Wireless charging infrastructure – simulation

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- Cooperation in the simulation of two charging strategies: In-process charging and out-of-process charging
- Real optimization scenario of a medium-sized production plant in Brandenburg
- Proof of a potential lever through a contactless in-ground/in-process charging infrastructure (WCPS)
- Prospects and project implications for customers

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Initial situation

A new fully automated welding production line for reinforcement products is to be further automated in terms of downstream logistics. Currently, the finished product is stacked on Euro pallets and then manually transported to the packing area using an electric pallet truck until it is ready for dispatch. In the course of further modernization, an autonomous pallet stacker equipped with a wireless charging pad on the underbody side is to be used, and the existing battery charging zone (cable) for the manual electric pallet trucks is far away from the production and picking processes.

MHP- A Porsche Company and **PohlCon** use a project example to demonstrate the enormous efficiency potential that is possible with a well thought-out simulation and the associated project recommendations. MHP is an experienced optimizer of complex automation projects with its own software tool "FleetExecutor" and PohlCon has the necessary expertise as a manufacturer of infrastructure solutions (WCPS) for contactless charging of robots.

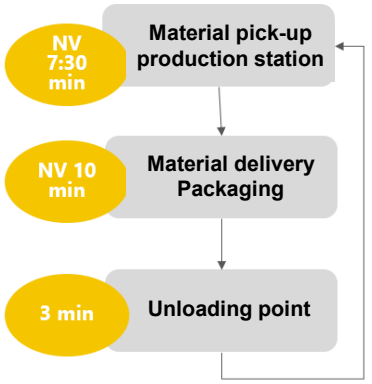
Goal of the simulation

The goal of the simulation was a comparative analysis of location advantages with regard to charging points embedded in the process vs. separate charging zones.

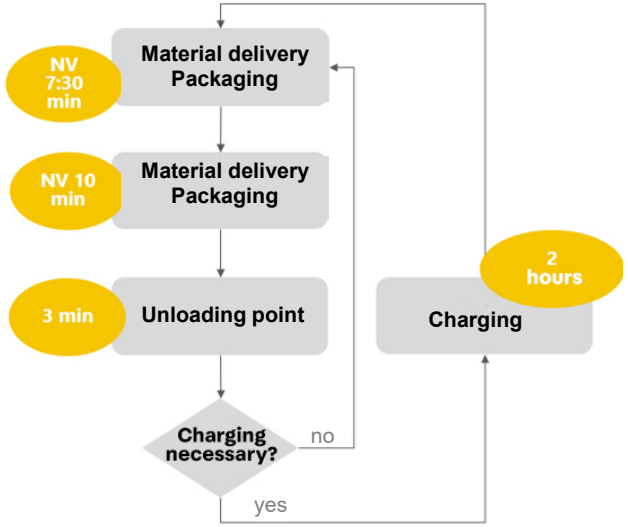
With in-process charging, the process-related waiting times can be used as charging time for the battery, which can have a whole range of positive economic effects if the deployment is planned correctly.

To demonstrate this effect, two simulations of the same material flow were carried out: a charging strategy embedded in the work process and a standard variant with charging points outside the process.

