

Sustainability is the new normal in high-volume semiconductor frontend production: Balancing WIP flow for energy availability, cost and peak consumption

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Energy Utilization in Semi Frontend

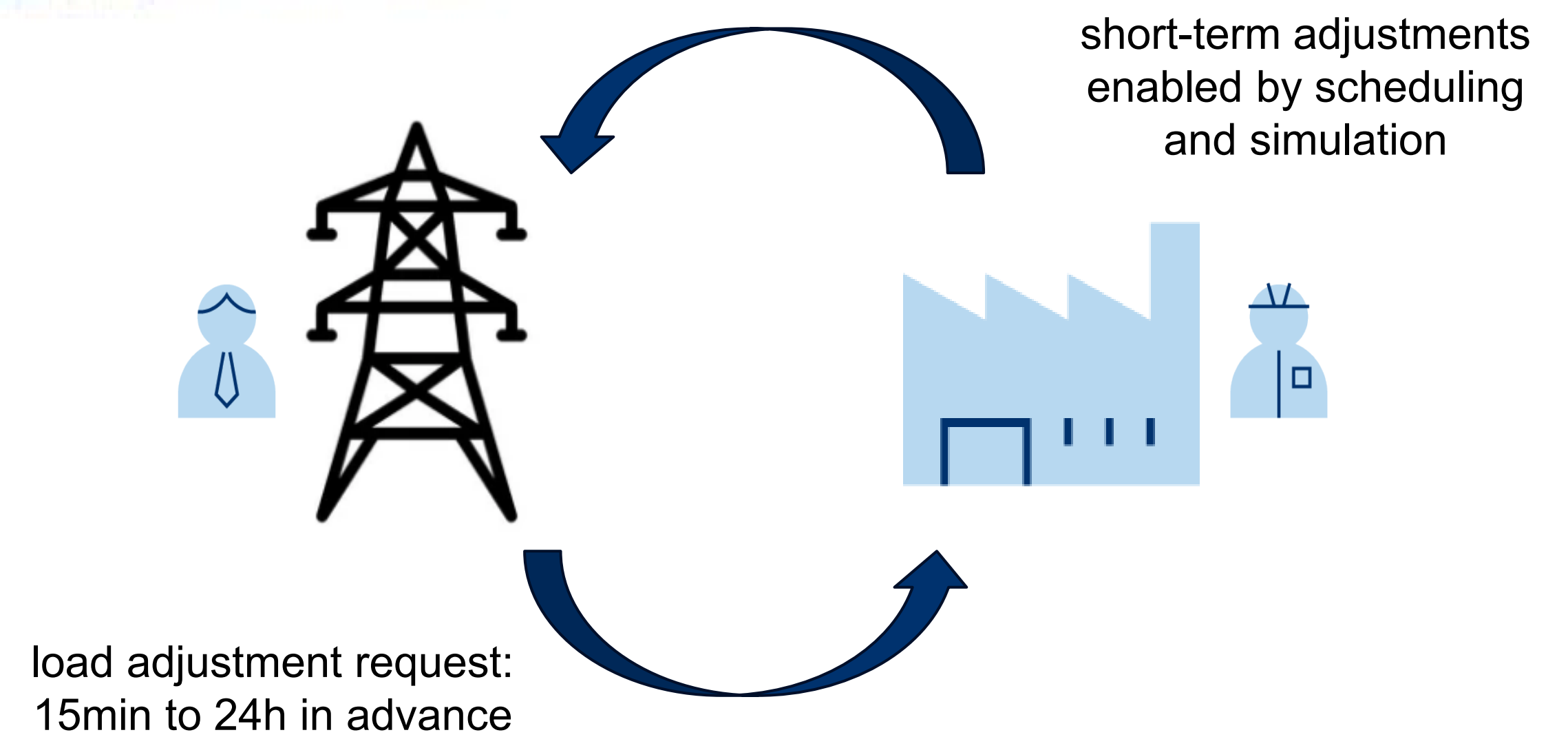
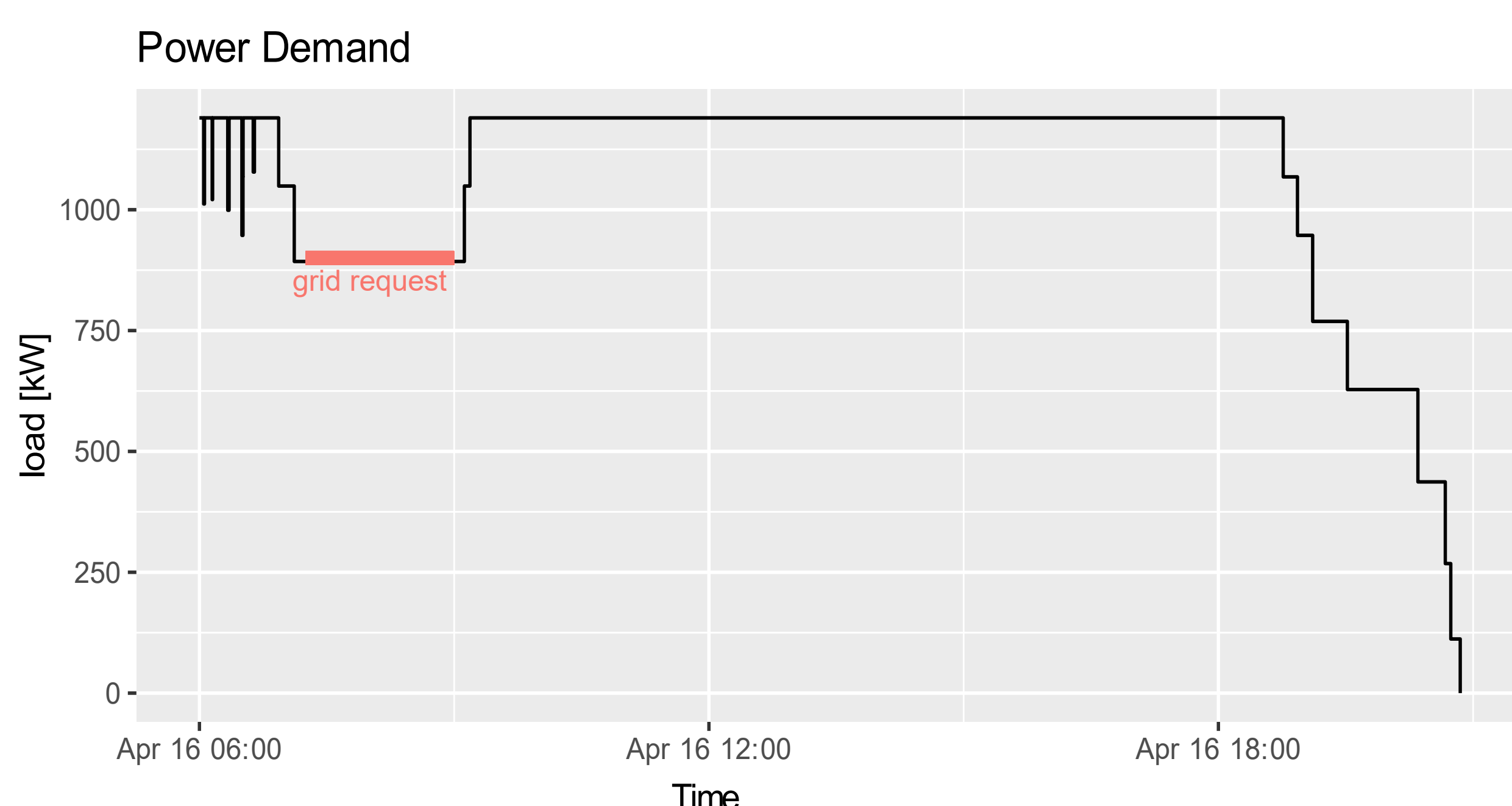
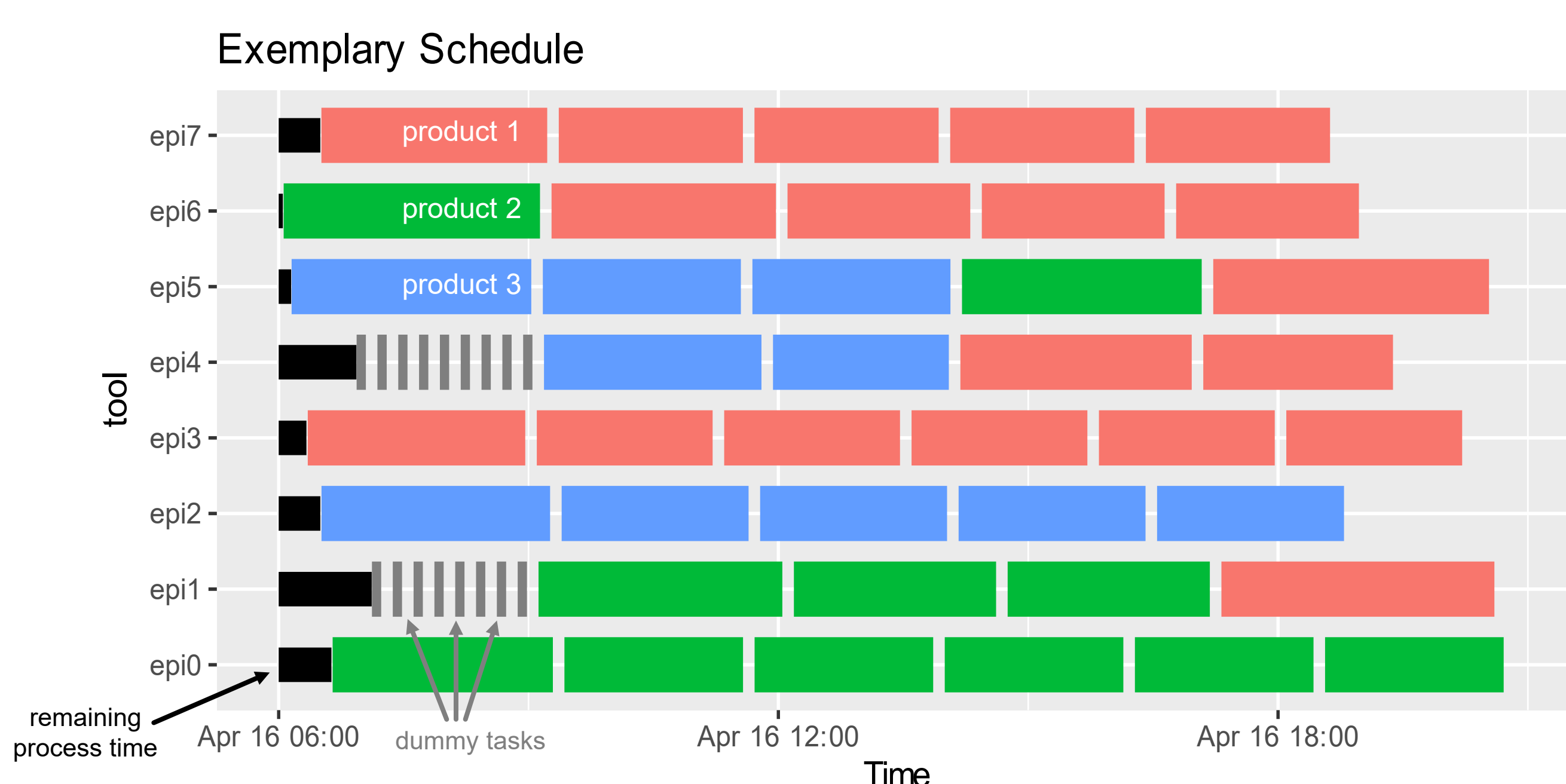
This study is motivated by the pressing need at Nexperia Hamburg to confront challenges posed by limited resources, escalating energy prices, and the heightened demand for sustainable practices.

