

SMART INNOVATION NORWAY





Large-scale electrification. How flexibility and business innovation can avoid unnecessary grid enforcements

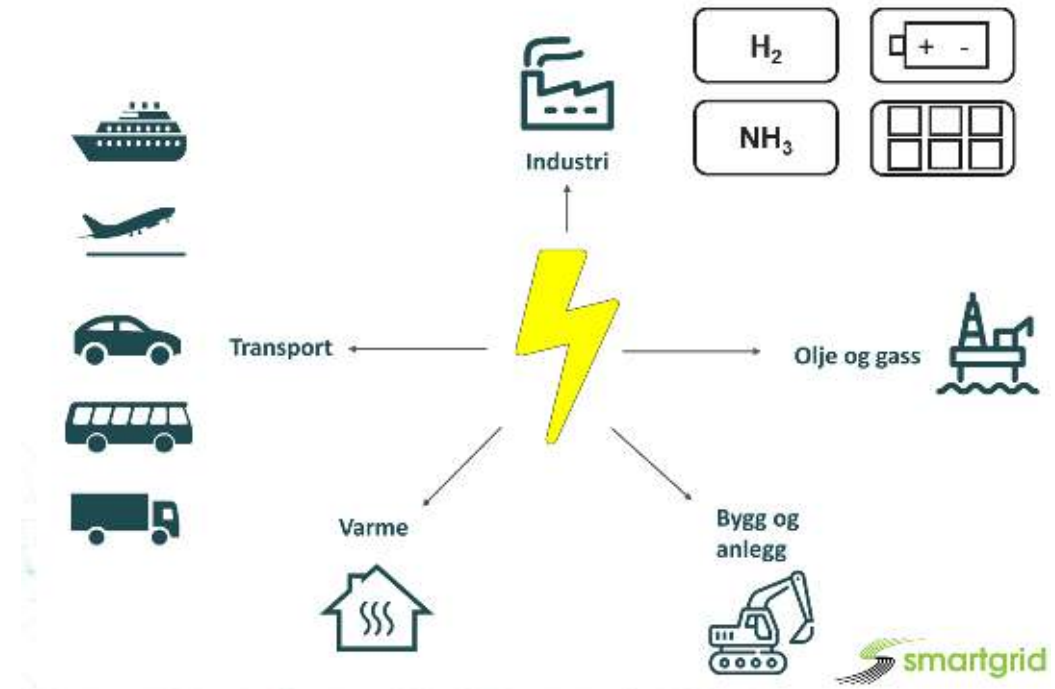
Energy flexibility – From customer to market, Halden 20.09.2022

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Background

- Two targets:
 - Electrification
 - Industry development



Massive increase in demand for grid capacity

- High costs
- Long lead times

Det grønne skiftet er i gang: Eksplosiv etterspørsel etter nettkapasitet fra mange næringer i hele landet

Troms - Senja kommune:



- Forespørsel om 300 MW, tilsvarer 1,5 * Tromsø by
- Sjømatnæringen, eksisterende industri og ny industri
- Senja: 6-dobling i energiforbruk innen 2030, tester fleksibilitet og bruk av batterier inntil ny linje er på plass

Møre:



- Forventer vekst på 25-120 % de neste 5 årene
- Fra: transport, landbasert oppdrett, industri, batterifabrikk ++

Bergensområdet:



- Forespørsel om 2800 MW (~ Oslo by). Ikke plass til kunder > 5MW inntil 2026
- Transport, offshore, industri, H2-produksjon, datasenter, alminnelig forsyning. Gasskraft nedlegges.

Sør-Rogaland:



- Forespørsel om 900 – 1000 nye MW. Tilsvarer ca. 75% av årets forbruksrekord (på 1300 MW). Flere kommuner forespør mer enn sitt totale nåværende effektforbruk.
- Elektrifisering av skip og oppdrett forsinket pga. manglende nett.