With WCPS



Without WCPS



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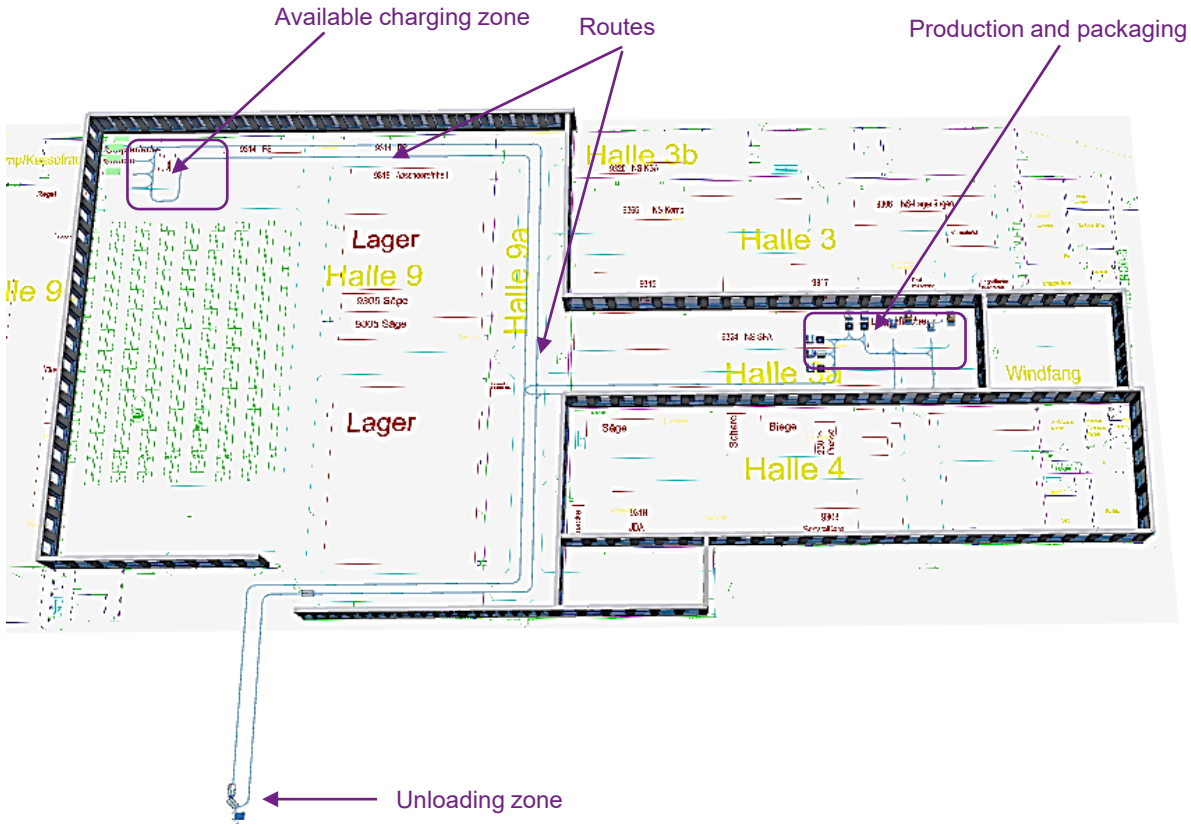
Scenarios considered

1. Consistent throughput, different charging strategy (charging points in the process vs. separate charging zone)
2. Constant number of driverless transport vehicles, different charging strategy

Process parameters:

Transport processes from production via packing to the loading point using driverless transport vehicles instead of manual electric forklifts.

- 2 pick-up stations on the production line
- 5 packing stations
- 1 loading point
- Distance to be covered for a transport loop: 300 m
- Distance to be covered for a charging loop to the charging zone: 240 m
- Consideration of a 3-shift model
- Charging system with 3000 W power



Use of the MHP "FleetExecuters" as a simulation model

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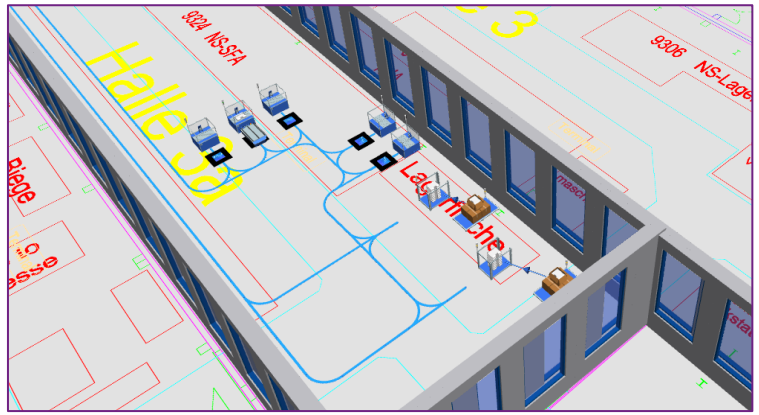
Conclusion

The comparison of both charging strategies showed very positive effects with in-process charging using the WCPS in-ground charging infrastructure.

Customers benefit from results 1 + 2 in particular through

→ Increased efficiency of the fleet (transport rate)
→ Greatly reduced investment costs and Folgekosten
→ Better utilization of the associated Ressourcen
→ Optimized use of space & saving space
→ Work safety
→ Reduced labour costs (focus on personnel deployment)



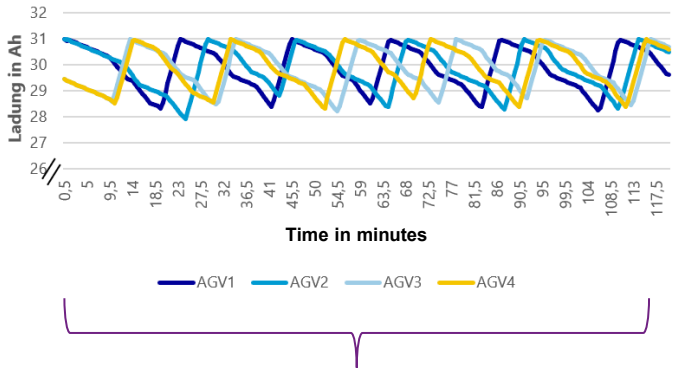
1 Consistent throughput, different charging strategy

Reduction of the required **AGV** by **30 %** (with the same throughput)

