

UiO • **Department of Technology Systems**
University of Oslo

Energy Modelling - Master Thesis at ITS - Nov2022

Communication and Modelling for a Sustainability Future

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Energy & Digital, enablers for the SDGs

7 AFFORDABLE AND CLEAN ENERGY



People without electricity

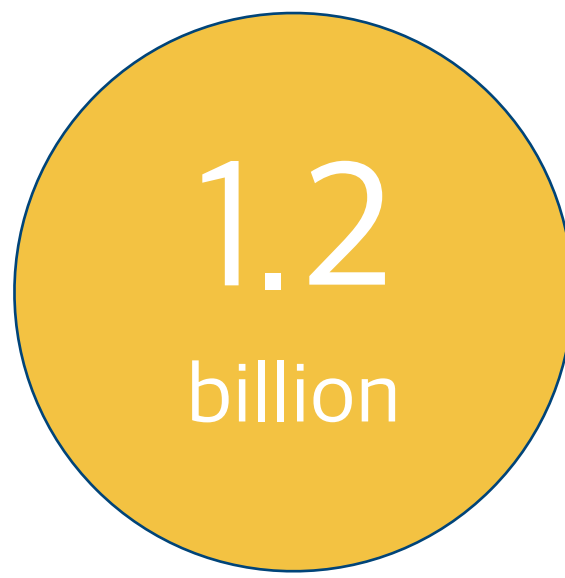
SDG 7.1 calls for universal access to ... energy by 2030

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



People not using Internet

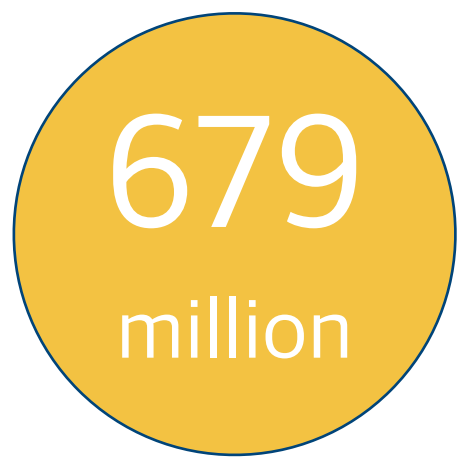
SDG 9c calls for universal, affordable internet access by 2020



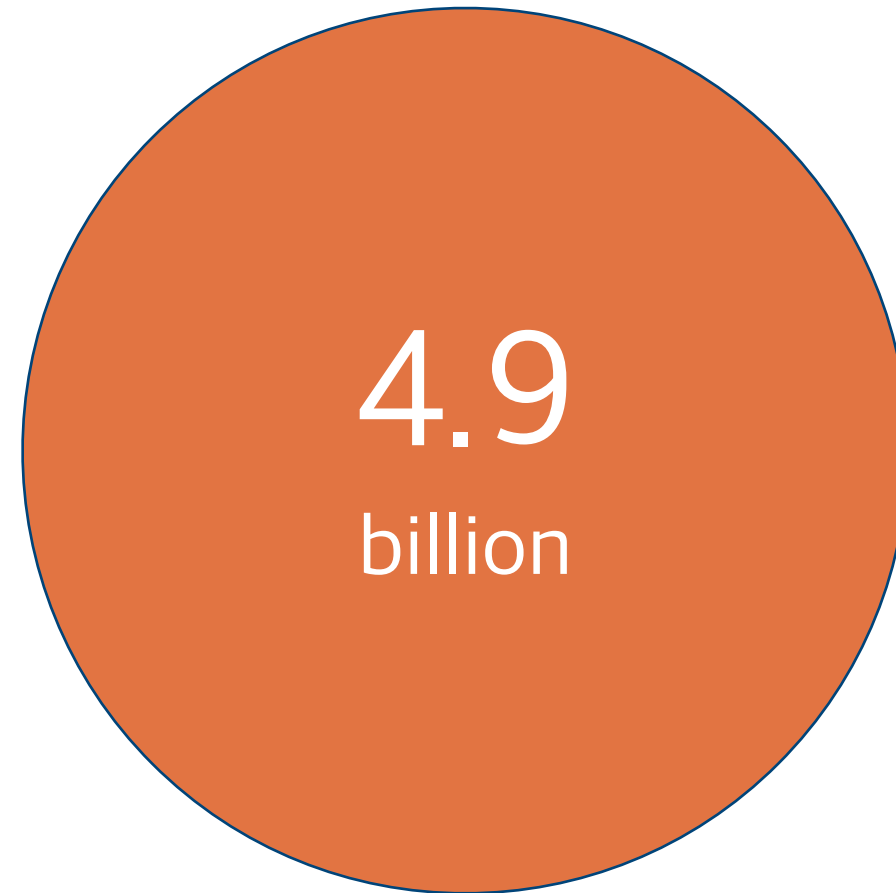
2010



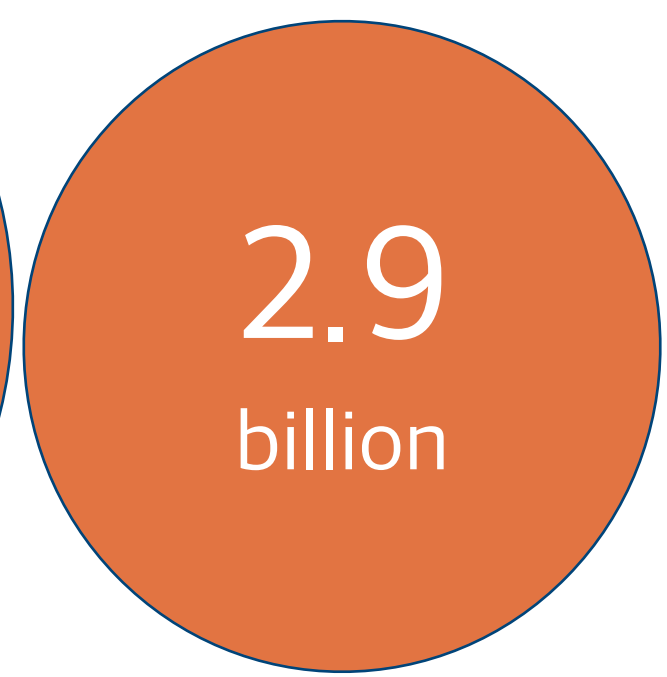
2020



2030 (trend)

