EV systems: current research & future outlook

Electromobility Ecosystems: Towards mass electrification

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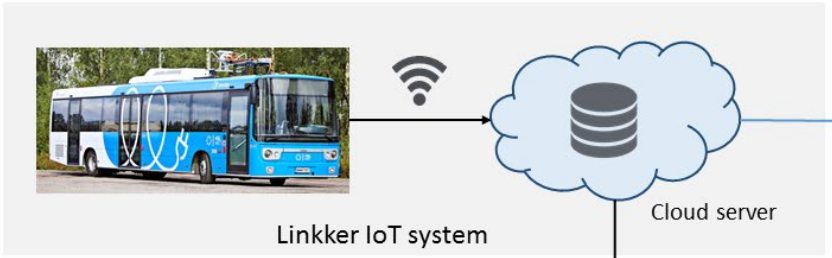
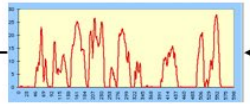
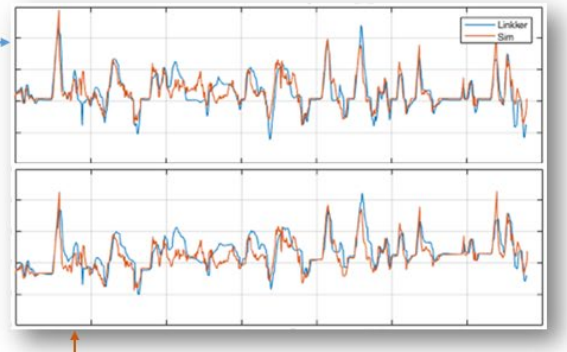
Research results on:

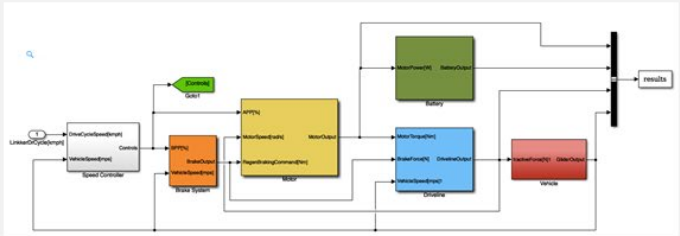
- **Electric busses**
  - DSc theses: Klaus Kivekäs *23.8.2019*
    Jari Vepsäläinen *22.11.2019*
- **EV charging**
- **Battery research**
- **Future?**