Agder:



- Forespørsel om 1000-4000 MW (0,5 – 1,5 * Oslo by)
- Vekst 1-3 ganger dagens strømforbruk
- Batterifabrikk, ny industri, offshore, transport, landsstrøm

Helgeland:



- Ny vindkraft: 400-1400 MW + pot. offshore vind
- Forventer sterk vekst i etterspørselen fra batterifabrikk, transport, oppdrett, sjømat, grønn stålproduksjon

Trøndelag:



- Næringsaktører over hele fylket med store planer
- Oppdrett, transport, industri, offshore, datasenter, m.m
- 38 kommuner + fylkeskommunen som driver frem omstilling/vekst på «sine» områder

Buskerud - Hadeland:



- Nye forespørsler på 1000 – 2500 MW
- Fra batterifabrikk, datasenter, ny industri, lading for transport inkl. tungtransport

Industriområdet Øra i Fredrikstad:



- Etablert industri vil konvertere fra fossil energi til strøm.
- Det tar 10 år å realisere nytt nett og det vi koster > 500 MNOK

Lede:



- Potensielt 100% økning de neste 10 årene
- Elektrifisering av Yara Herøya: utslippskutt + næringsutvikling
- Datasentre, batterifabrikk, elektrifisering av industri ++

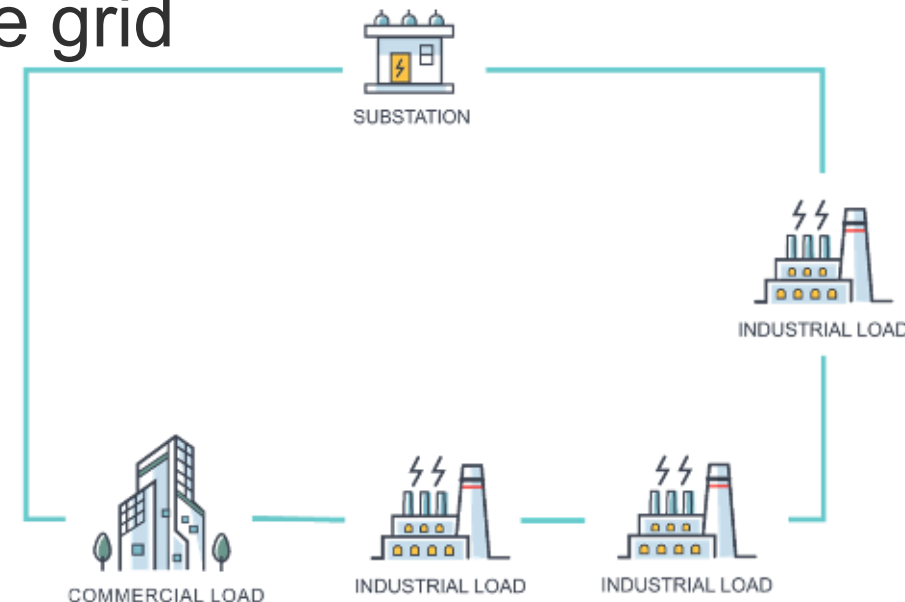


Connection process – current regulatory regime in Norway

- A new grid customer contacts the DSO (Distribution System Operator) and applies for connection to the grid
- In case of lack of capacity (“ikke driftsmessig forsvarlig”), the DSO offers two options
 1. Wait until grid is reinforced – pay (part of) the cost. May take years
 2. Connect now with non-firm contracts (“tilknytning med vilkår om utkobling”). In case of operational grid problems, the DSO will disconnect the customer



?



Possible consequence

- Potential jobs will be lost
- The green transition must be put on hold

Flytter til Midtøsten om de ikke får strøm

En ny fabrikk og 100 arbeidsplasser kan bli flyttet fra Norge. Det er fullt i strømmettet og industri får nei til strøm over hele landet.



De trenger strøm for å lage silisium til solcellepanel. Nå kan planlagt fabrikk flyttes ut av landet. Fra venstre Torfinn Krogstad, Arvid Inge Sørvik og Christian Landaas fra Northern Silicon.