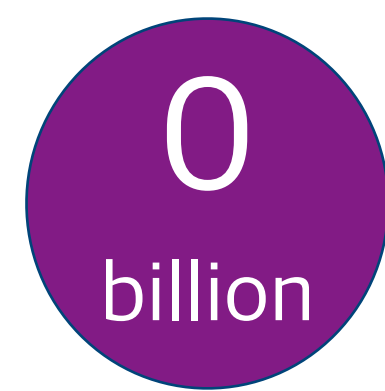


2010



2021

96% in dev countries



2030 (hope)



WSIS Forum 2022

[WorldBank 2021]

<https://www.worldbank.org/en/news/press-release/2021/06/07/report-universal-access-to-sustainable-energy-will-remain-elusive-without-addressing-inequalities>

[ITU 2010, 2021]

<https://www.itu.int/hub/2021/11/facts-and-figures-2021-2-9-billion-people-still-offline/>

Africa "Connect The Future"



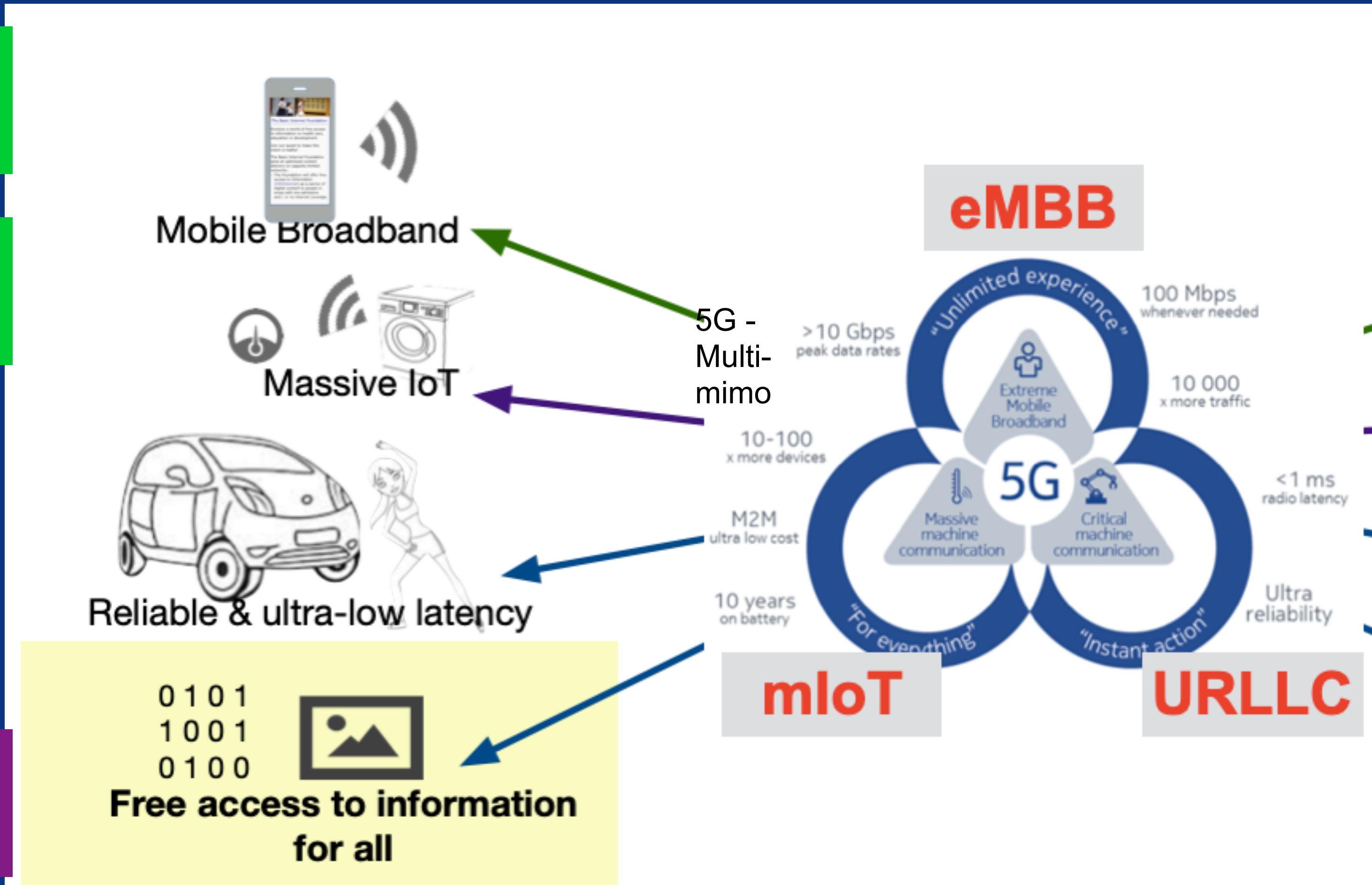
[https://
www.mylifeelsewhere.com/
country-size-comparison/
tanzania/norway](https://www.mylifeelsewhere.com/country-size-comparison/tanzania/norway)

What do we need to change?

