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Research at Dansmästaren

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Uppsala University

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Who I am

Alexander Wallberg

- 2014 – 2019 Master's in Electrical Engineering at Uppsala University
- 2019 – 2024 PhD in Electrical Engineering
  - Project: From Parking to Power
    - Multifunctional building
    - 60 EV charging points
    - EMS
- 2024 - … Researcher at the Division of Electricity at the Department of Electrical Engineering

Department: Electrical Engineering

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Dansmästaren

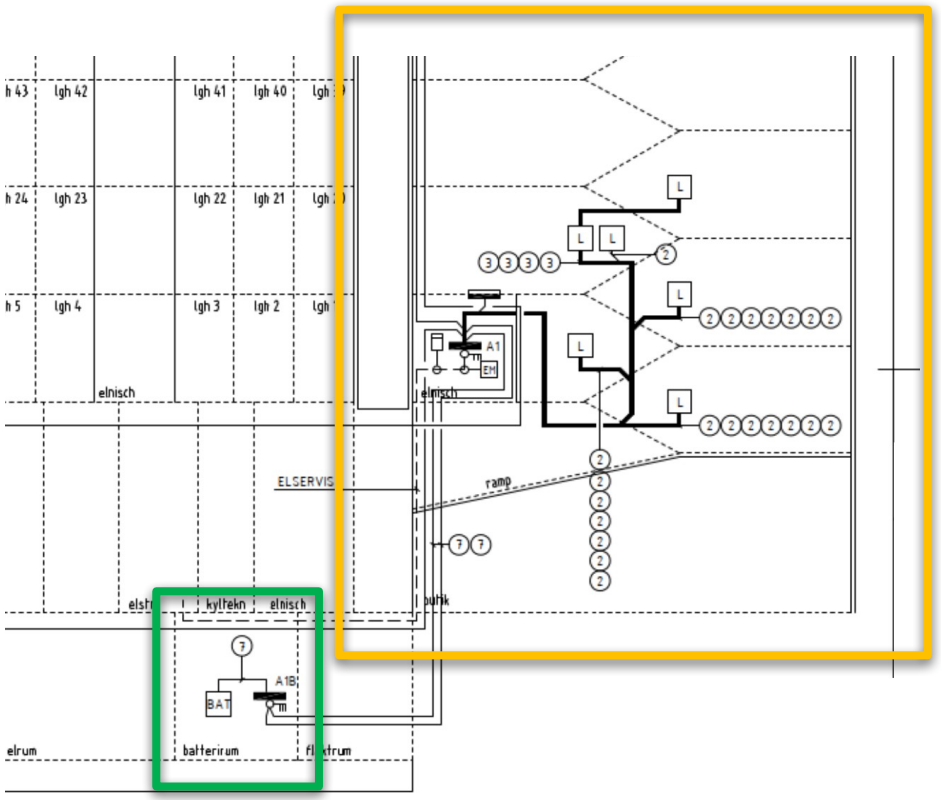
- Uppsala's first multifunctional building
  - Parking
  - Charger for EVs
  - Carpool
  - Apartments
  - Grocery store
  - Postal office
  - Peripheral services
- Owned by Uppsala Municipality
- Focus on the parking facility and the associated technical system

