Summary

Baggage handling systems are big energy users within an airport. Airports invest in baggage handling systems and are looking forward to improve the sustainability of their systems. Therefore, the assignment is to identify possible solutions in order to make a baggage handling system more sustainable, and analyze their potential. This research focuses mainly on the existing (already in use) baggage handling systems

Mainly, there are two reasons why it is to be expected that existing baggage handling systems offer significant potential for improving sustainability:

- First, energy saving and sustainability were, up to a few years ago, not really priority issues. Not many investments regarding this subject were made in the past.
- Second, other interests were (and still are) in product development on the first place. The main priorities are the operational availability and the initial cost.

From an airport point of view, there are mainly two important drivers for increasing efficiency and sustainability:

- Expected cost reductions due to lower energy use.
- Improving 'green image'. (mostly promoted by a corporate responsibility report)

Figure 1 Transportation by belt conveyor

Despite the saving potentials and possible financial benefits, airports can still be reluctant (or indecisive) to invest in improving equipment. Possible barriers are limited awareness, initial cost, and (allowable) payback period, uncertainty of the benefits, implementation gap, shutdown time, unfamiliar technology or just other priorities.

After assessing the proposed actions on the following indicators, practical implementation/barriers, initial cost, expected payback period, effectiveness, moment of applicability and possible adverse effects, it was concluded that the two options that offer the most potential are (1) adjusting the PLC control software, and (2) buffering baggage before sending them into the handling system.

Analyzing a real case, showed the following conclusions:

The main benefits of implementing the proposed actions are:

- Direct energy savings due to significant reduction in operational activity, which contributes to the energy savings side of the sustainable energy balance and CO_2 reduction.
- Financial benefits due to lower energy cost, the economical aspect is one of the three pillars of sustainable development.
- Possible increase in durability of conveyor parts (hard to quantify or estimate); increase the life-span of a product is one of the design principles of the LiDS-wheel. (figure B6)

An analysis of the start-up of a conveyor showed that one start-up equals approximately (for the considered example) one second of continuous operational activity. Based on this notification two propositions have been made for a new PLC control architecture, with a (from a practical point of view) minimum allowable idle running time of 1 second, which provides the most (net) savings.

Analyzing the test case at Rotterdam Airport showed that:

- Average operational conveyor activity during the measured week can be reduced by 67%
- An annual reduction of the operational conveyor activity of about 47%
- This results in a reduction of about 30% of the total energy consumption of the total BHS and a reduction of 7.2 tons of CO_2 emissions annually.

The thermal and mechanical effects of the additional start/stop actions (from about 260 to 600 stops per day for the considered example of Rotterdam Airport) are not expected to cause problems. The possible side benefit of an increase in durability of mechanical parts is hard to quantify.
The payback period is approximately 2 years for the case of Rotterdam Airport.

A first estimation showed that, theoretically, buffering baggage first and sending them into the handling system per batch (combined with the proposed new PLC control mode), will reduce the operational conveyor activity even further. The practical implementation and the possible difficulties require more research.

Furthermore it can be concluded that, based on the similarities in the arrival-time distribution patterns and the expected operational conveyor activity between the measurements and the simulations, the baggage handling process (for this type of baggage handling) can theoretically by approximated by a Poisson process. This process is, in essence, used to create a sample simulation model and calculation model. When information regarding the expected amount of handled baggage is available (with what frequency different handling intensities per hour occur), it is possible to make an estimation of the operational conveyor activity for different PLC control modes.