Road model: pedestrians & cyclists

Internet: text & pictures

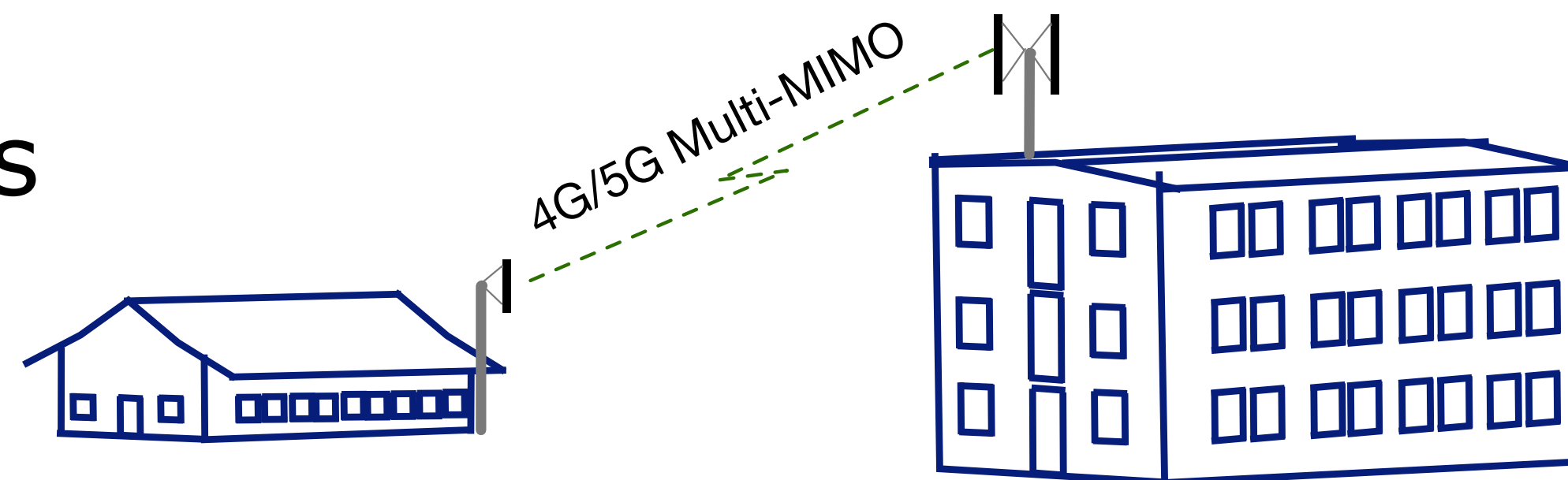
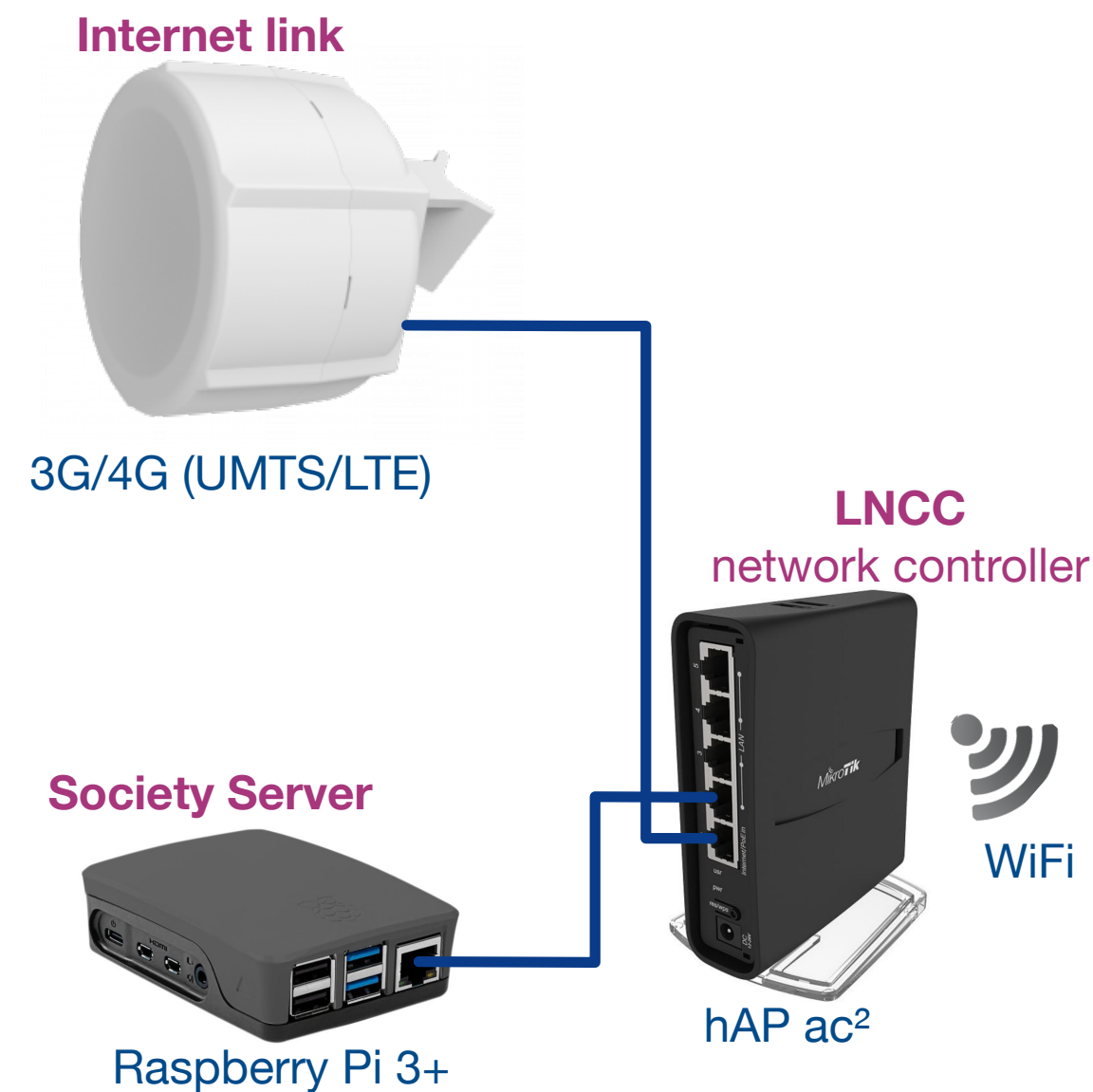
Internet Lite



Solving the Challenge of Access

- ➔ Wireless information spot (InfoSpot)
 - Reaching out >20 km to 3G/4G network
 - Affordable solution: OPEX <20 USD/month

- ➔ Next: 5G access
 - University to schools



Electrical systems

- Device level: Sensor, Mobile phone,
- Micro-grid:
 - House, Shed
 - Village-/Neighbourhood network
 - Industrial system (Power box)
- Region/country/international grid
 - Nordic Net