Rita Kleven
Journalist

Tariq Alisubh
Fotograf

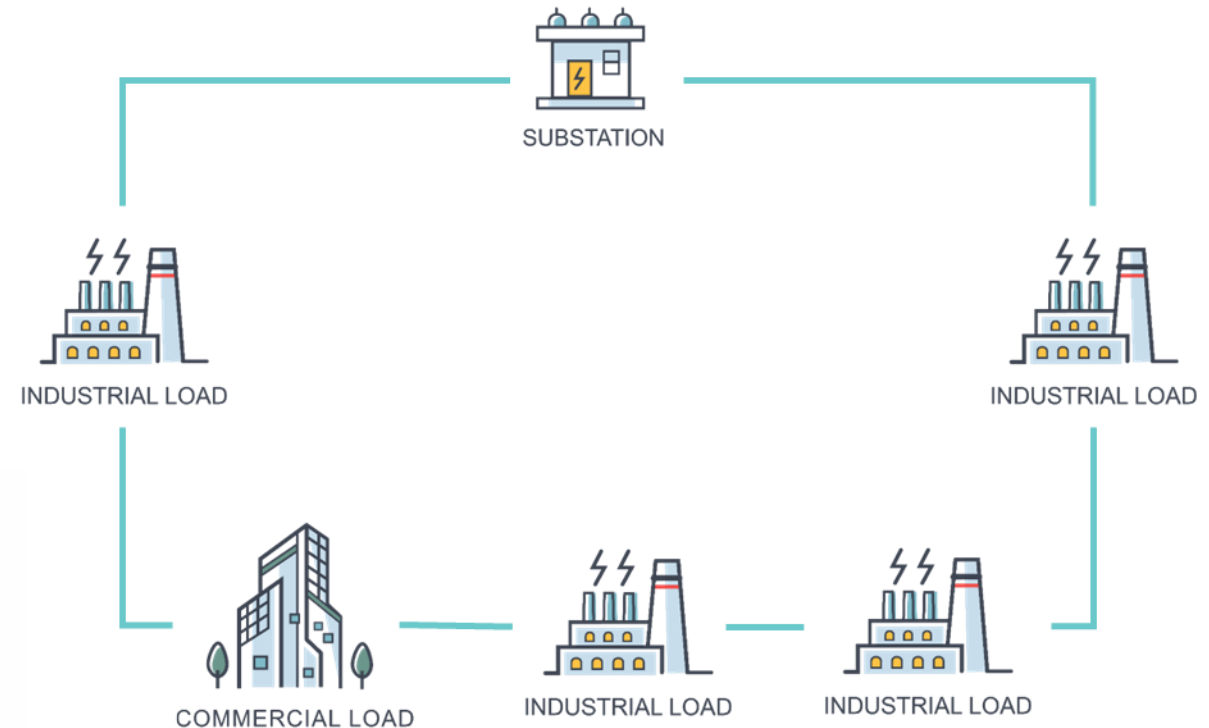
Bent Lindsetmo
Fotograf

Vi rapporterer fra Meråker

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The potential role of flexibility

- Flexibility can make it possible to connect the new customer without violating the limited grid capacity
- Sharing economy where capacity and flexibility are shared
- So what is the problem?
- Regulations, rules and business models not ready



Concept project

“Zero emission energy station at ASKO Vestby – Innovative technological and business concept for charging of electric trucks”

ENOVA

Nullutslipps energistasjon på ASKO Vestby - Innovativt teknologisk og forretningsmessig konsept for lading av lastebiler

Konseptutredning for innovative energi- og klimaløsninger i bygg, områder og energisystem



ASKO

Glvia

Fixii



Entelios

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ASKO Vestby

- Grocery warehouses storing groceries at different temperatures
- Trucks transporting to grocery stores etc
- Energy system
 - Connected to 16 sub stations with 16 main meters and 16 connection contracts
 - PV system
 - Batteries
 - EV chargers
 - Forklift charging
 - Electric water boilers
 - Ventilation systems
 - Cooling machines
 - Generator (originally for emergency purposes)

Flexibility



Renewable transport

- A part of ASKO's sustainability strategy is to shift to vehicles running on renewable sources
- ASKO Vestby has bought 125 electric trucks
- Charging infrastructure needed
- Total electricity demand will double



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- An aerial photograph of a large industrial complex, likely a food processing plant. The facility consists of several large, white, rectangular buildings with flat roofs. One building in the foreground has the word "AVO" visible on its side. The complex is surrounded by green fields and parking lots filled with vehicles. Two green circles are drawn on the image: one on a grassy area to the left of the main building complex, and another on a smaller building or structure to the right. A green line connects these two circles, passing over the main industrial buildings. The text "ations" is visible at the top left, and "able" is visible at the bottom left, both partially cut off.