→ **Efficiency gain**

- Transport rate 11.25 transports/hour
- Reduction from 6 vehicles (out-of-process) to 4 vehicles (in-process)

Battery charging In-process charging (first 2 hours)



Sufficient waiting times in the process for charging processes

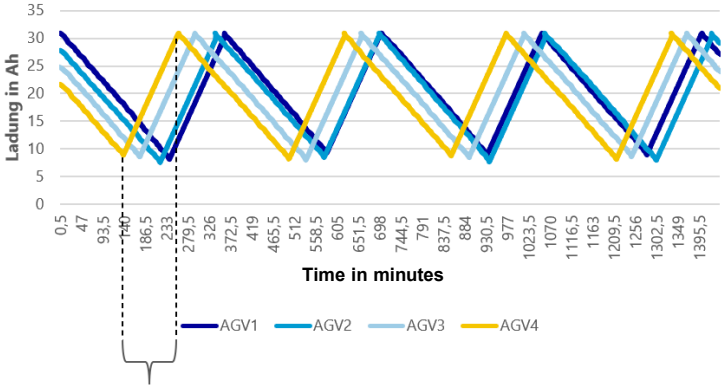
2 Constant number of autonomous robots, different charging strategy

Increase throughput by **50 %** (with the same number of driverless transport vehicles)

→ **Cost reduction**

- Increase from 7.45 transports/hour (out-of-process) to 11.25 transports/hour (in-process)
- With 4 vehicles for both charging strategies

Battery charging Out-of-process charging (24 hours)



Charging time during which the vehicle is not available

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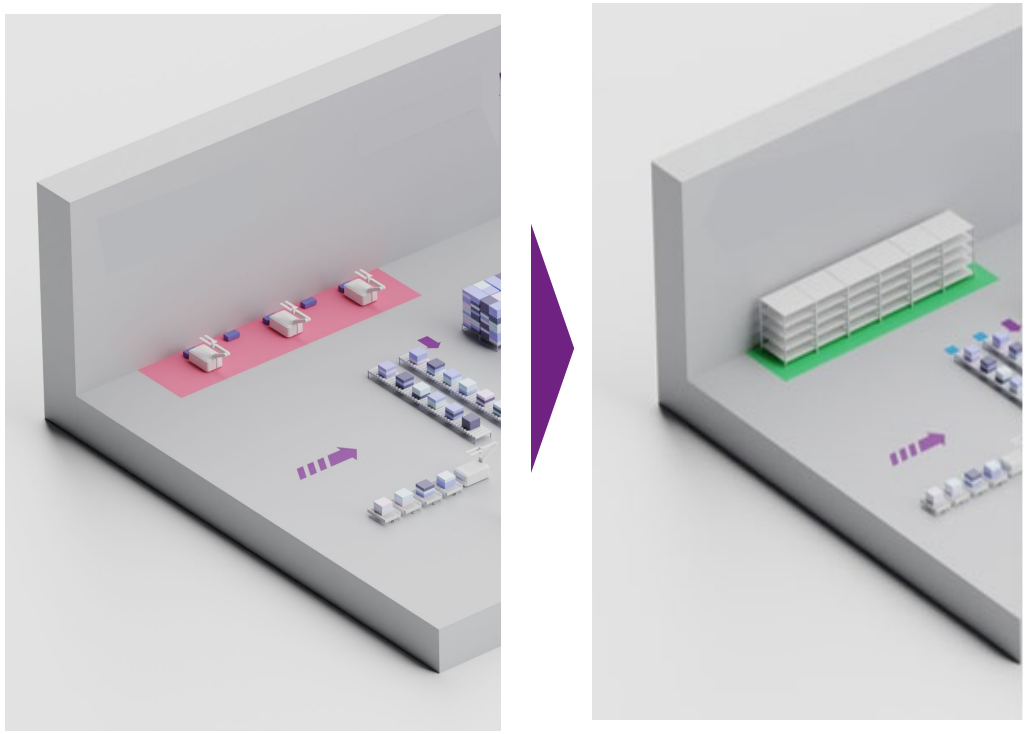
Saving space with WCPS

By charging in the process with WCPS, 30 m² of the originally blocked floor area can be saved and converted into storage space.

In the specific case study, a high rack with approx. 290 m² of storage space can now be set up.



Less fleet traffic and distance saved thanks to WCPS charging infrastructure

With an original distance of 480 meters (outward/return journey) and a fleet size of 6 vehicles, compared to using the WCPS charging infrastructure **per year**

1) > 1300 km of **distance** is saved* and
2) > 5000 hours of unproductive **downtime** due to charging breaks are saved and
3) > 10,900 **cross-contact points** with employees/vehicles are avoided.