Hospital – Galkayo, Somalia

Project: Hospital Size (kWp): 36,0 System: Energy Save



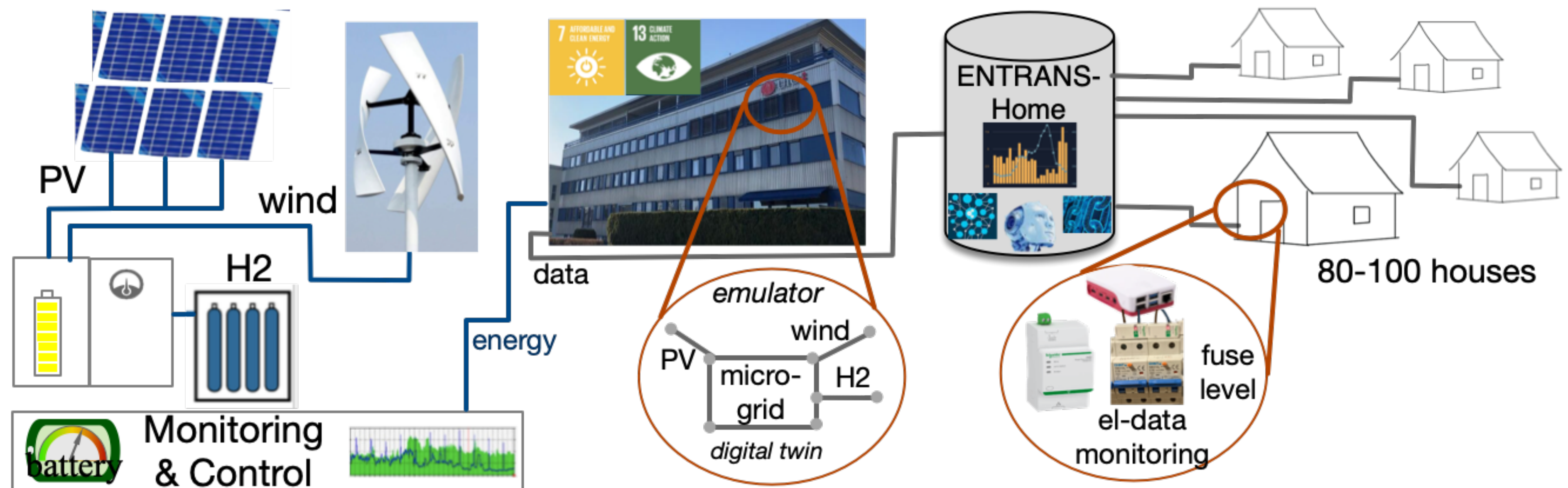
Waterpump – Mwingi, Kenya

Project: Waterpump Size (kWp): 2,7 System: Off-grid



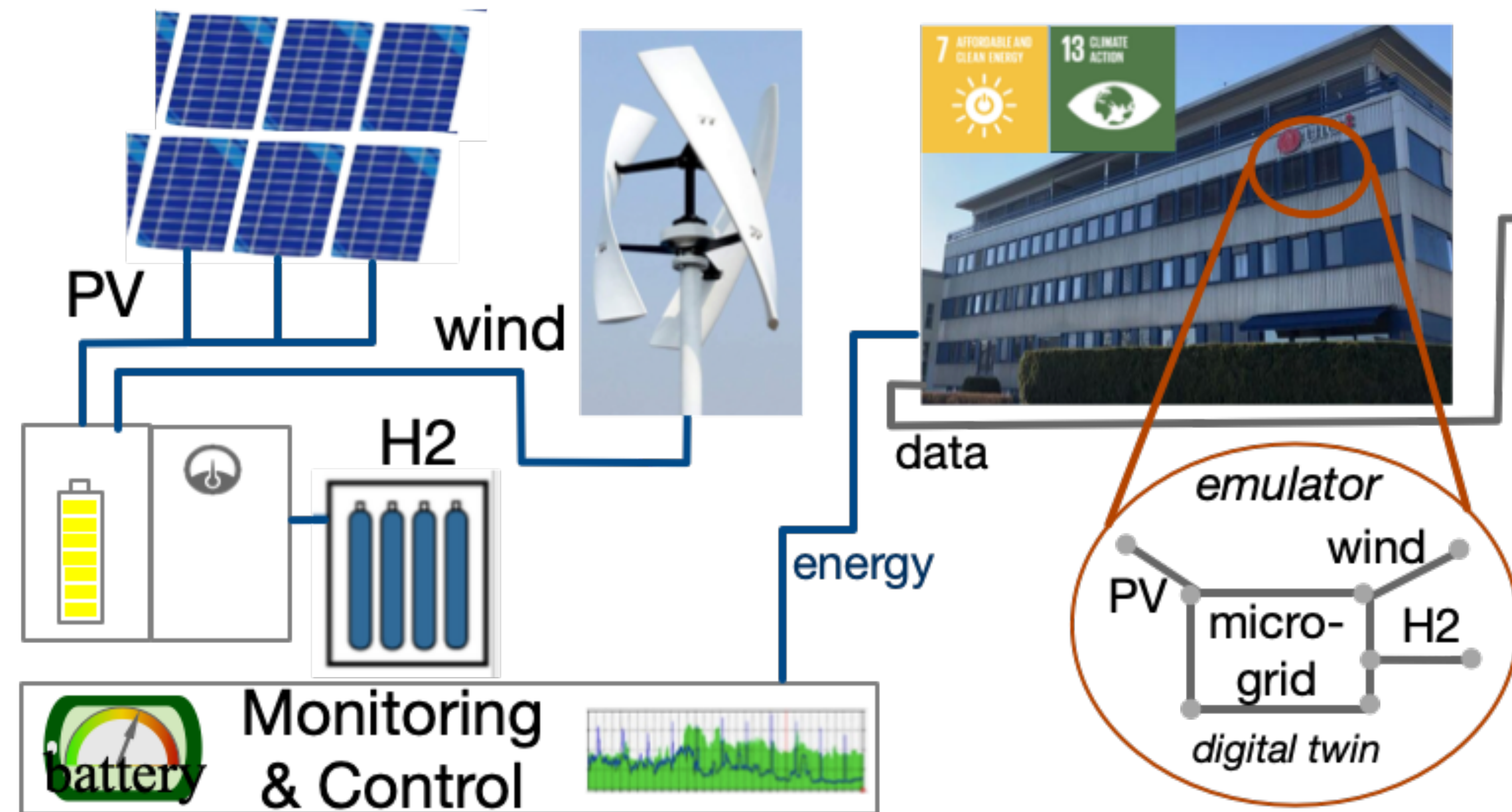
Distributed Energy System and Security Infrastructure (DESSI)

- Physical infrastructure (PV, H2, wind)
- Digital Twin (Simulator)
- ENTRANS-Home scientific database



