

# UNIVERSITY OF OSLO

ITS Talks, 6Jun2024

## Energy Transition in a Norwegian Perspective

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*“we need participation of all people if we want to succeed with the green transition - and intermediaries & municipalities are the key to success”*



# Why Norwegian Perspective?

- Yearly: 150-155 TWh
- Miljødirektoratet: 34 TWh is needed for “55% reduction by 2030”
  - 22.6% increase
- Energikommisjonen: minst 40 TWh (26% increase)
- Are we asking the right questions?

## Regjeringa med «realitetsorientering»: Ikkje nok kraft til klimamålet

Statsministeren har vitna om si tru på klimamålet. Nå erkjenner energiministeren at dei ikkje greier å skaffe nok kraft.



✉ Håvard Nghus  
Journalist

Publisert i går kl. 05:35

Source: nrk.no, 3Jun2024,  
Photo: Anders Martinsen,  
Agder Energi

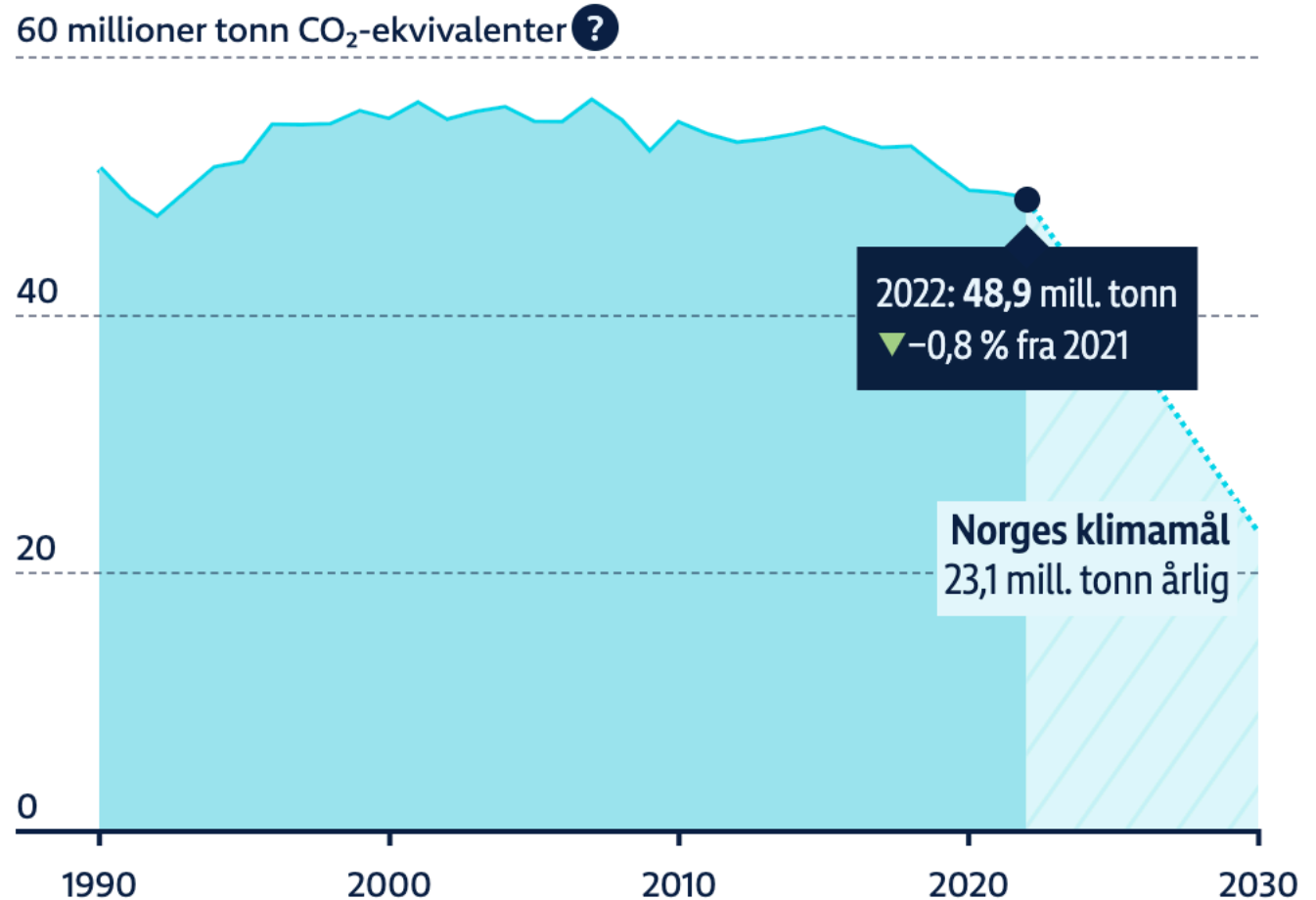
# Why Norwegian Perspective?