Zero-emission energy station

- Three different energy carriers
 - Electricity (> 100 charging points)
 - Hydrogen (incl. production)
 - Biogas
- Must be ready by 2026
- Electrical part challenging
- Requires a separate, new sub station
- Capacity in the distribution grid not available
- But ASKO has large volumes of flexibility



Vestby trans-
former station

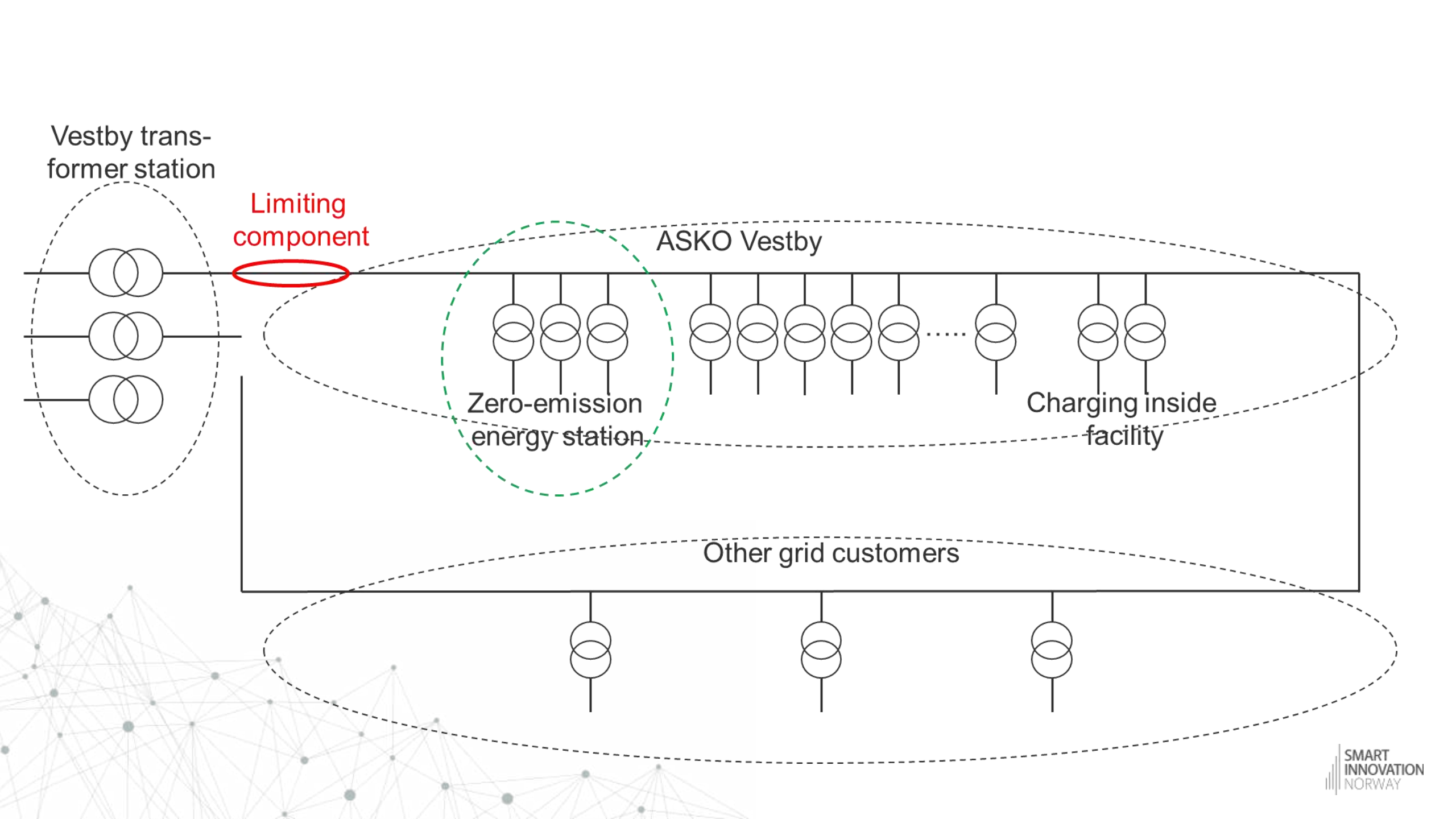
Limiting
component

ASKO Vestby

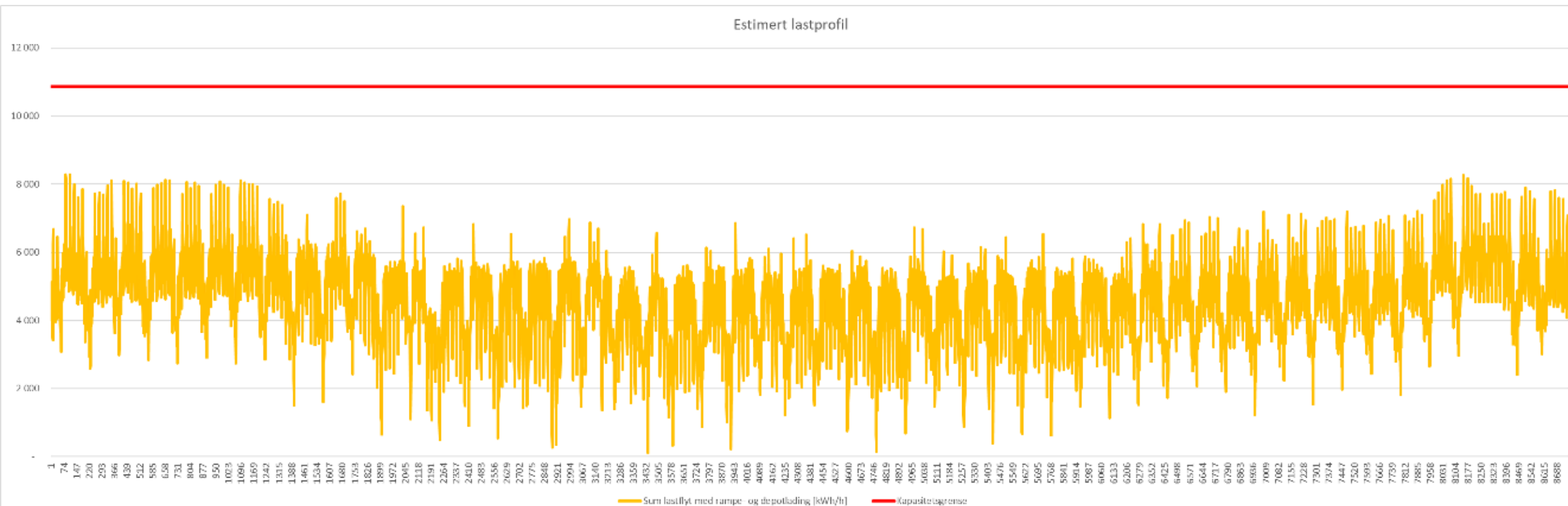
Zero-emission
energy station

Charging inside
facility

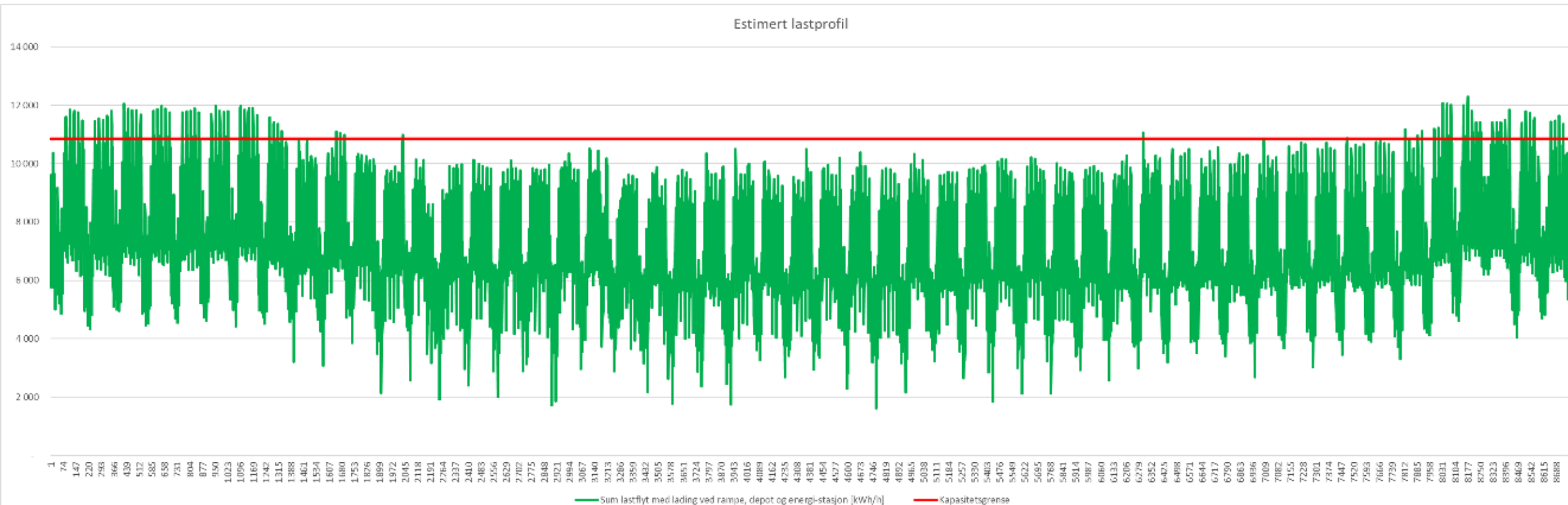
