UNIVERSITY OF OSLO

Elektrodagen - OsloMet - 27Okt2023

Energiforbruk, Styring og Bærekraft
og det digitale skiftet


Vi må omstille energisystemet vårt og produsere store mengder ny fornybar kraft, skriver Ole Erik Almlid. *Foto: Terje H.T. Andersen*

Josef Noll

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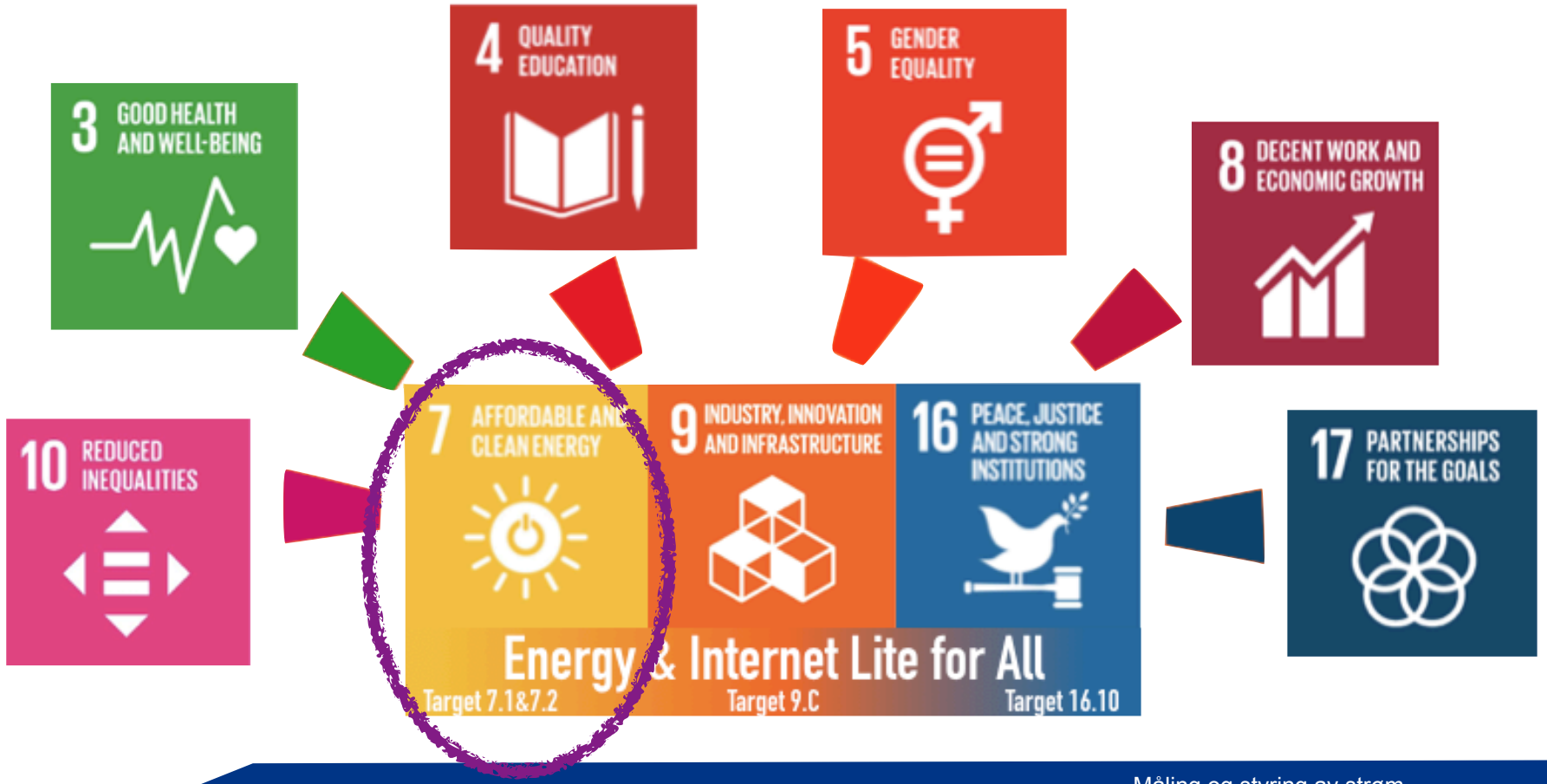
Department of Technology Systems
Kjeller, Norway, m: +47 9083 8066

Bærekraftig utvikling
hva er katalysator for Bærekraftsmålene (SDGs)?



SDG 1.4 Equal access to basic services

SDG 4.A Education facilities for effective learning for all

SDG 5.B Use of enabling technologies

SDG 9.C universal and affordable access

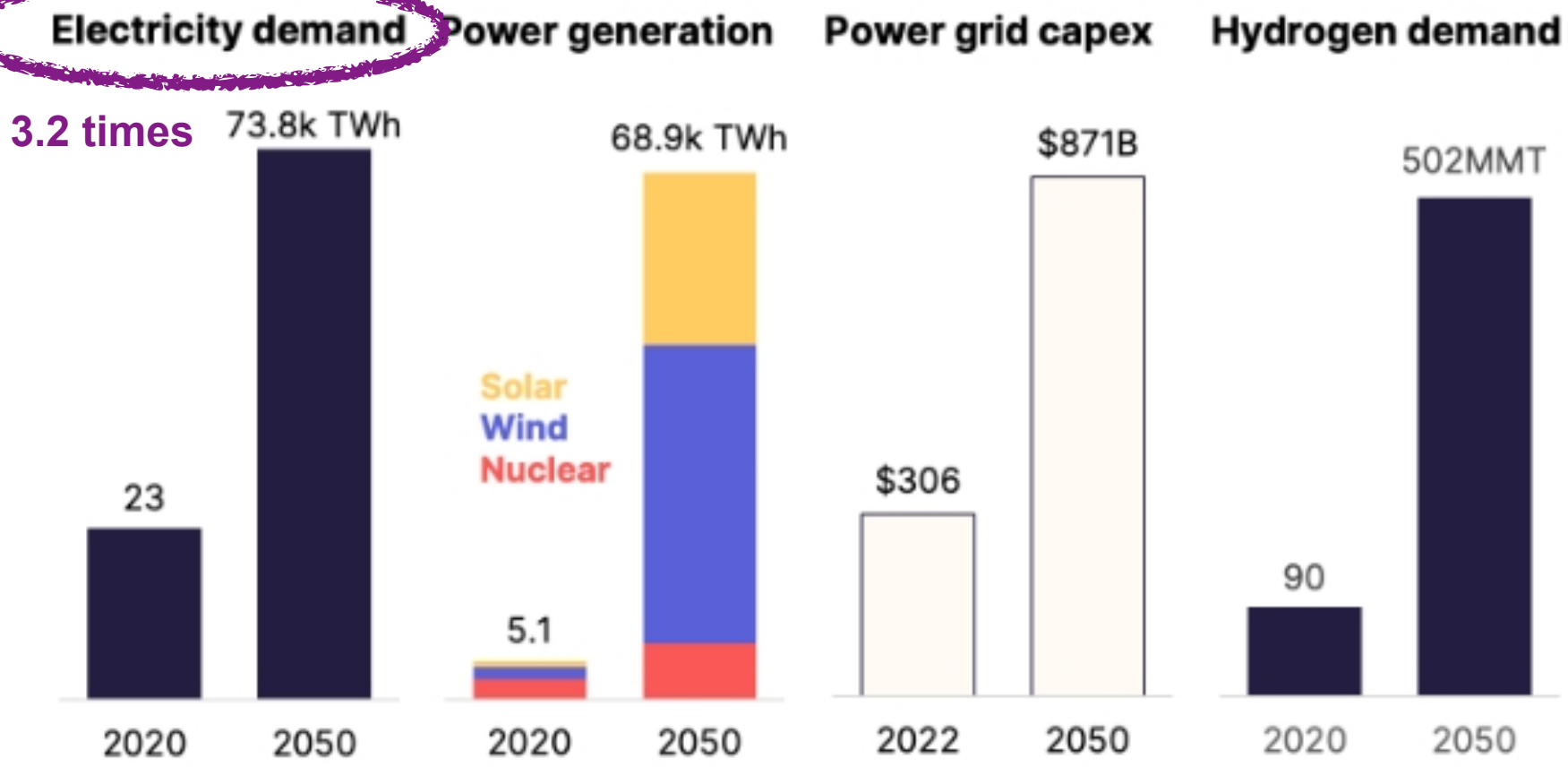
SDG 16.10 ensure public access to information