The idea of our approach is to take into account load adjustment requests by the grid operator and automatically decide in short-term scheduling if to follow the requested load thresholds. Implementing versatile low-latency energy procurement policies in frontend manufacturing can contribute to fostering grid stability, especially when fabs are integrated into urban areas as it is the case for Nexperia. Subsequently, monetary incentives can be given to reduce production-related power load if requested.

Energy-oriented WIP Scheduling

In terms of a Constraint Programming (CP) problem, we model several shopfloor characteristics as constraints and set different penalty types and weights (based on the given importance) for each objective to be optimized.

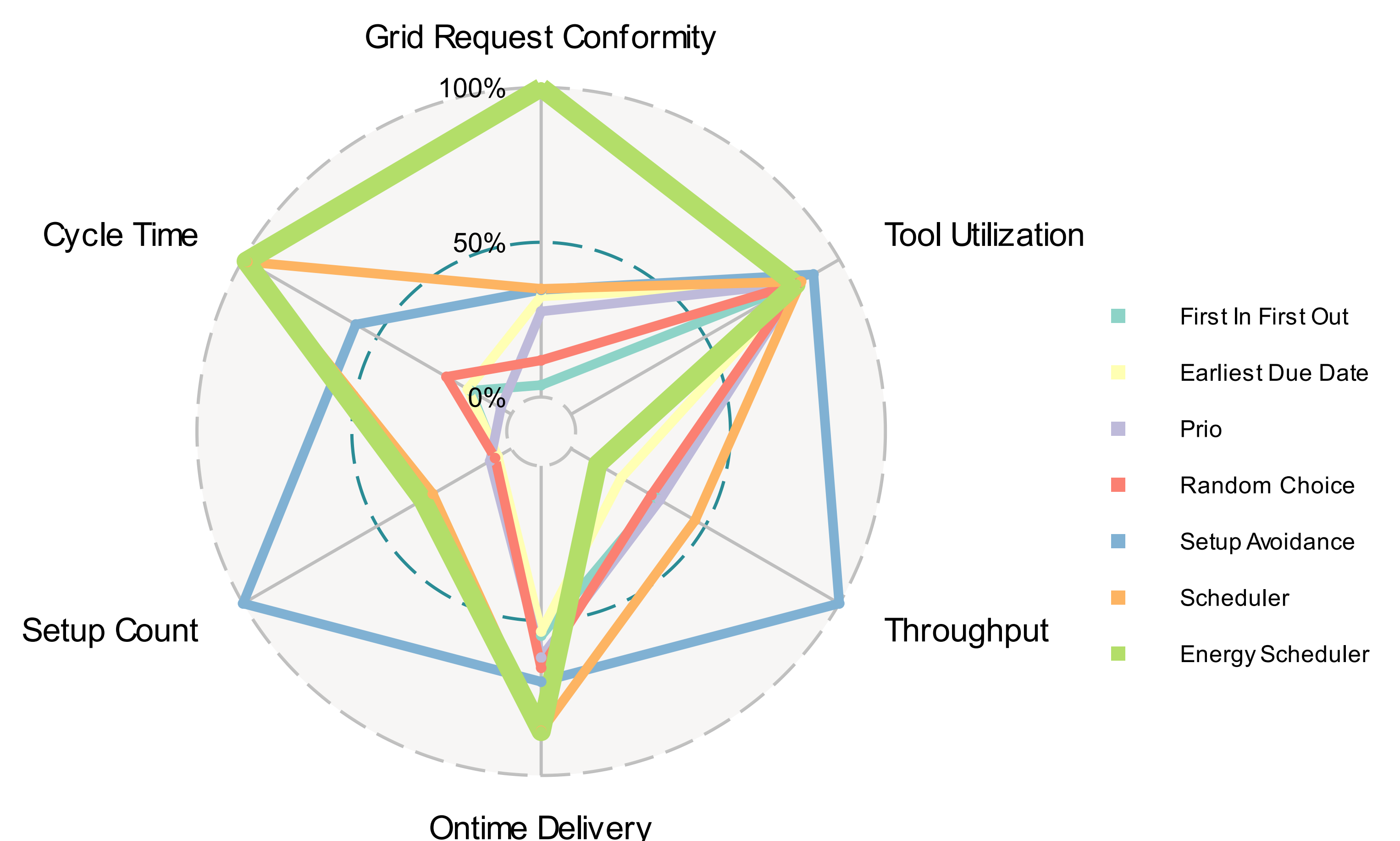
We extend this model to account for grid requests, representing maximum thresholds limiting shopfloor-related power demand.



Simulation and Optimization

Various planning strategies (color-coded in below radar chart) corresponding to different production targets are discernible through simulation of a Nexperia workcenter. Due to the multitude of objectives pertinent to semiconductor production planning, resulting production plans undergo analysis based on several Key Performance Indicators (KPIs), normalized to facilitate comparison.

The proposed test-bed represents a significant step toward sustainable production practices at Nexperia, offering a holistic view of the production line and contributing to a balanced satisfaction of production and sustainability targets.



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