Other grid customers



Estimated load profile including “internal” charging



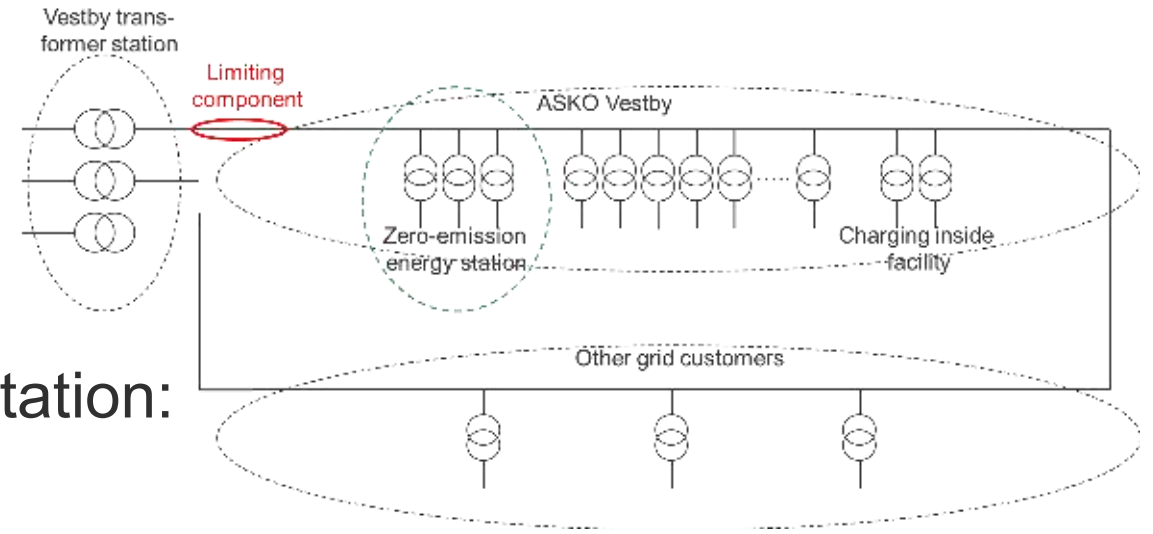
Estimated load profile incl. energy station



- Number of overload hours: 200 hours
- Maximum flexibility need: 1 425 kWh/h
- Maximum flexibility energy need per day: 3 360 kWh