SDG 17 Partnerships for the Goals

Energiforbruk

Net zero means much more energy

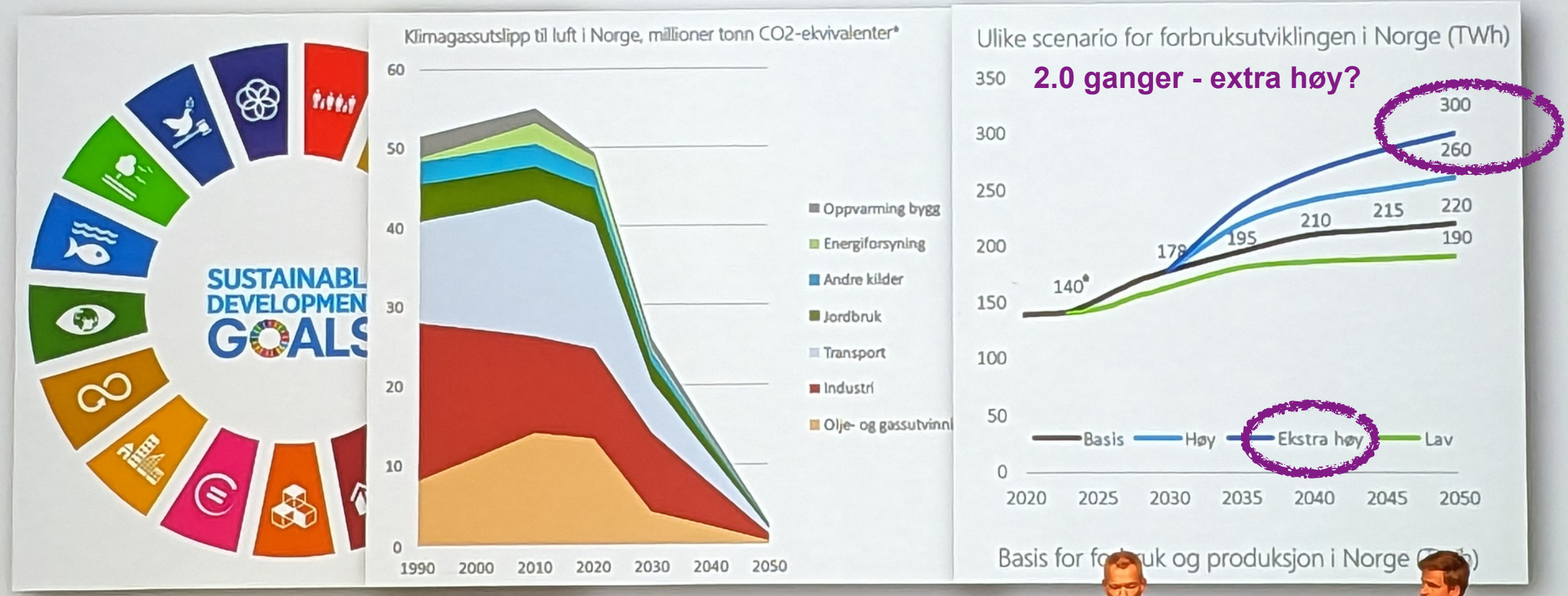
Power demand and grid capex triple; hydrogen demand grows more than 5x



[Source: NathanielBullard.com/presentations - Jan2023]