IoT harnessed for electric bus design

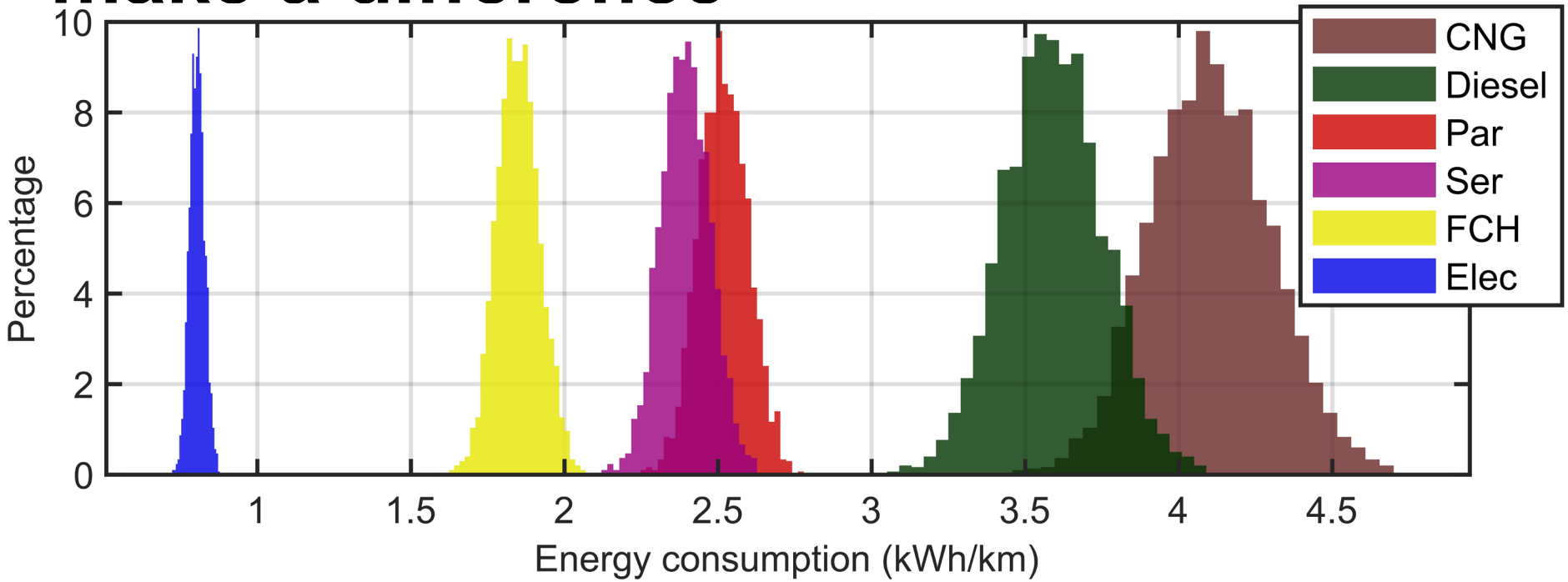




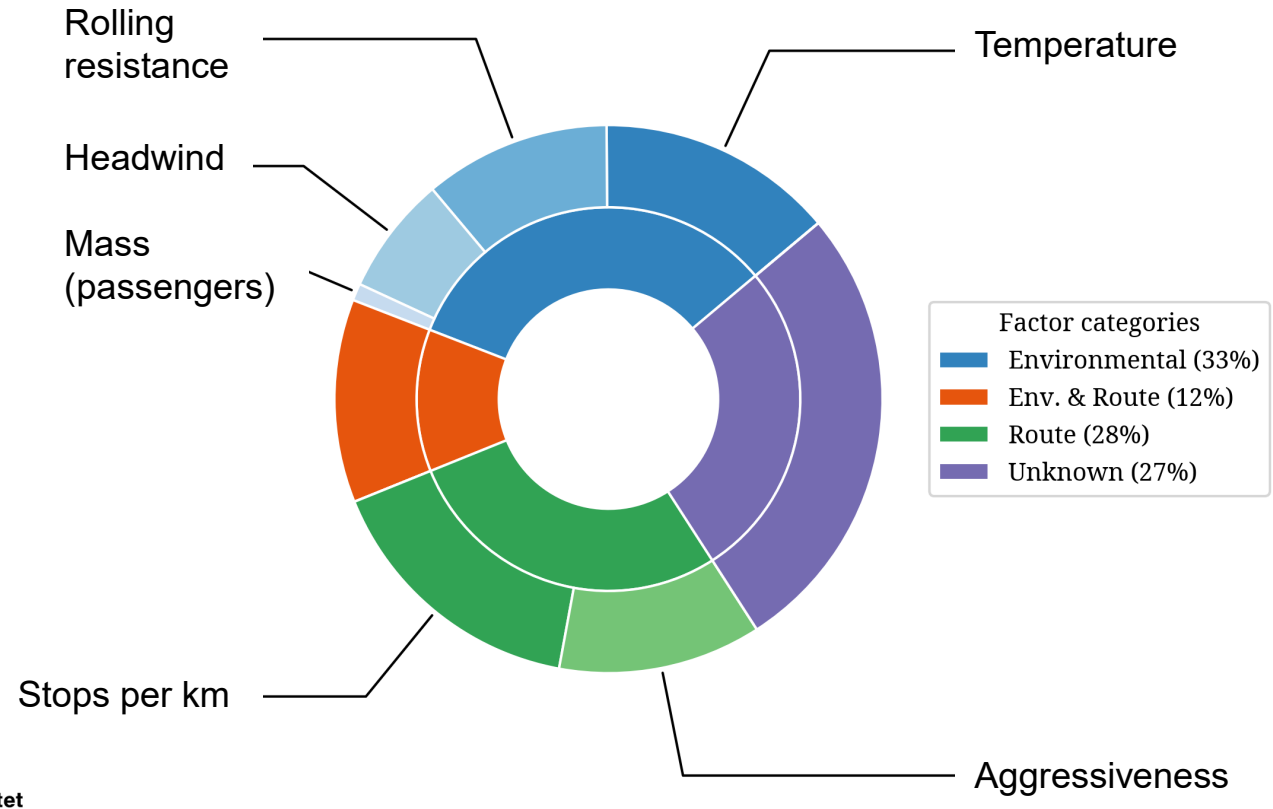




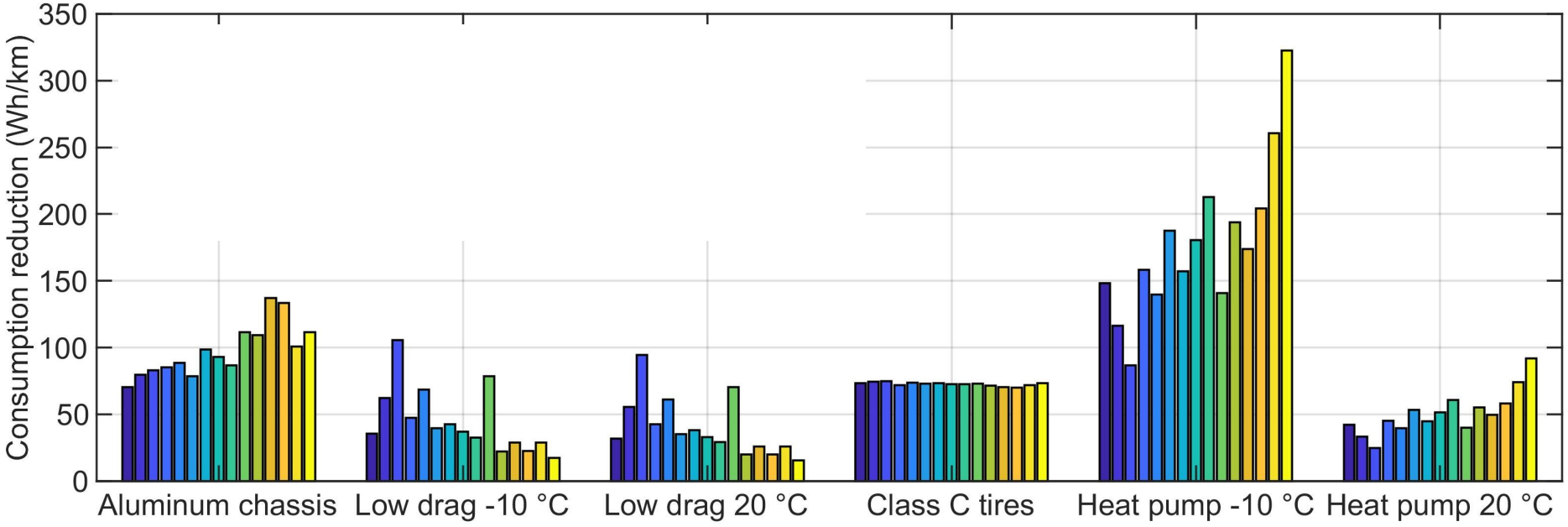
Efficiency and regeneration make a difference



Factors: Energy consumption variability

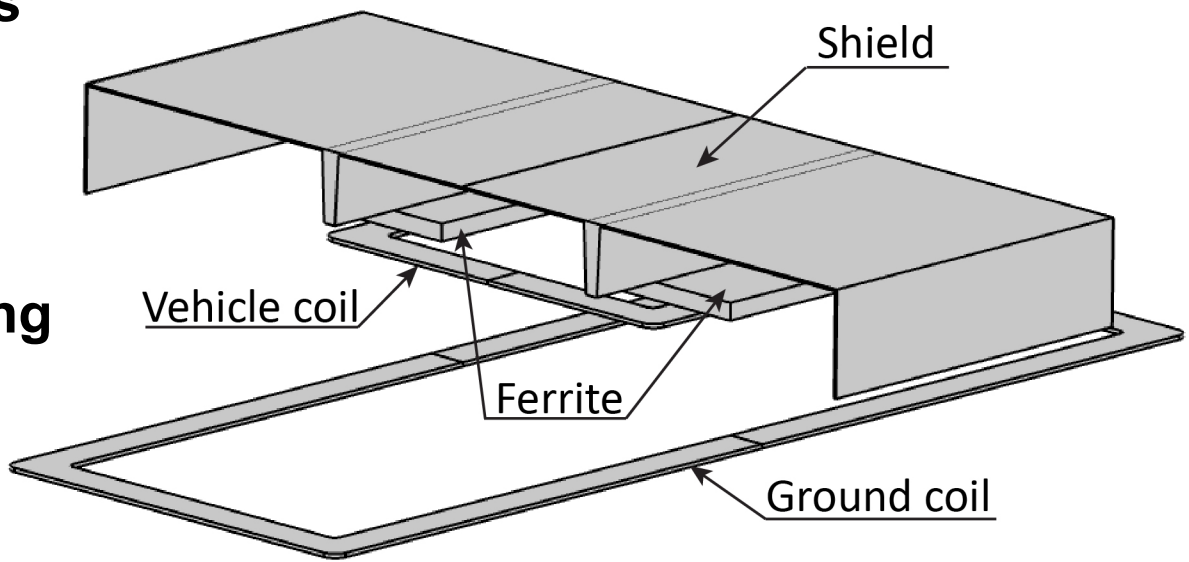


Design choices reduce consumption



Wireless charging

- **Static: on e.g. parking lot**
- **Dynamic: on road e.g. traffic lights, bus stops**
- **Demonstrated up to 70-80 km/h, 30 kW**
- **Adding range, not replacing fixed charging**
- **Efficiency?**



Batteries for vehicles and machines

Non-destructive analysis of batteries using X-rays

Battery tester (cycler)

XCT Shadowgrams at 10 µm res.
500 mAh LiPo cell

Future?

- **Biofuels** *vs.* **hybrids** *vs.* **fully electric?**
- **Fuel cell*** *vs.* **EV fast charging** *vs.* **opportunity charging?**
- **Owning** *vs.* **shared?**
- **Autonomous** *vs.* **human driven?**
- **Physical mobility** *vs.* **virtual mobility?**

** remember to study Sabatier equation:*
https://en.wikipedia.org/wiki/Sabatier_reaction