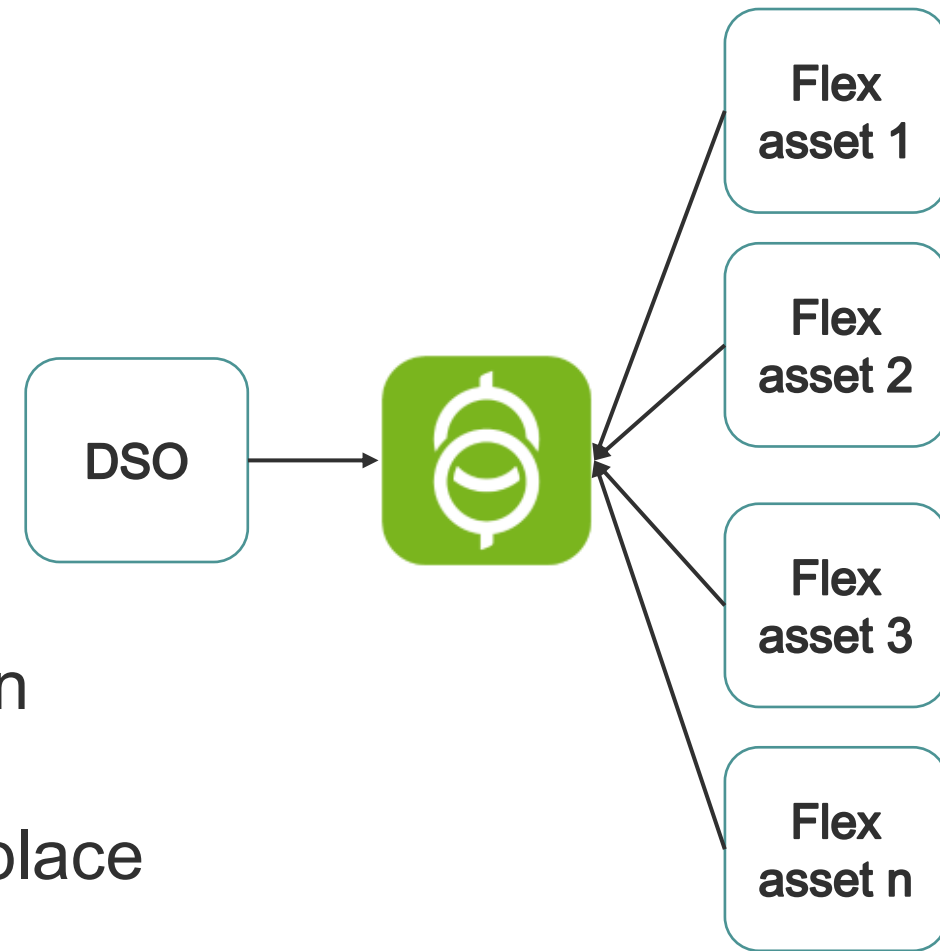
Basic idea

- Energy station connects with non-firm contract
- The DSO shares information about limitation:
 1. Real-time information for activation
 2. Forecast information for planning purposes
- When load flow reaches limitation, ASKO activates flexibility
 - In the energy station
 - Or in other parts of the facility
 - Needs some algorithms that consider availability, cost, disadvantages, etc
- If not sufficient, the DSO disconnects the energy station



Market based approach

- Energy station connects with non-firm contract
 - A local flexibility market is established
 - All ASKO's flexible assets participate, including disconnection of the energy station
 - Other grid customers may also participate
 - Flexibility bids are submitted to the market place
-
- In cases with capacity problems, DSO activates bids
 - If the market is unable to solve the problem, the DSO disconnects the energy station



Illustrative example

- Suppose DSO needs 2 MW to avoid overload
- DSO activates bids for battery and electric boiler
- Problem solved
- The energy station will not be disconnected
- Cheapest resources used first
- Costs are saved

Flex asset	Volume	Price
Battery	1 MW	2.000 NOK/MW
Electric boiler	1 MW	2.500 NOK/MW
Emergency gen.	2 MW	3.000 NOK/MW
Energy station	4 MW	4.000 NOK/MW

Summary

- Electrification and industry development increases the need for grid capacity
- Costly and takes time
- Alternative/temporary solution is to utilize flexibility
- Technically possible, but regulatory/business solutions must be solved to implement in real life
- It is possible!
- Will help society reach climate and job creation goals





Thank you for your attention!

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