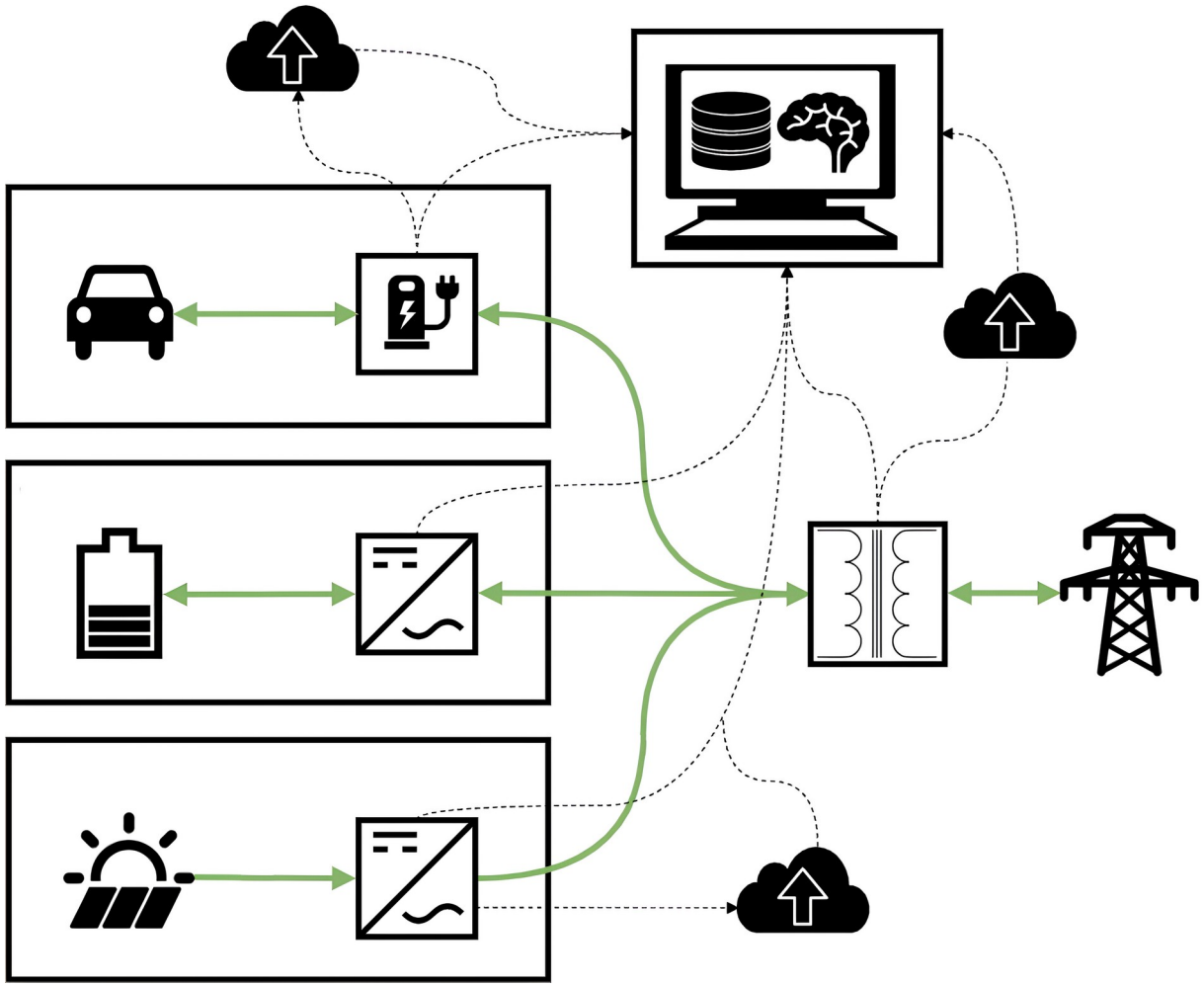


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The challenge

A building with many chargers
has to coordinate electricity use.