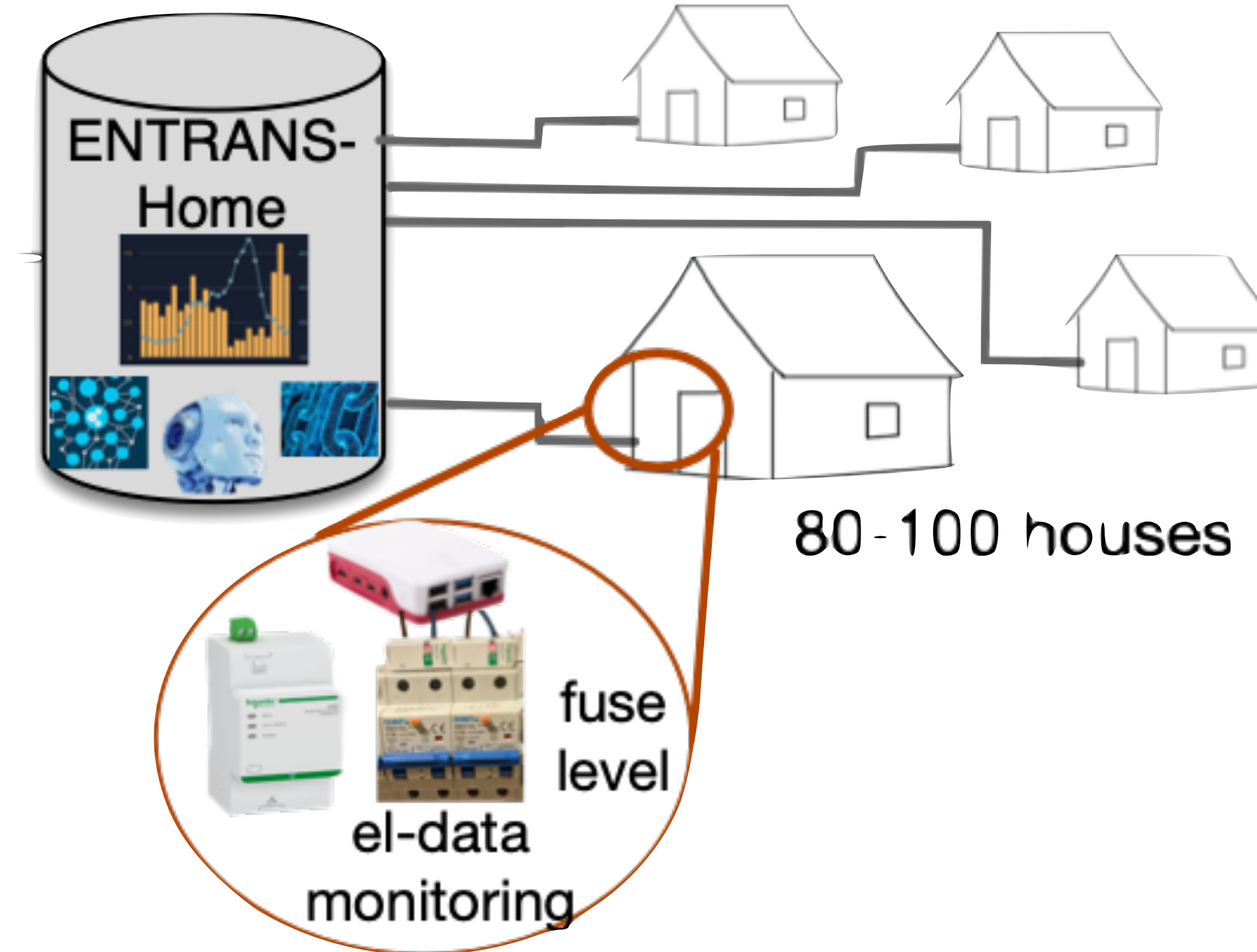
Physical infrastructure & Digital Twin

- ➔ Physical infrastructure
 - understanding real data
 - weather (effect)
- ➔ Simulator lab
 - Digital Twin
 - SFF: *Twins4Life: The Science of Digital Twins* (322299)
 - Simulate
 - Climate effect
 - daily/seasonal variations
- ➔ Outcome
 - Education & research
 - Recommendations & public



ENTRANS-Home scientific database

- Unique Scientific database
 - high-resolutions electricity data
 - every 10 s, per fuse
 - commercial actors (tibber, homely,...)
- Outcome
 - Recruitment: VGS Oslo-Viken (Nittedal, Strømmen, Ullern,... Elektrofagdag)
 - Research:
 - privacy awareness (10 s, 1 min, **15 min**, **1 h...**)
 - H2020 unique database
 - Recommendations: “*Nettleiemodell*”

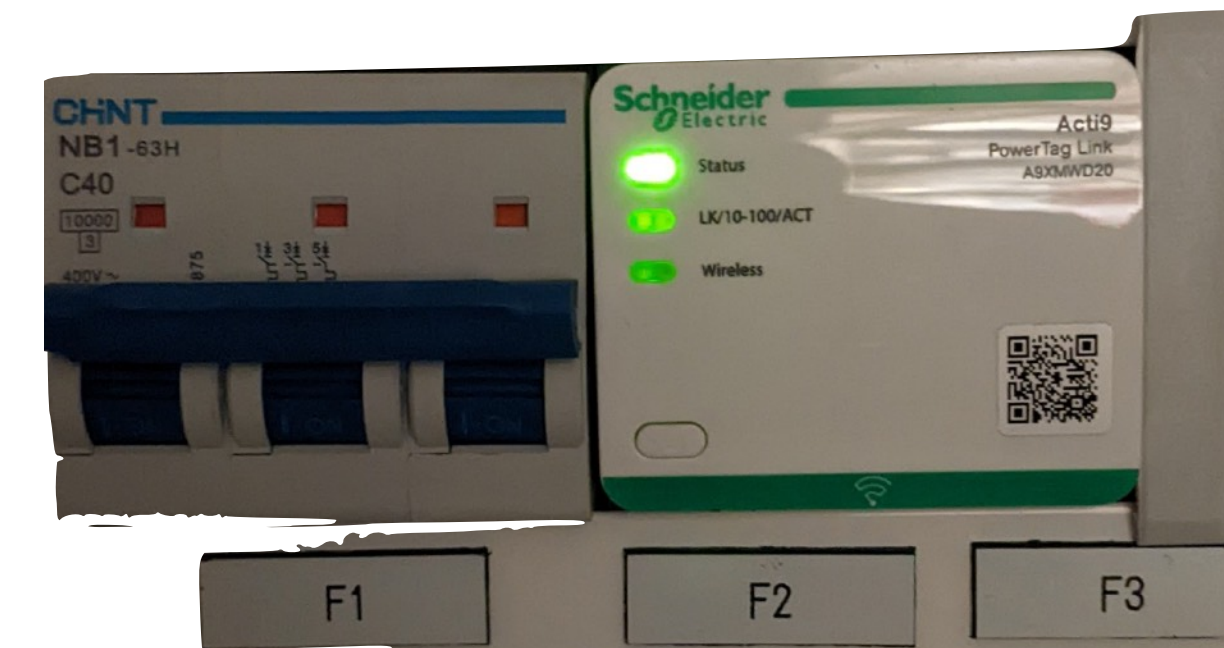


Bruk aldri vaskemaskin, tørketrommel eller andre husholdningsapparater når du ikke er til stede eller sover.