* out-of-process, 1x charging per shift, 3-shift system, 6 robots, 480 meters (outward/return journey)
** out-of-process, 6 relevant **intersection contact points** on the route to the charging zone, 3-shift system, outward/return journey, 152 working days/ year

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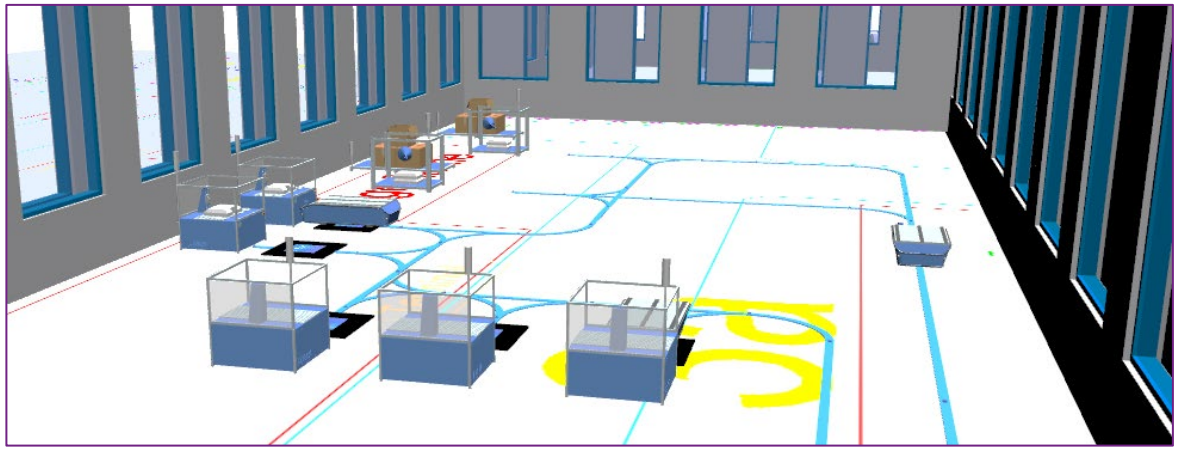
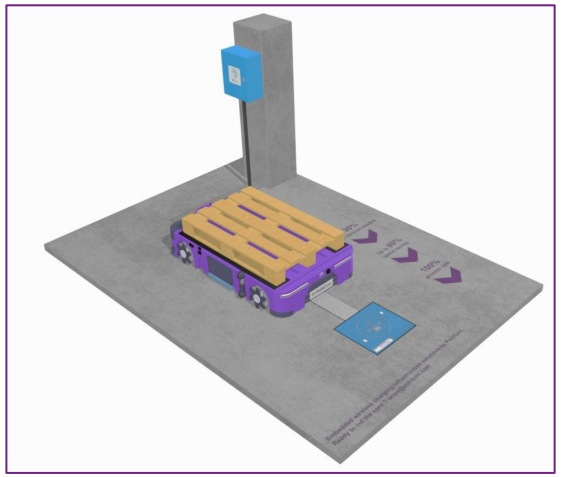
How can customers benefit from this in their own projects?

The earlier the material flow is simulated in combination with suitable robots, the better the investment in an automated future can be planned.

Three statements in particular are decisive for success:

1. Optimal location for charging points in the process
2. Number of charging points required for the current tasks
3. Analysis of the battery capacity compared to the "embedded" charging time in the process or scheduling of an optimized "forced charging break"





- → Chart with min. battery charge over the entire process
- → Chart with average charging time per charging point
- → Chart with number of charging processes (particularly interesting if charging points are not used in every process)
- → Checking a special process control of the AGVs so that those with a low battery level are next given an order that takes them to the inductive charging point

Augmented Reality

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About

PohlCon

The PohlCon brand PUK has been designing, developing and producing high-quality energy supply solutions for over 50 years. The charging infrastructure for contactless charging of robots via the floor is their latest innovation. This ensures a robust, efficient and reliable supply of energy via the floor. WCPS thus supports the special requirements for the automated electrification of robot fleets in modern production and logistics facilities.

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As a technology and business partner, MHP has been digitizing the processes and products of its approximately 300 customers worldwide in the mobility and manufacturing sectors for 27 years and supporting them in their IT transformations along the entire value chain. For the management and IT consultancy, one thing is certain: digitalization is one of the biggest levers on the way to a better tomorrow. This is why the Porsche AG subsidiary provides both operational and strategic advice in areas such as customer experience and workforce transformation, supply chain and cloud solutions, platforms & ecosystems, big data and AI as well as Industry 4.0 and intelligent products. The management consultancy operates internationally, with headquarters in Germany and subsidiaries in the USA, the UK, Romania and China. More than 4,500 MHP employees are united by a commitment to excellence and sustainable success. This aspiration continues to drive MHP - today and in the future.