Sustainability and electrification

Source: Statnett LMA 2022

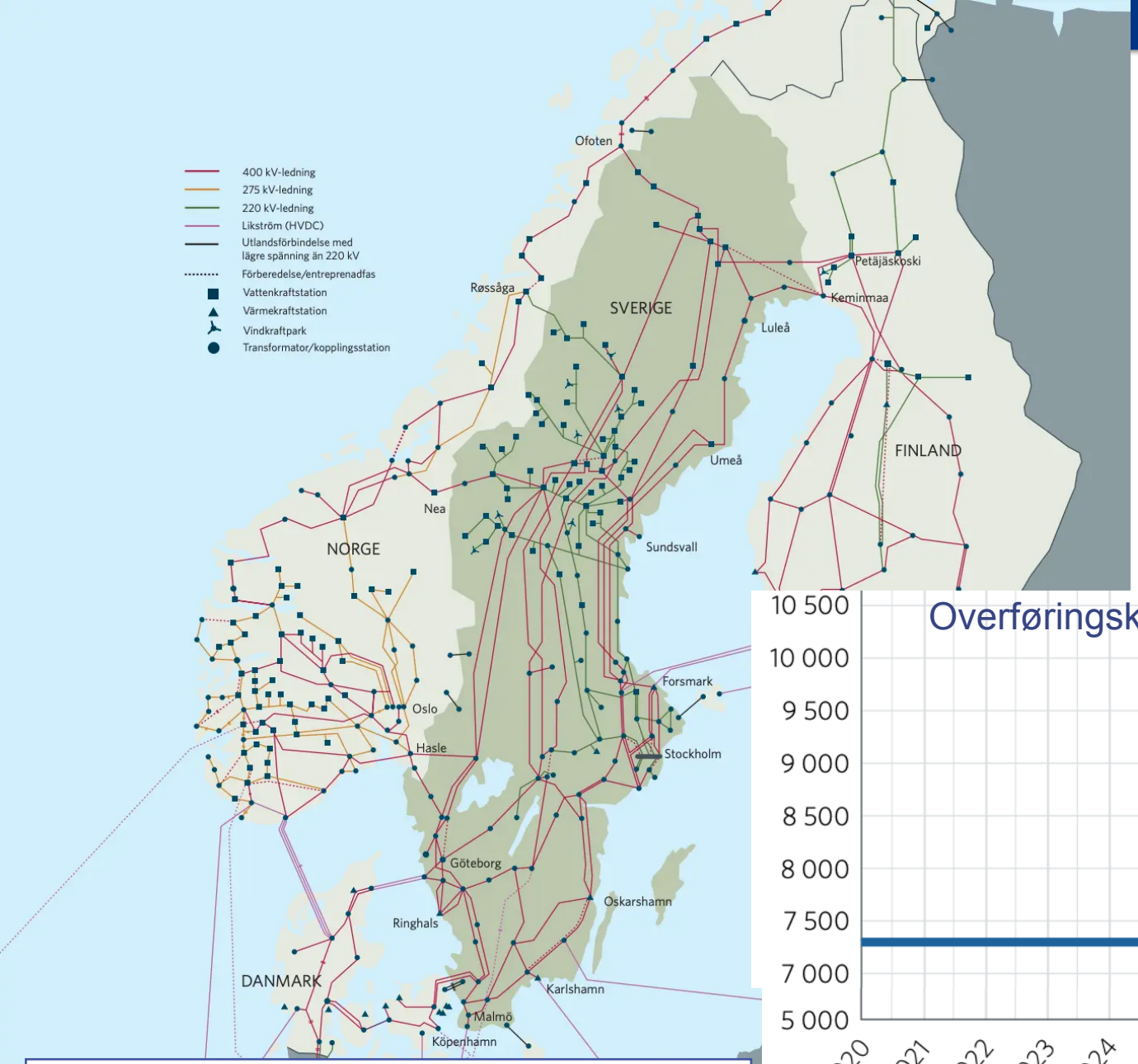


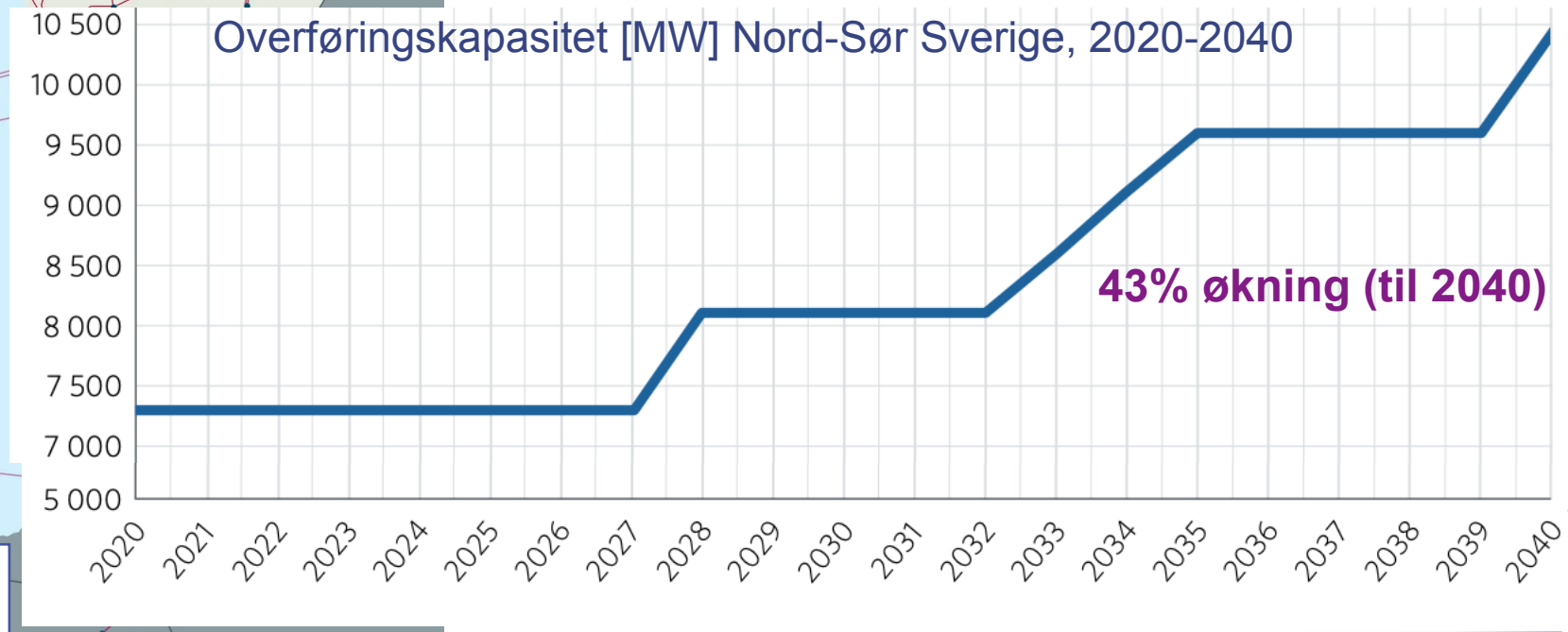
[Source: SmartGrid Conference 27Sep2023]

Per-Oddvar Osland
GlitreNett.no

Simon Koopmann
Envelio.com

Grid utviklingen





https://www.aftenposten.no/norge/politikk/i/z7vWJw/statnett-vil-ha-mer-flyt-av-kraft-mellom-nord-og-soer-men-det-vil-ikke-sp-og-sv-ap-er-i-tenkeboksen

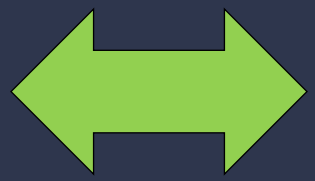
https://www.svk.se/siteassets/om-oss/rapporter/2021/svk_systemutvecklingsplan_2022-2031.pdf

The Power is in the Edge

of the grid

Det grønne skiftet

For samfunnet handler det om å redusere utslipp av klimagasser, bevare og gjenopprette naturen, reversere miljøforringelse og sikre at fremtidens energi kommer fra fornybare kilder.



Det digitale skiftet

berører alle nivåer i samfunnet som produserer og bruker infrastruktur, tjenester, applikasjoner og menneskelig atferd som er avhengig av digital representasjon av kunnskap og datamaskinkraft.

og alle må være med

Cross-sectorial Participatory Transition

Hypotheses:

- We need to involve people in the “fit for 55” transition
- Participatory transition requires a cross-sectorial approach

Means:

- Human-centric decision-making, engagement
- Upscaling from the edge, societal involvement
- Mediator between Use Cases and Research
- Psychology, Law, Sociology, Politics, …
- Municipalities, SMEs, Industry & Research
- Knowledge- and Innovation-Ecosystem

International Labour Organization

Just Transition

1.
In tackling critical environmental challenges like climate change, pollution and plummeting biodiversity, nations and businesses must transition towards greener, resilient and climate-neutral economies and societies.

2.
A Just Transition is greening the economy that is as fair and inclusive to all, creating decent work opportunities and leaving no one behind.

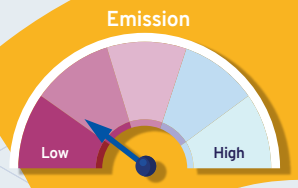
3.
A Just Transition maximizes economic opportunities of climate action, minimizes and manages challenges – It does this through effective social dialogue among all stakeholders impacted, and respects fundamental labour principles and rights.

4.
Ensuring a Just Transition is key for all countries, rural and urban communities at all levels of development as well as all economic sectors – not only limited to energy supply chain.

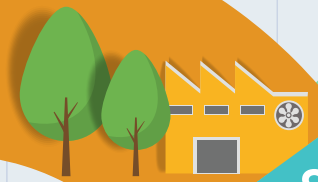
5.
A Just Transition is both a process and a goal to undertake climate change actions that equally advance: **job creation, social justice and fair transitions for workers, enterprises and communities** on an equal footing.

Green Jobs

6.
Green jobs limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems, improve energy and raw material efficiency, and support the adaptation to the effects of climate change.



7.
Green jobs propel the preservation and restoration of the environment across sectors such as agriculture, manufacturing and energy.



8.
Decent jobs, are a co-benefit of a green and just transition due to the fact that such jobs entail practices such as cleaner production & consumption and energy efficiency that improve occupational safety and health (OSH) in the workplace.

9.
At the enterprise level, green jobs can produce goods and services that benefit the environment, for example green buildings or clean transportation.

10.
Green jobs also contribute to more environmentally friendly processes. For example, green jobs can reduce water consumption or improve recycling systems.