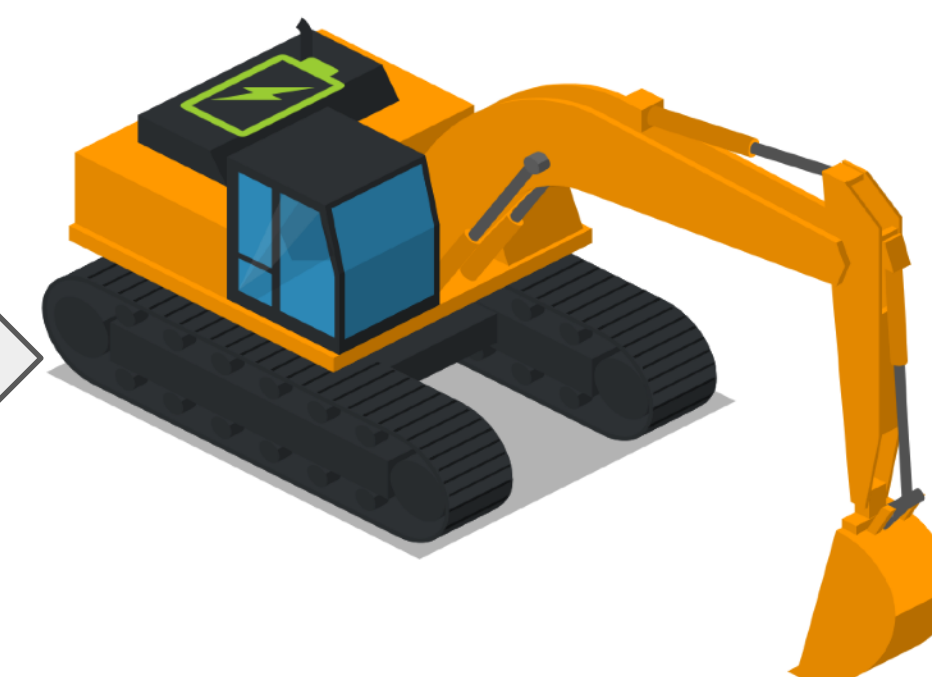
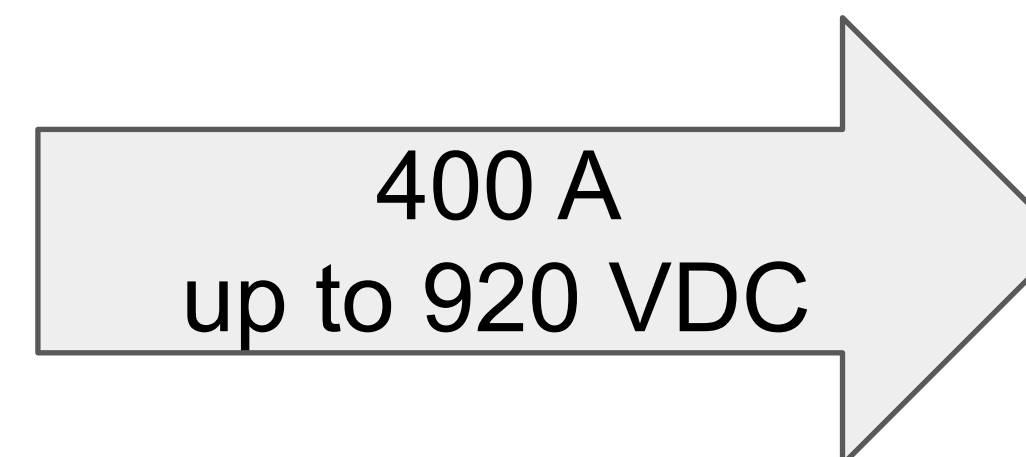
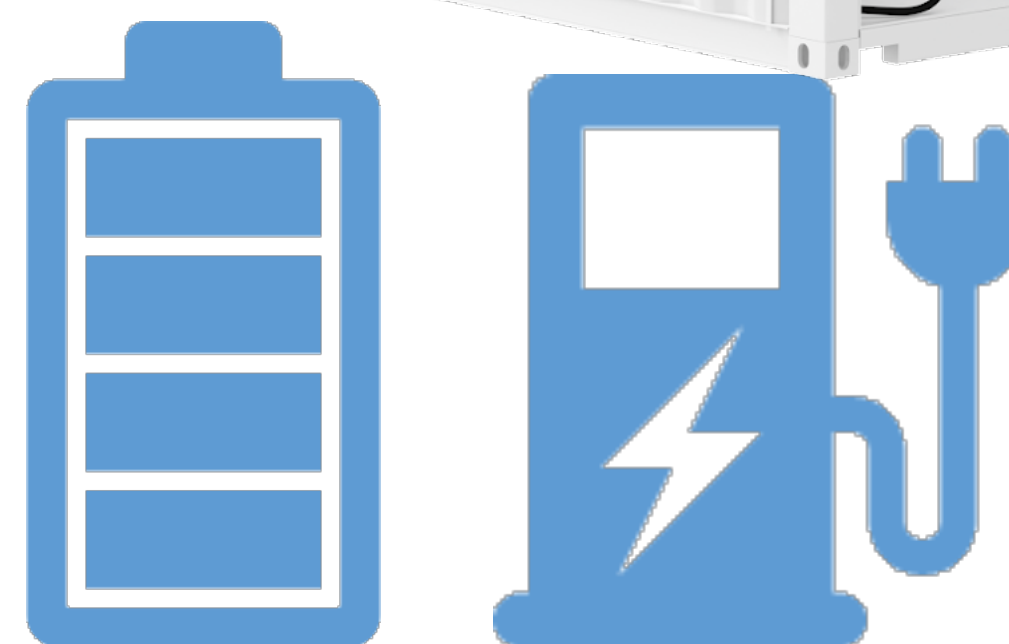
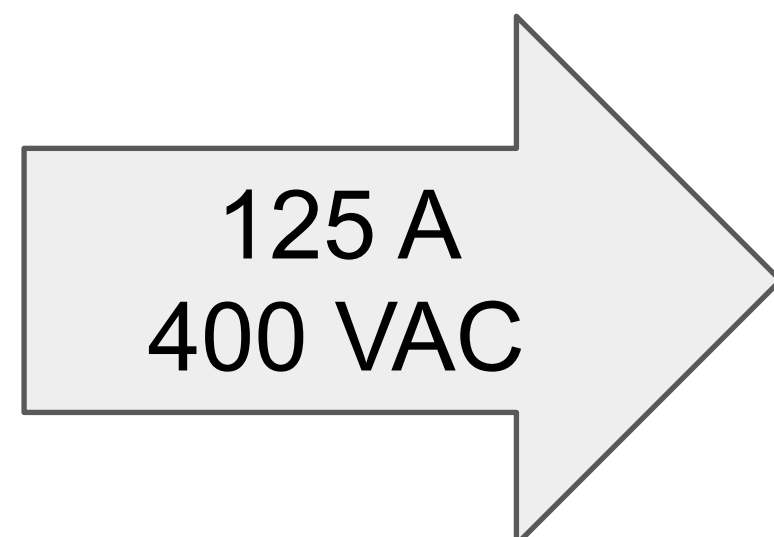