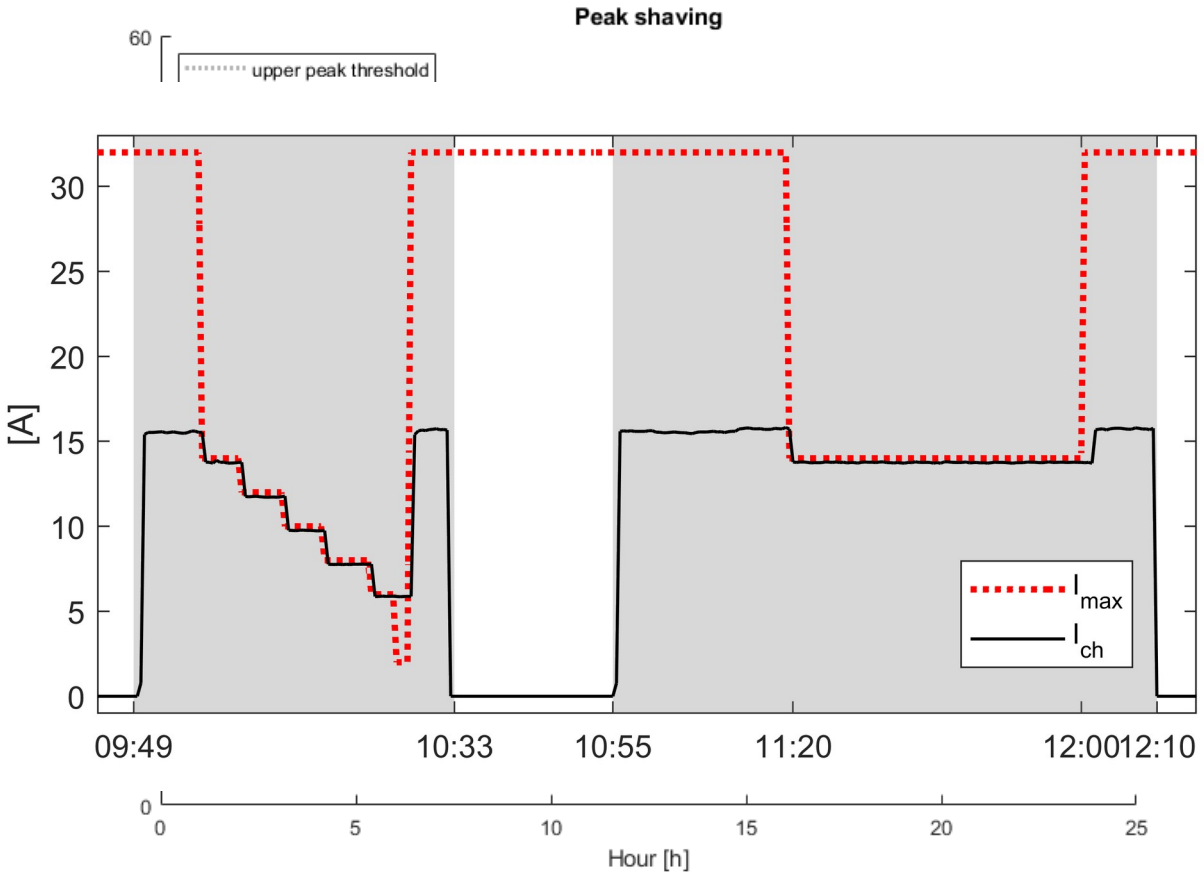


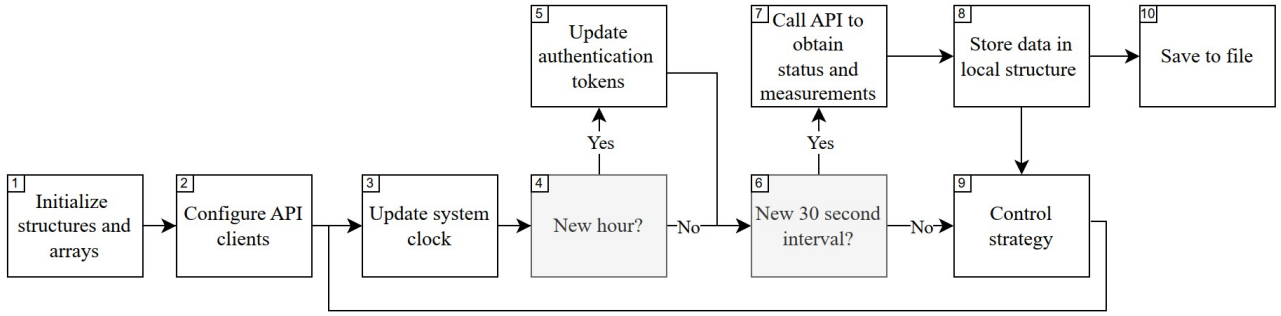
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What I built