11.
Green Jobs are jobs that are good for people, good for the economy and good for the environment.

Digital Empowerment

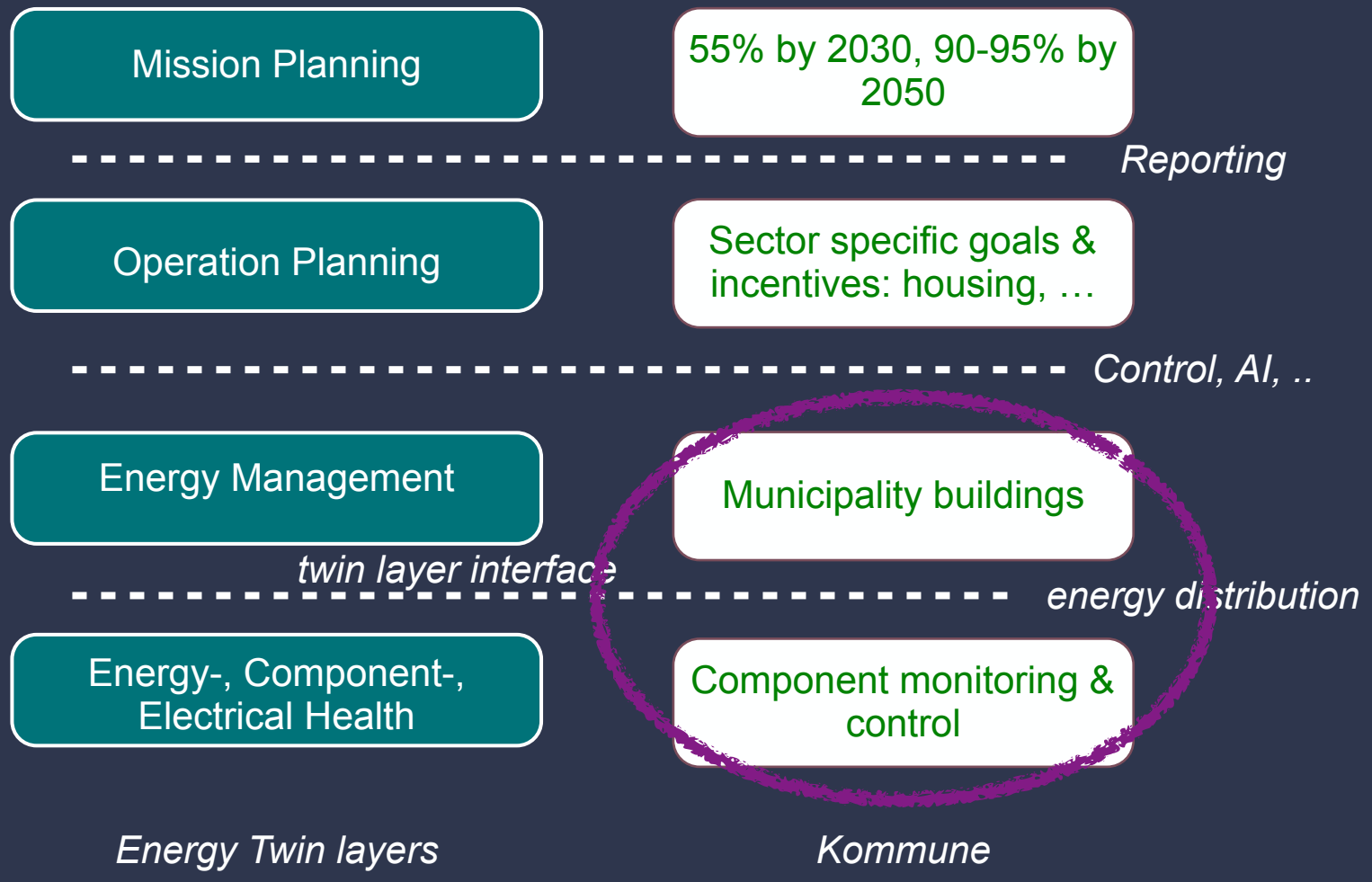
Participatory transition

Market place

Neighbourhood

Måling og styring
ved kanten av nett

Energy Twins struktur og deltagelse



Verdineutral reduksjon
- *value-based transition*
- *normative integrity of energy transition*

Kommune profil
- hightech
- green
- justice
- rettferdighet

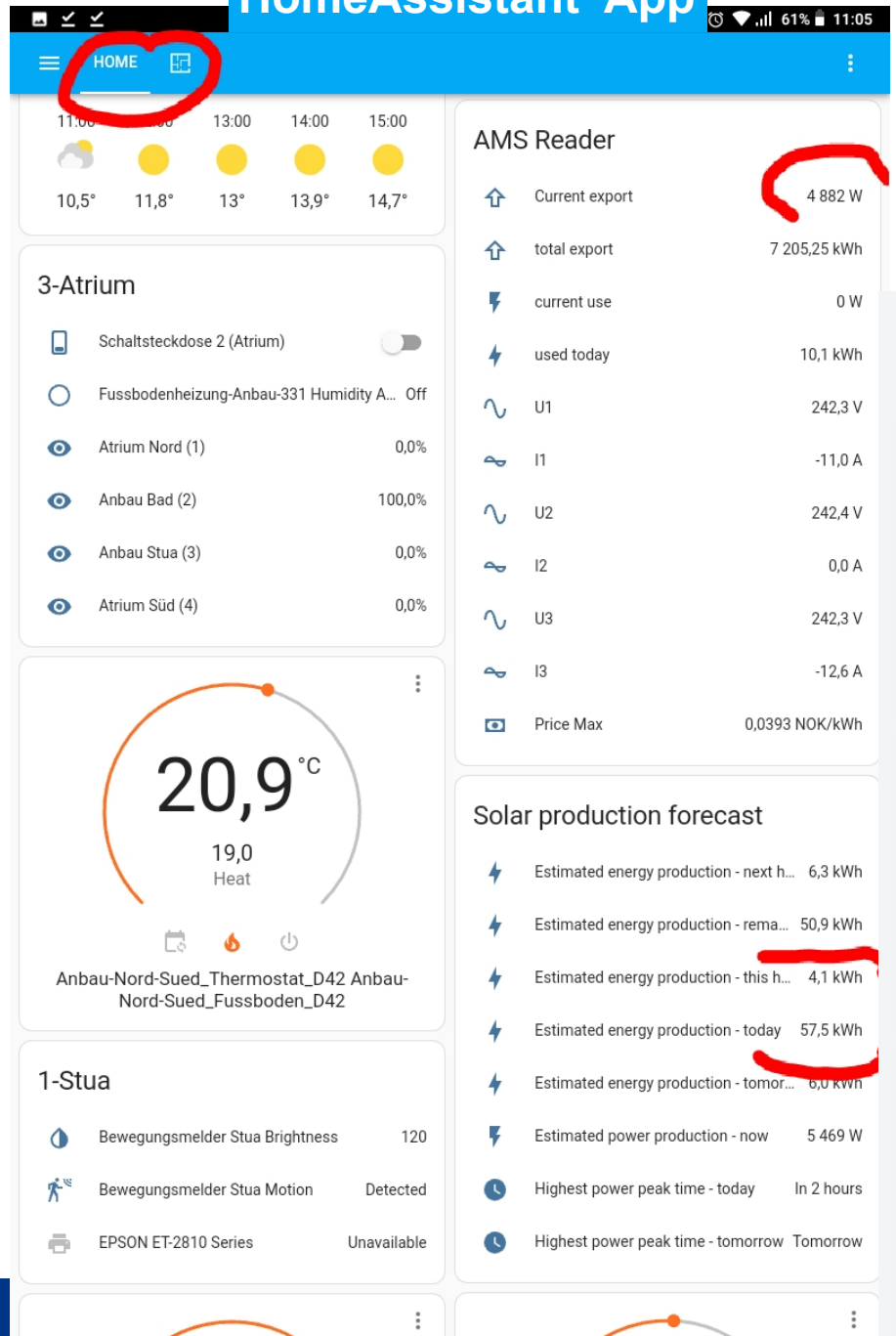
ESG - environment, social, governance

Vil du være med?