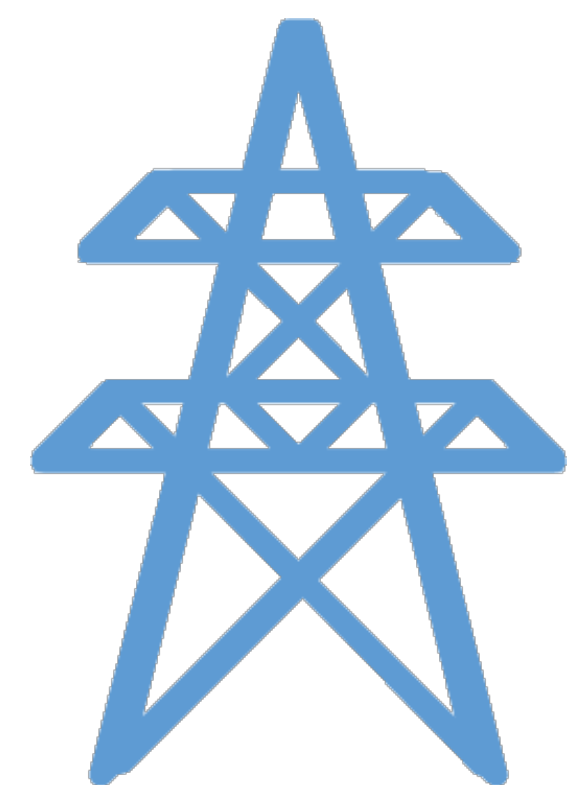
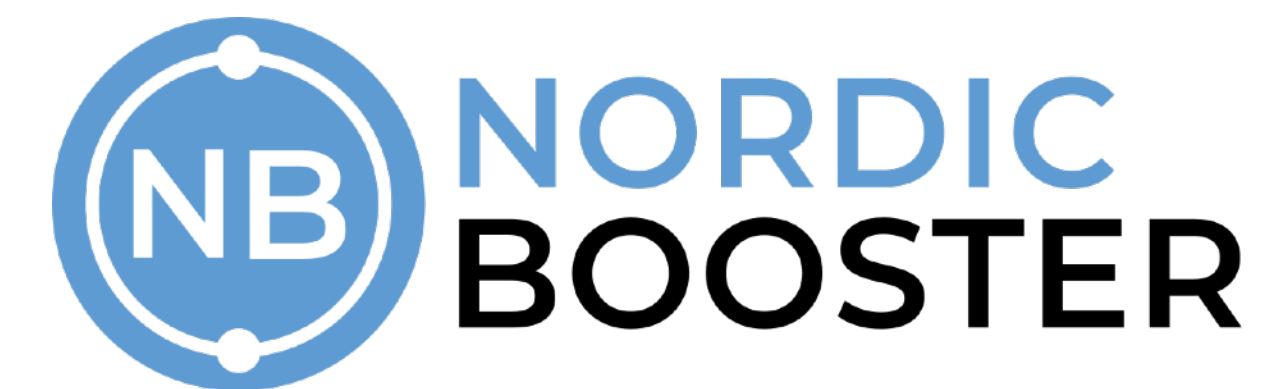
[Source: <https://www.elvia.no/nettleie/alt-du-ma-vite-om-ny-nettleie-for-2022/>]

