that the re-refined oil is refined within Europe. The high energy demand from the U.S. re-refining process in combination with the transport to Europe has a large negative effect.

The conclusion is that it is justified, both technically and sustainably, to use re-refined oil. Liander introduced re-refined oil as a pilot project in 2018. In 2019 re-refined oil will be the standard. However, not without some caution. The aging process of re-refined oil differs slightly from that of new mineral oil, and there is still hardly any practical experience with applying this oil. For smaller transformers, ≤ 20 MVA, this is regarded as risk-free. For larger transformers, in which the oil is an important element for the temperature control, Liander will set up a monitoring system that allows active monitoring of the oil and information exchange between Liander and the transformer manufacturers.

Another step towards sustainability is the use of recycled copper. Tironi starts using production waste of copper for the windings as raw material for new copper windings. A next step will be a research to close the loop using scrap transformers as raw material for new transformers.

**20 kV sustainable substation De Laarberg**

The market was given the challenge to offer the most sustainable substation possible. A maximum price was set, based on the price of a standard substation. A huge market response resulted in a substation that will set the standard for industrial buildings in the Netherlands.

The design is based on existing technology and will be built at hardly more costs than a traditional substation. The substation is CO2 positive over its lifespan, can be disassembled and the parts can be reused. There is extensive use of recycled and bio-based materials, and a site design which stimulates biodiversity. Major breakthroughs are the use of a timber frame house (instead of concrete) and the elimination of a traditional air conditioning / heating system. The substation uses its cellar and an earth wall, as buffer for controlling the temperature and humidity. Furthermore, the heat generated by the secondary equipment and transformers will be used for temperature and humidity control.

**RECOMMENDATIONS**

Integrating circular economy into tenders, requires breaking mental barriers. Grid operators claim: “the industrial market is not innovative”. The industrial market claims: “we never get the chance to show what we are capable of, because the grid operators only focus on the price”. So, someone has to break the cycle, however, without immediately expecting magical results. It creates homework, the need to help each other, dialogue, hard work and guts.

Development of a sustainable product calls for cooperation between supplier and buyer throughout the contract period. A longer contract period is helpful. Sustainability can be distinctive and lead to lower production costs. Be aware that sustainability is only sustainable if there is a positive business case on the longer term.

Incorporation of sustainability in procurement is new. There is (still) no standardised Dutch or European approach. Liander’s advice is to get started, experiment and keep it simple. Start a dialogue with the market early in the procurement process. This way, one stimulates the market and at the same time make maximum use of the knowledge and developments in the market.

Information is the key to start a change. The MPP is a simple overview of (raw) materials used and the product chain. Filling out does not ask for much time, it is basic knowledge that any supplier should have. Which supplier can explain that he does not know the material composition of its product?

Demonstrate that you are serious about sustainability by:

1. Awarding a significant weight to sustainability within the total score of a purchasing decision. Experience within the Dutch National Green Purchasing Development program shows that a minimum of 15% can be considered a relevant score.
2. Giving specific attention and time for conversation about sustainability during the tender.
3. Incorporating the agreement on sustainability (product and process development) in the contract. This way, it is binding for both buyer and seller. Monitor and discuss the progress at least every three months during the contract period.

4. An incentive can be helpful. Multiple methods are possible, for instance: supporting market positioning, prolonging contract period, increasing order volume, sharing of financial gains, price penalties or rewards, etc.

5. Developing and reporting a sustainability KPI at board level. Report progress both internally and externally periodically. For example in the annual report.

There is not yet a common method, find your way by doing it. Dare to fail and dare to formulate high ambitions. Often, much more is possible than thought at first sight.

On a final note, be aware of the trap. Forced sustainability is not always sustainable, nor is circularity. For example, forced reuse of recycled materials is circular, however can cause a lot of extra CO₂ emissions. Therefore, always keep thinking and keep the broader perspective in mind.

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