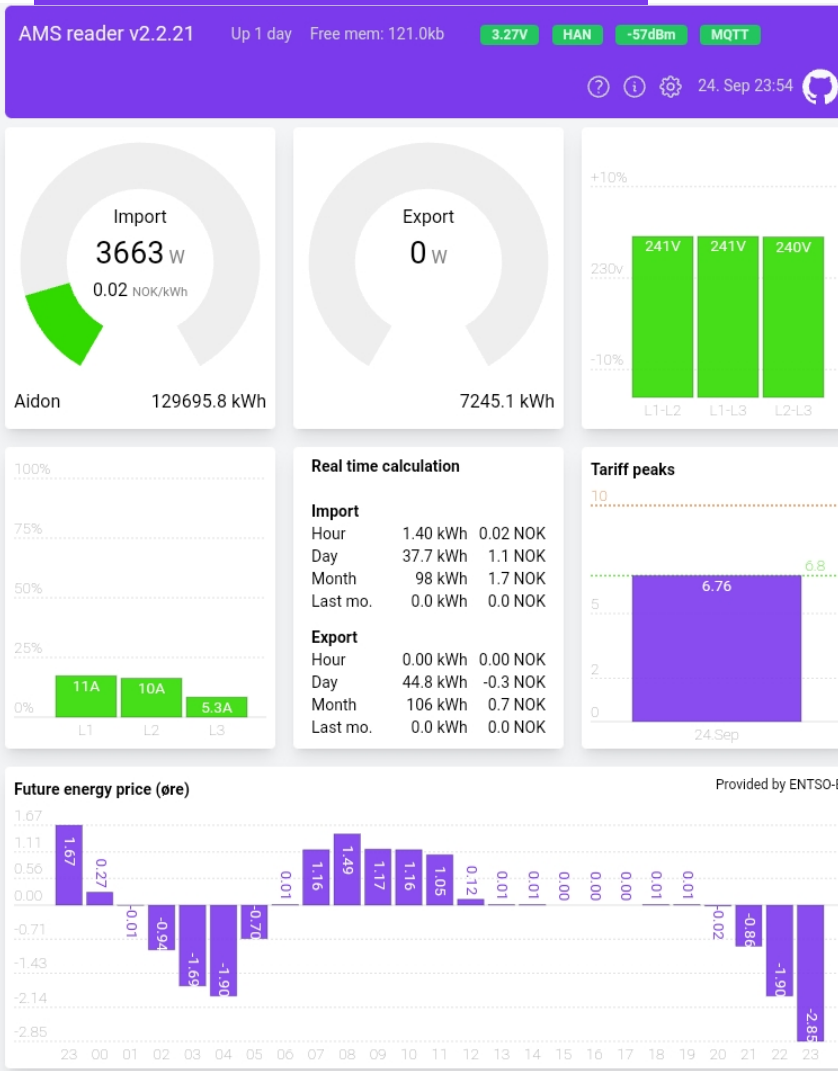
Kontroll over strømforbruk i ditt hus

- UiOs studenter og forskere vil hjelpe deg å forstå energi i huset
- Utstyr (dekket av UiO for de første 100 kunder)
  - Strømmåler (900 kr)
  - Raspberry Pi (1400 kr)
  - Home Assistant App
- Hva ønsker vi fra deg?
  - anonymiserte strømdata til vitenskapelig arbeid
- Interessert?
  - http://DESSI.its-wiki.no

HomeAssistant App

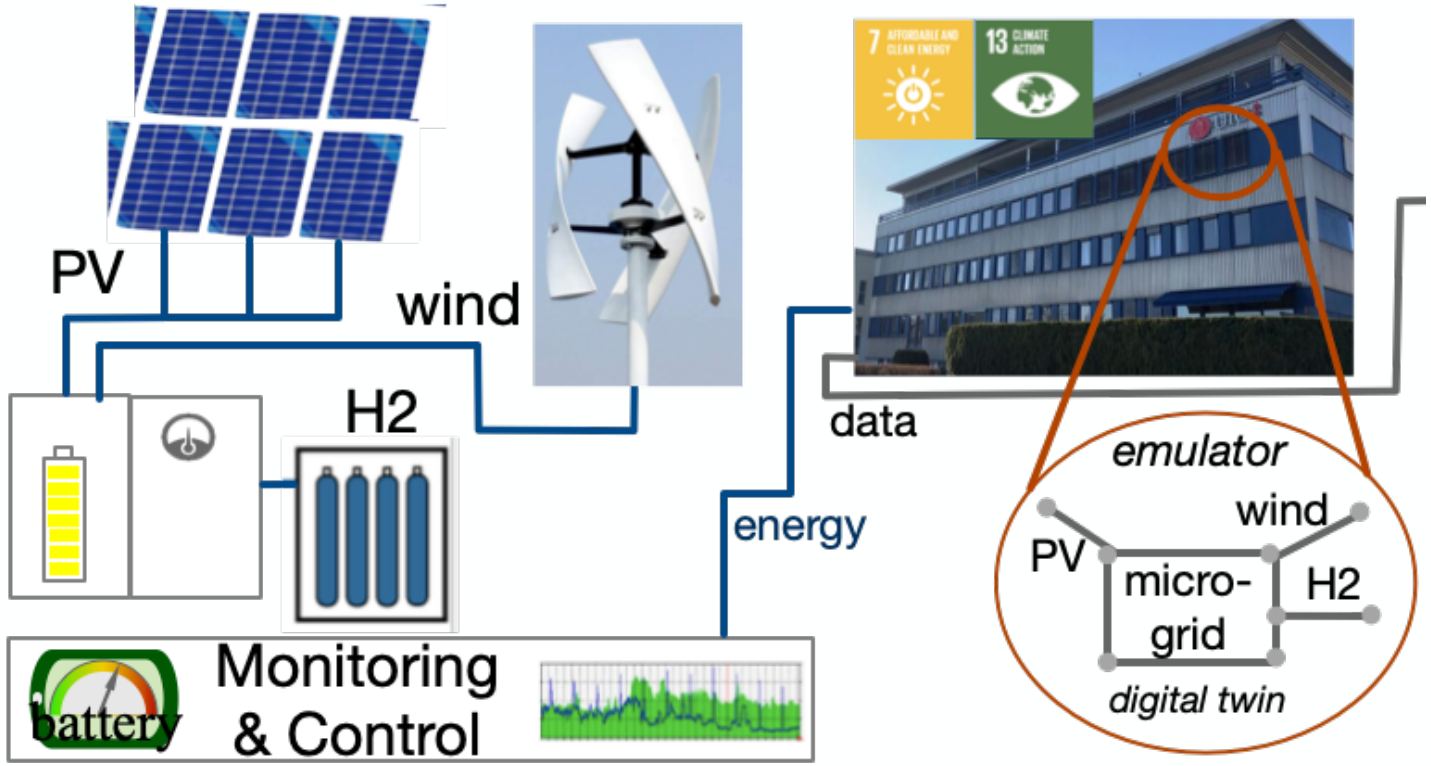


AMSleser data fra ditt hus



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



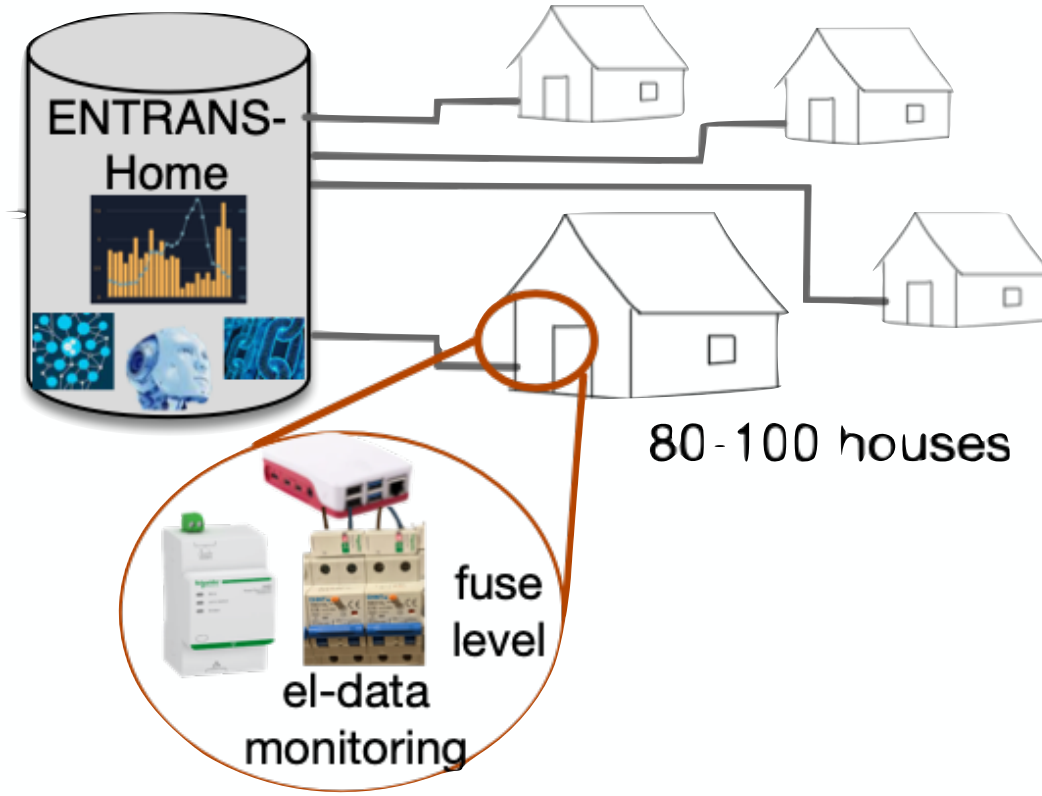
DESSI scientific database

Unique Scientific database

- high-resolutions electricity data
- every 10 s, per fuse
- commercial actors (tibber, homely,…)