Home infrastructure

- Grid-stabilisation
 - frequency stabilisation through battery or home demand
 - given grid demand and solar-/wind-variation
- Home monitoring & control
 - Integrated solutions using Raspberry Pi
 -



Løsningen



No more diesel engines



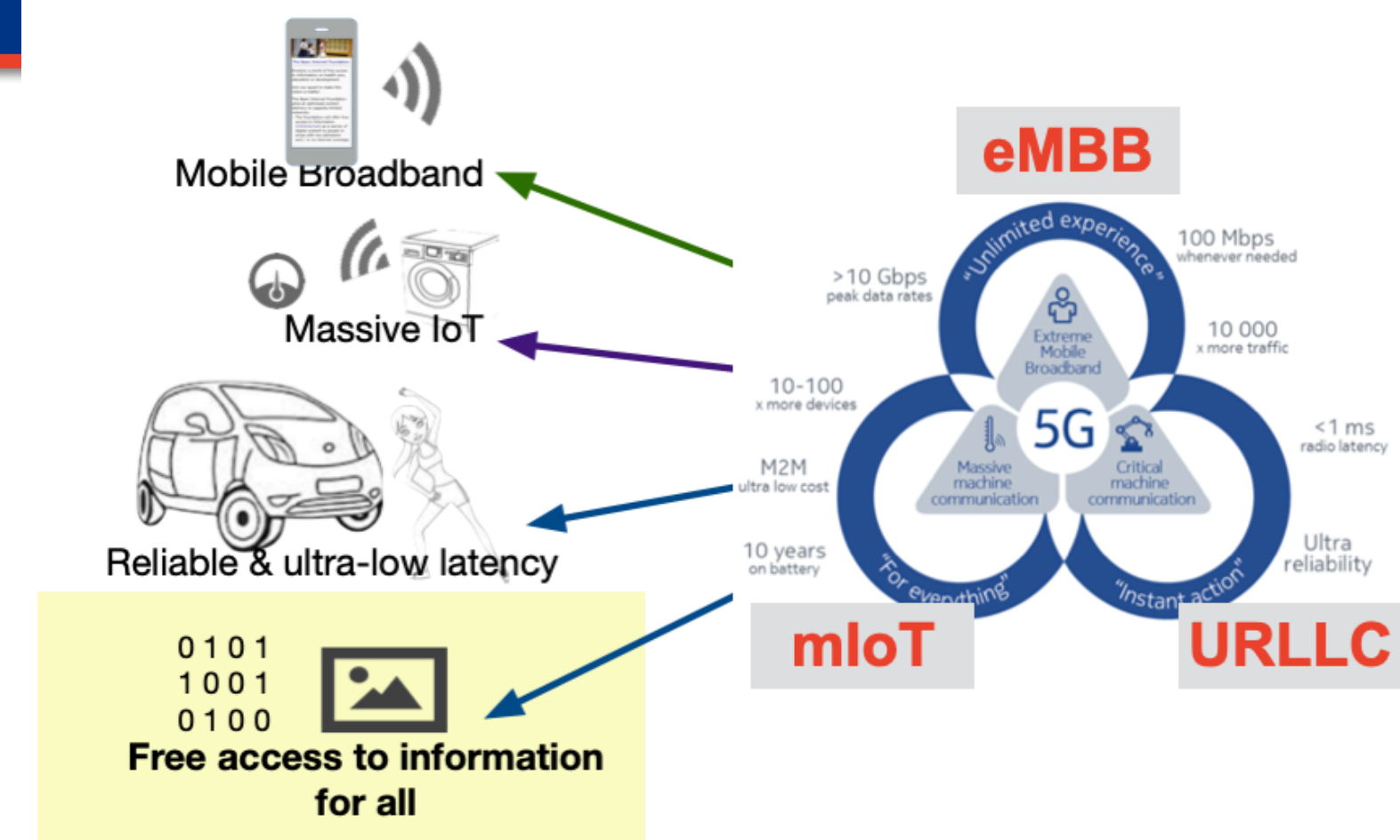
Mobile and reusable solutions

NordicBooster.com

Topics for Project or Master Thesis

- Construction: PhD Machine Learning - optimisation - "enough energy"
 - National vehicle market: trucks and busses - "charging modules"
 - delivery, range, -> optimisation of charging infrastructure (Bama...)
 - combine with power availability (Glitre, ..., Elvia)
- Grid vs flexible energy solutions (Utsira)
- Sensor (temp, hum, ...) for energy controlling (Nordic Booster, Siemens, ABB, Schneider,...)
- Container heating (depending on usage profile and expected temperature)
- Daily, Weekly, Monthly energy storage
- Fast-frequency response market
 - mid-European countries (e.g. UK 50% wind)
 - long transmission line (DSO), due to inductance on the line (V, f drop)
 - willingness from TSO/DSO for battery to compensate

Conclusion - Master Thesis opportunities Digital for Sustainable Internet Connectivity

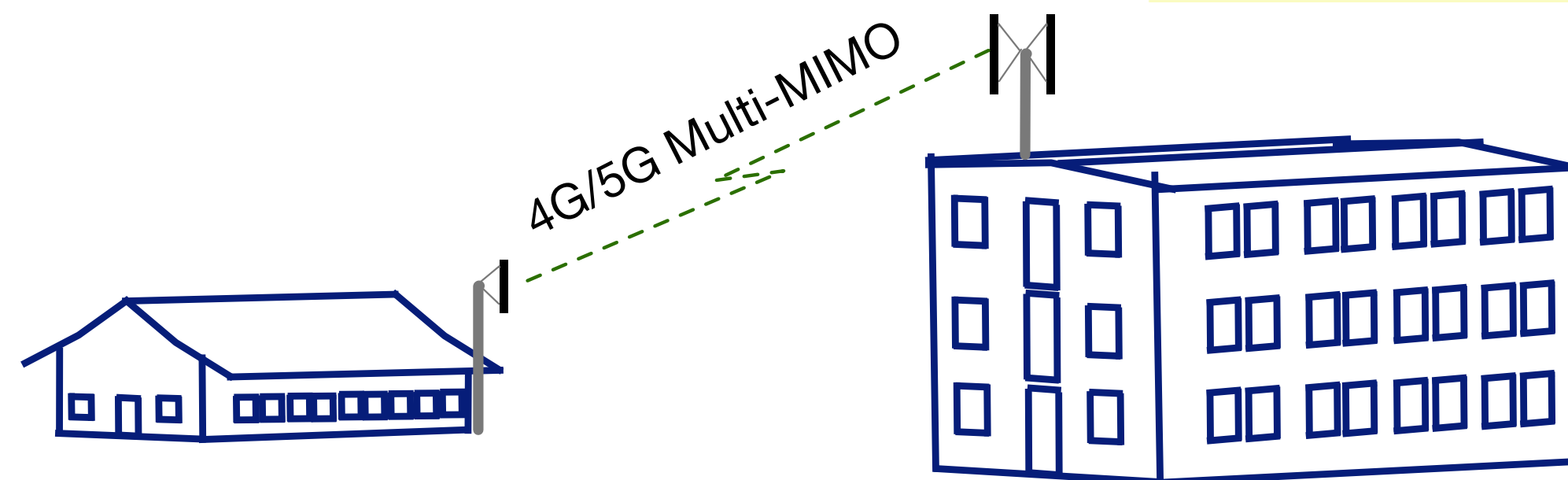


→ Communications

- Internet Lite - "Digital Pedestrians & Cyclists"
- 5G InfoSpot - Universities connecting schools

→ Energy Modelling

- physical infrastructure (H2, wind, solar)
- digital twin



→ Home automation

- Scientific database
- machine learning

Interest in a Master Thesis,
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