Energy management system, EMS

- Monitor, control, and optimize electricity production, distribution, and consumption in the building
- The “brain” of the energy system in the building
- Charging strategies to reduce peaks
  - Load demand prediction
  - Assist or alter EV charging





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The research group



Professor
Rafael
Waters



Castellucci

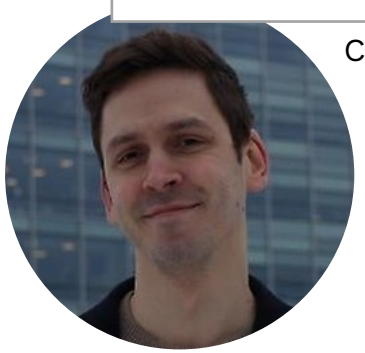




PhD
student
Erika De Bardi

STandUP for ENERGY

Opportunities and Challenges with AI, Big Data, and Cyber Security in Energy Systems



Researcher
Alexander
Wallberg



PhD student
Martina Tibaldi



PhD student
Johannes Ridefelt

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Where the group is heading



PhD student
Marina Martins Mattos

AI forecasts grid demand to enhance smart EV charging

Cyber security: Security of data collection and technical control



PhD student
Erika De Bardi

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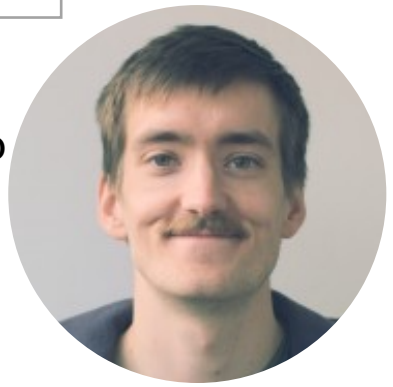
Opportunities and Challenges with AI, Big Data, and Cyber Security in Energy Systems



PhD student
Martina Tibaldi

Models built from collected data to present Dansmästaren and Energy communities

Federated learning to train or use models while keeping data distributed



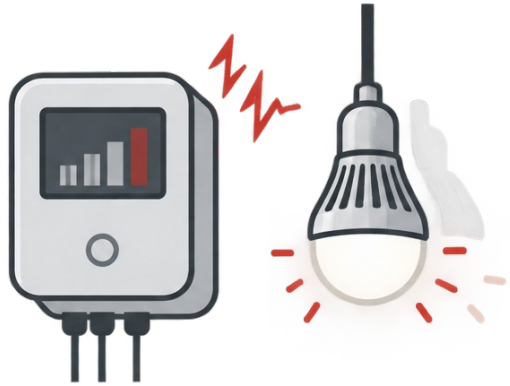
PhD student
Johannes Ridefelt

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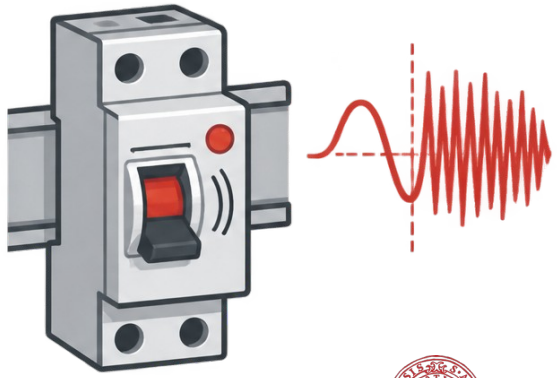
What changed in my research