Outcome

- Samarbeid: VGS (Strømmen…)
- Forskning:
  - 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:

Pågående arbeid

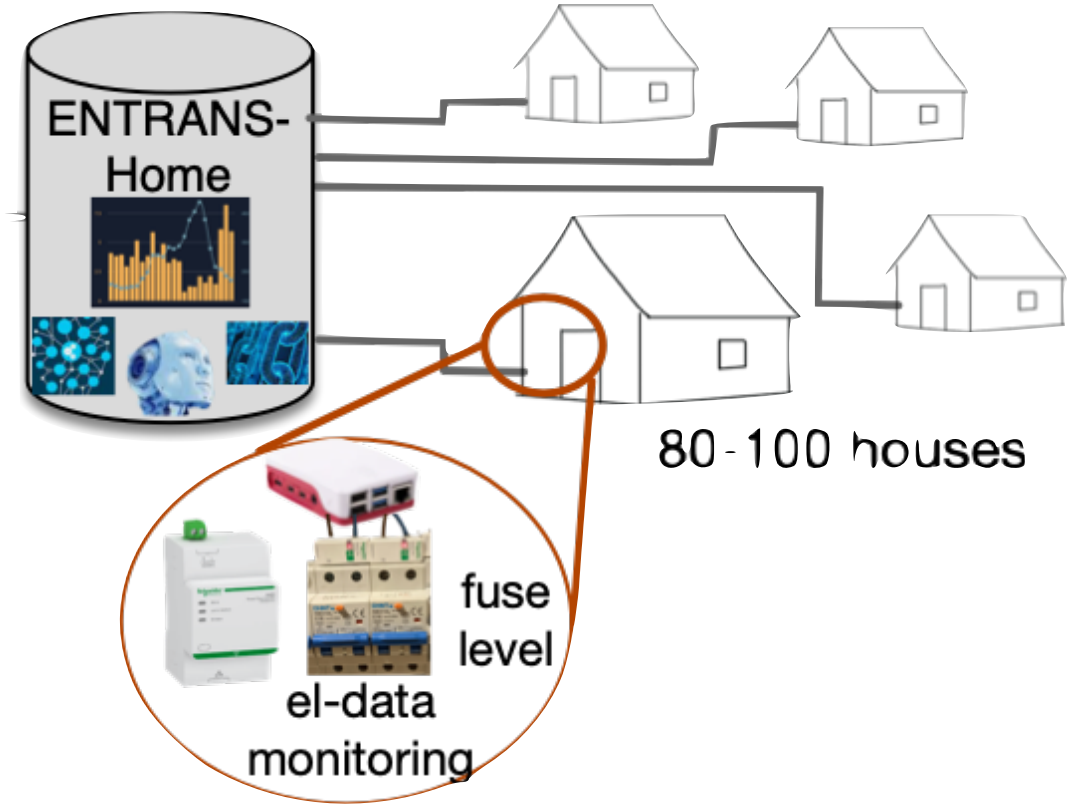
Group Topics

- 1. RPI monitoring of fuses
- 2. RPI monitoring of HAN port
- 3. Optimise control for weather forecast
- 4. Optimise electricity tariffs for prosumer home
- 5. RPI controlling and switching

1. RPI monitoring of Fuses

- how much energy does each of my appliance use? What is the characteristics of my appliance? Perform a classification of energy consumers in the home. Find out if the freezer is ruined, or the lock is open - or if a window is open, or a malfunction of an electricity system.

- Goal: monitoring the energy consumption per fuse, and store it into an SQLlite files (1 file per day).

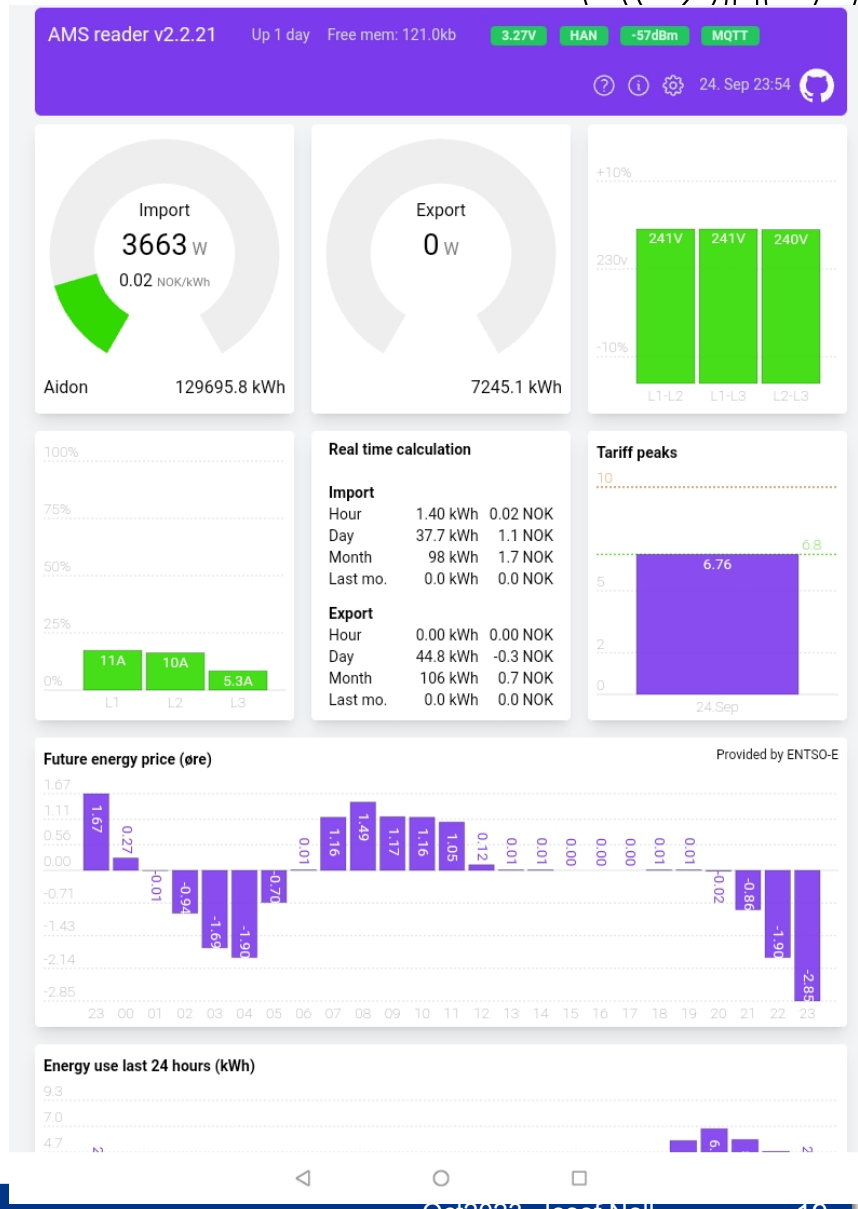


2. HAN port reading with AMSleser.no

- Use the HAN port reader from your smart home to receive the current energy readings, and integrate in HomeAssistant
  - read the energy consumption from the AMSreader and export to SQLite files
  - see other application examples and see what is possible to implement (direct MQTT access)

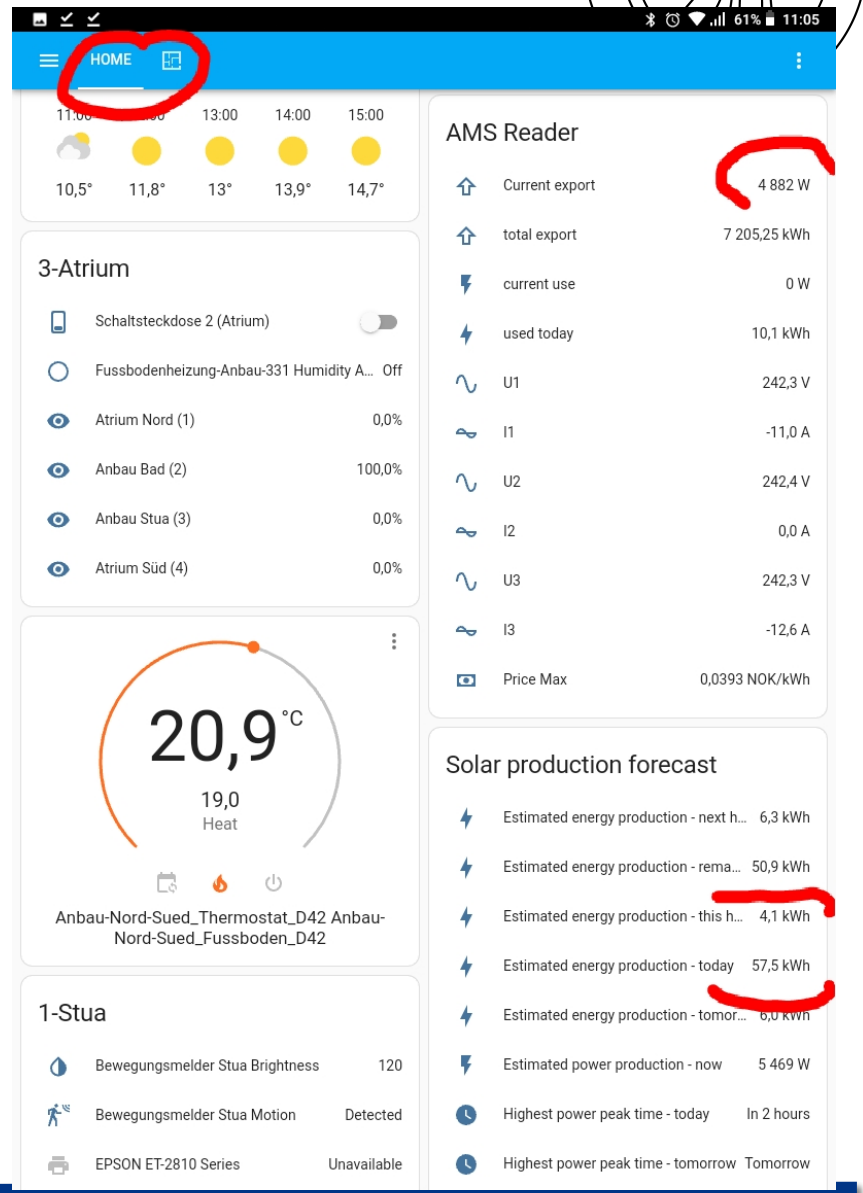
- Integrate the AMSleser into Home Assistant (Package for RPI): Home Assistant med Pow-K (amsleser.no) (video) and Homey-integration (wiki, Homey-integrasjon (amsleser.no))

- Examples of applicability are on BLOG (amsleser.no), e.g. the hardware reset Emergency factory reset (amsleser.no)



3. Optimisation control for weather forecast, price level and "home latency"

- Optimize your home based on grid tariff (0-3, 3-5, 5-10 kW max per hour) & price (every day at 12 h the electricity costs are published for the next day)
  - In case of a heat pump and a water-based heating system, weather prediction helps you in getting a better temperature control in the home, thus increase to convenience.
  - Assume that your floor heating has a 6 h delay, it means that increase heating will come in 6 hours. Thus, if outside temperature is expected to rise, there might be no need for heating.
  - My passive house has a 12 h delay before getting cold, the understanding of the outside temperature variation will help you with a better control of the inside temperature.
- Input: price, outside temp, inside/floor temp, warm water consumption (shower, washing, ...), hot-water temperature (45....90 deg), heat loss in W/m2/K
- Output: max comfort, min cost (based on heat-pump, warm water needed)
- Description of a model, examples



4. Optimise electricity tariffs for prosumer home

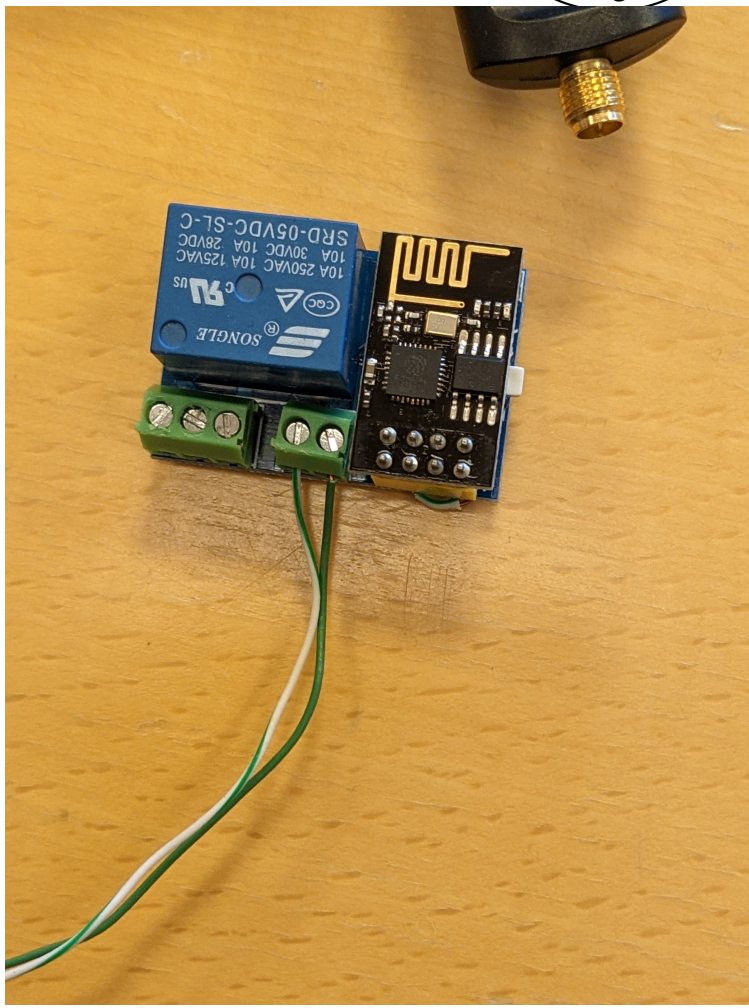
- Given the Energy production, consumption and sales as presented in Canvas / Stromdata / Energy_108x...xlsx, address
  - a) the earning given different energy tariffs
  - b) the impact of a virtual battery ("solbanken")
  - c) dimension a battery for the home

- Provide a model for the energy consumption, production and sales based on the available .xlsx data, and evaluate the alternatives.

	Oct2023		832,0	Sep2023		1068,4	Aug2023		943,6	Jul2023		895,6	Jun2023		984,6	May2023		1266
Day	buy	sell	prod	buy	sell	prod	buy	sell	prod	buy	sell	prod	buy	sell	prod	buy	sell	prod
	609,6	362,1	584,5	726,5	816,1	1158	582,1	1119,9	1481,4	408,0	1421,8	1909,4	422,2	1958,9	2521,3	644	1737	2358
1	24,1	18,1	32,4	23,8	45,0	59,2	7,5	43,1	53	20,5	56,4	76,7	10,0	78,4	97,7	35,6	0,0	71,9
2	18,9	21,8	34,9	18,1	43,4	60,7	8,0	47,1	57,3	19,7	15,9	35,4	11,8	88,9	107,0	30,5	0,0	71,9
3	29,8	25,5	38,6	23,8	27,9	38,2	11,2	61,8	71,8	16,0	43,5	58,7	17,5	79,7	98,3	35,1	35,3	71,9
4	28,3	33,2	46,6	12,6	65,1	75,9	12,0	41,2	51,1	31,6	11,2	35,7	13,2	82,5	106,8	28,2	56,7	71,9