- Smart charging and V2X
- Power quality & harmonics emission
- We can coordinate *when and how much* cars charge. Now I want to understand what their combined charging does to the electrical network.
- Types of disturbances
  - **Audible noise**
  - **Failure or incorrect operation of consumer electronics**
  - **Premature aging of insulation in cables**
  - **Problems with residual current protection devices**





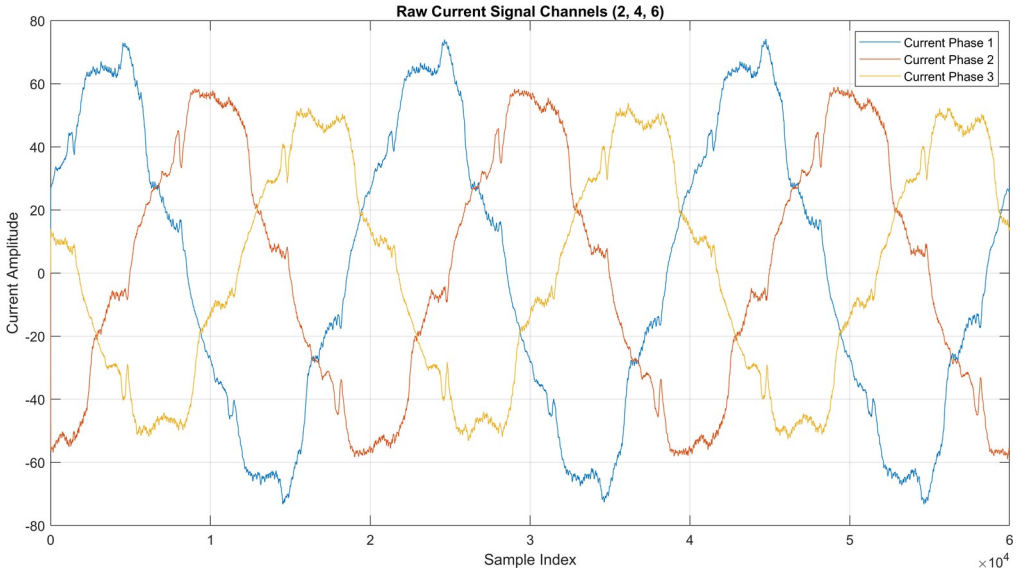


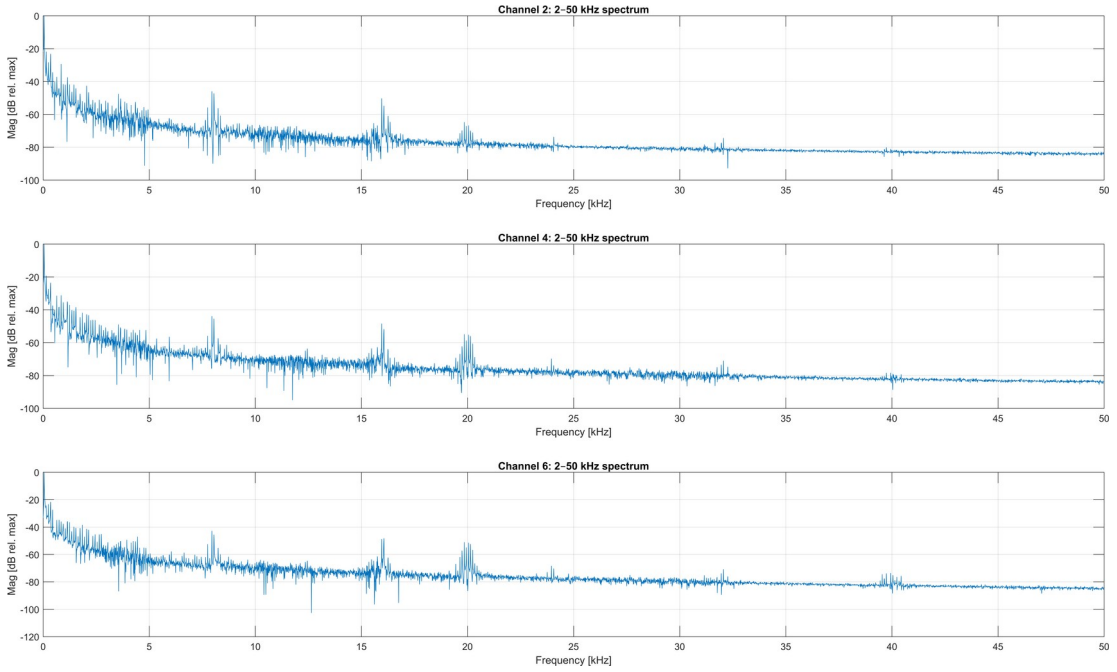


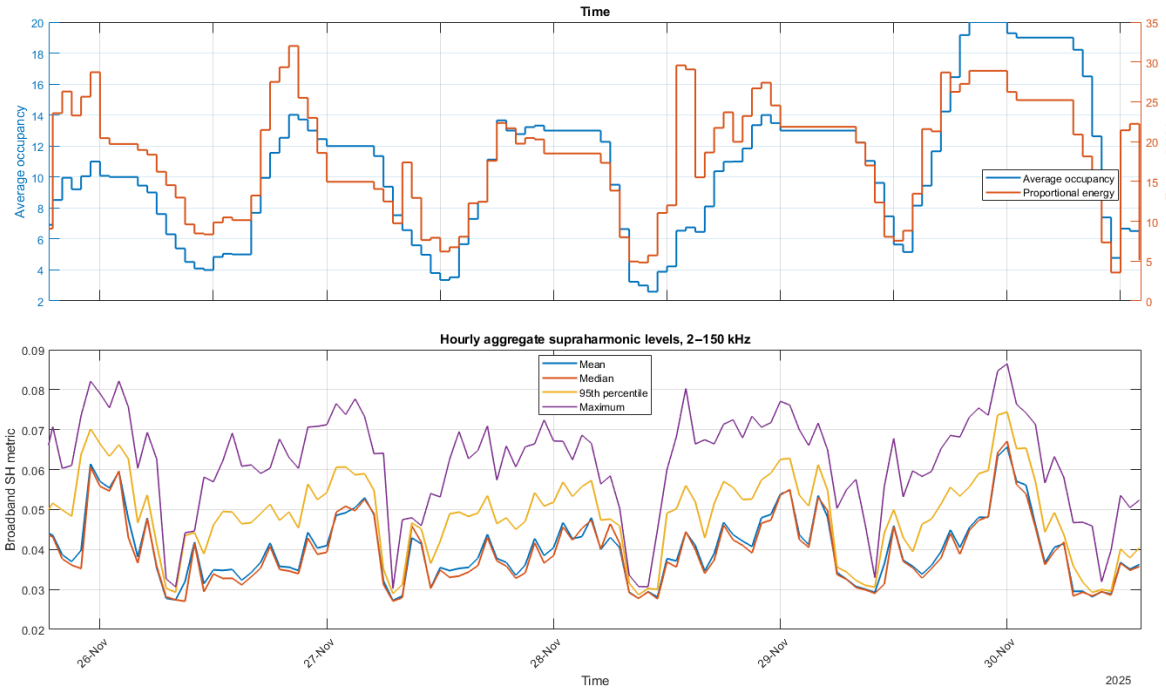
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What I measure now

- Emissions from aggregated EV charging at Dansmästaren
- Currently collection a large dataset – base case
- Investigate summation and propagation of emission







Going forward

- Map how harmonics are generated during smart charging and V2X.
- Investigate how the harmonics spread in large parking facilities.
- Mitigation tactics
  - Adapt charging behavior and strategies to reduce EV charging emissions
- Inform the municipality about their buildings grid impact
- Dansmästaren lets us move from controlling and coordination EV charging to understanding its effects on power quality and grid impact



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Thanks for listening!
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VOLVO