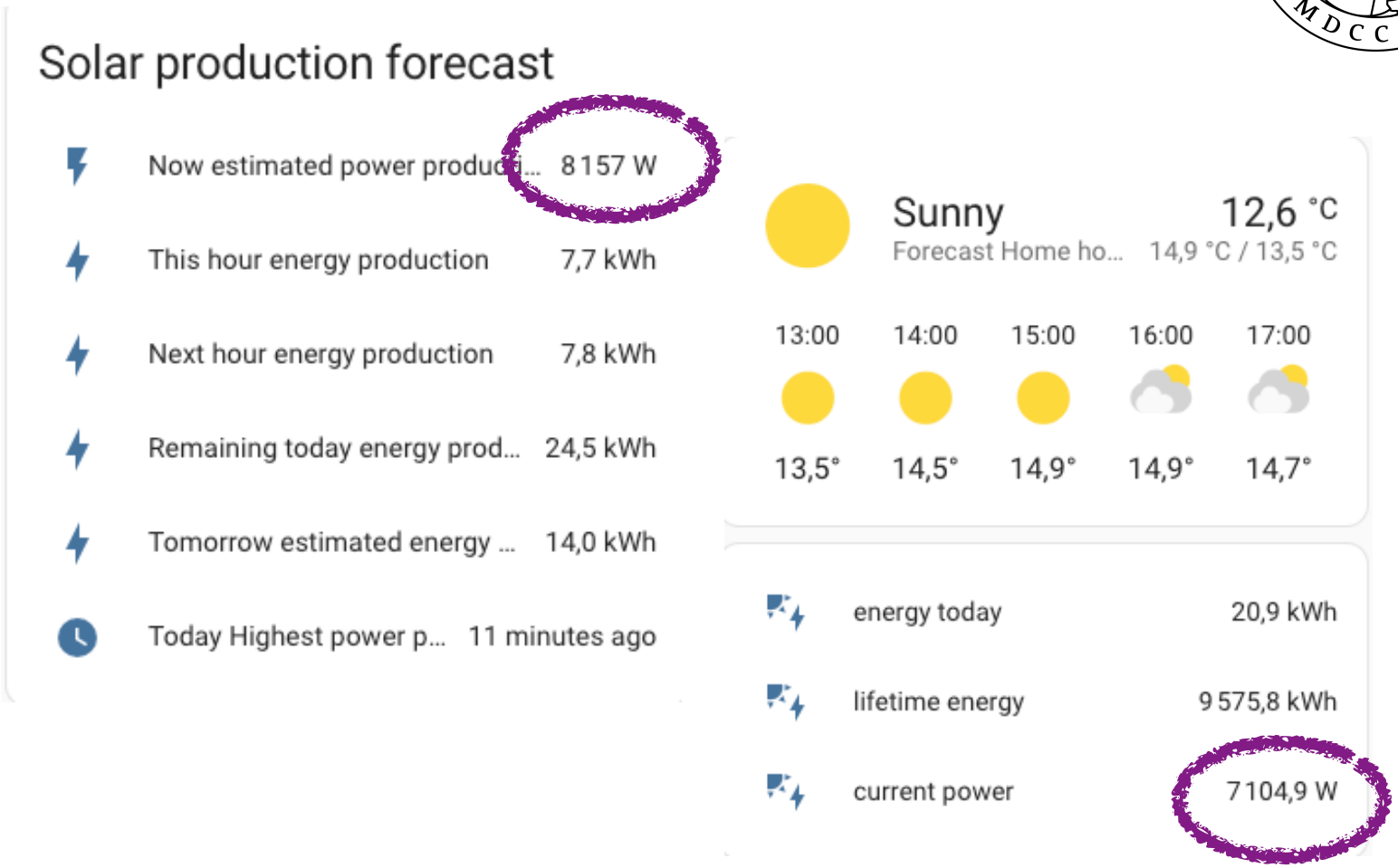
5. RPI controlling and switching

- Controlling electrical equipment from a Raspberry, e.g. switching the hot-water heater (OSO)
  - digital thermostats
  - switches
- Analyse existing solutions on the market
  - Tibber: Electricity company switching appliances in the home, concentrating on a) car charger and b) the warm water heater
  - Homely



Forbedring av modeller

- Modeller for produksjon og forbruk
  - Styring av laster
  - battery
- Styring av laster
- Empower through knowledge



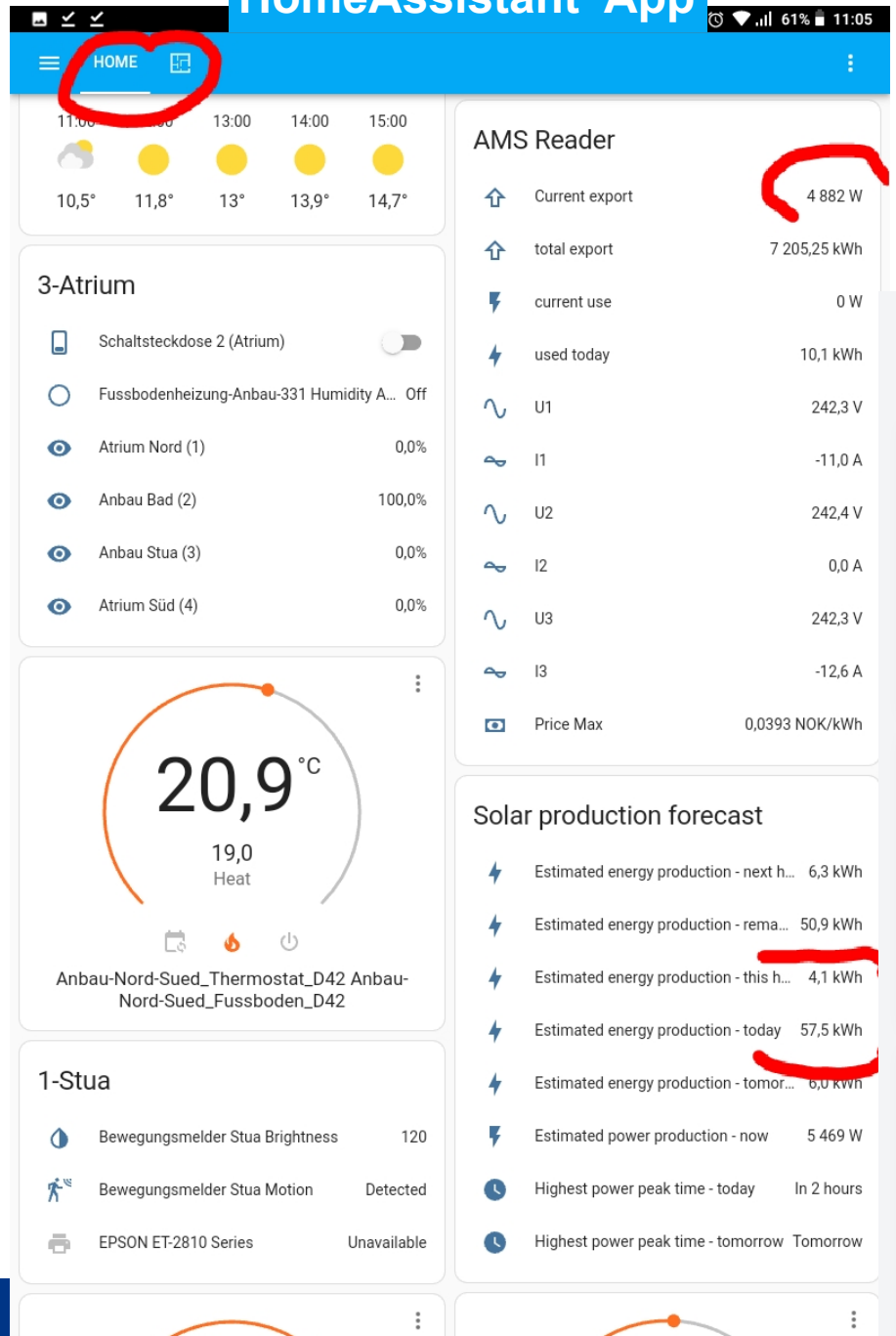
Hvordan samarbeider vi?

Kontroll over strømforbruk

- UiO, OsloMet & VGS
  - utstyr
  - installasjon
  - data
  - styring

- Analyse
  - kunstig intelligens
  - modeller
  - i hvert hus

HomeAssistant App



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