## → Yearly:

- 223 TWh total energy<sup>1</sup>
- 157 TWh electrical
  - 23-30% increase needed
- 2023: <1 TWh new renewable

## → CO neutral

- increase: 66 TWh netto
- incl. conversion loss 100 TWh
- new business: ?? TWh



<sup>1</sup>: total 338 TWh before losses and conversion

**Where can the needed energy come from?**

**Decentralised vs Centralised**

- where can we get the growth?
- 3-4 times more energy in winter

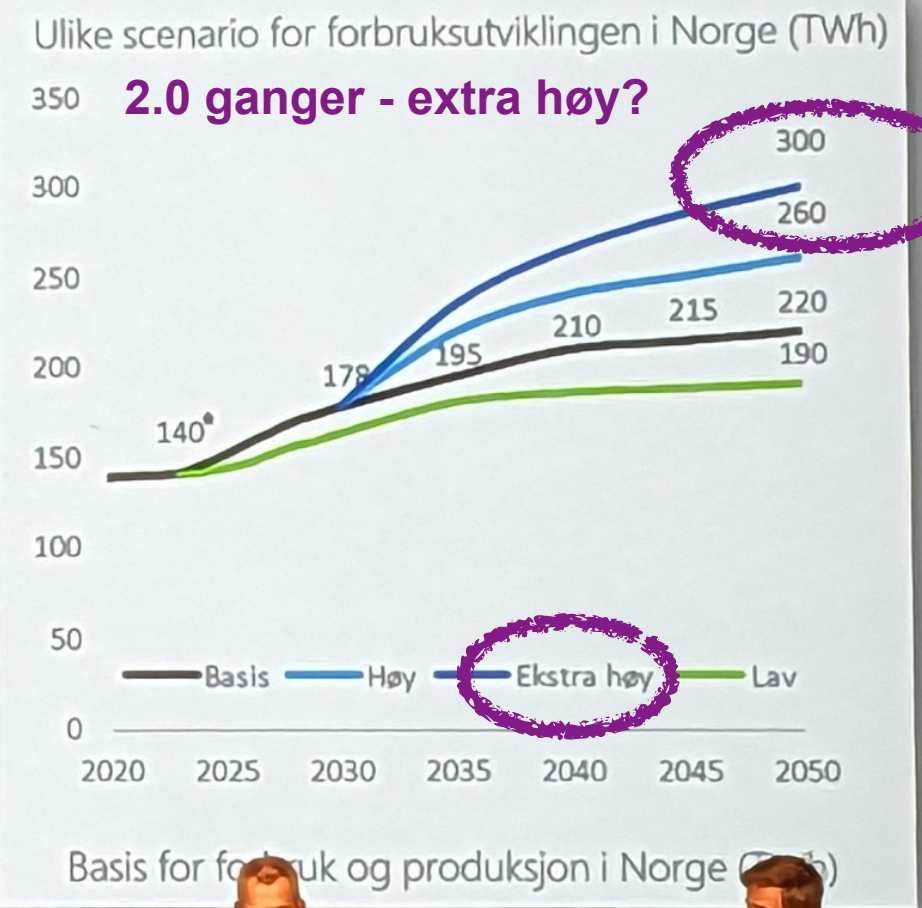
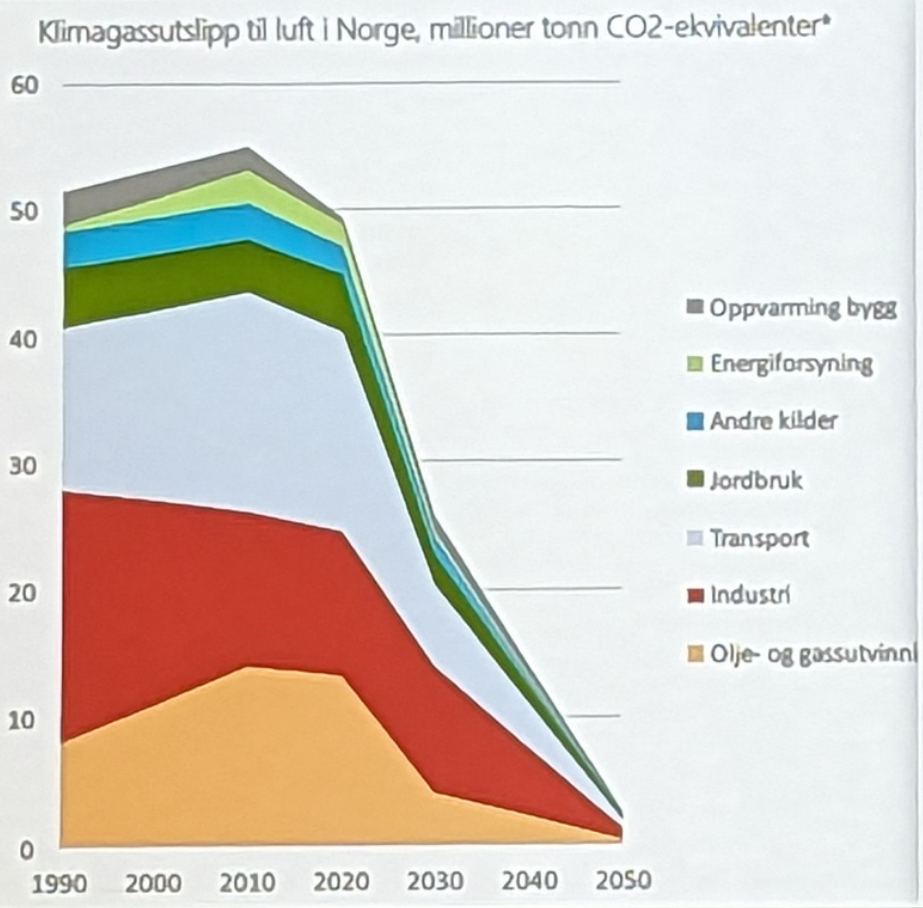
# Challenges of the Grid

- Grid enhancement & Edge Capacity
- Bottlenecks (“Flaskehalsen”)
- Edge customer aggregation
- Laws & regulations, e.g. EU/2023/2413



# Sustainability and electrification

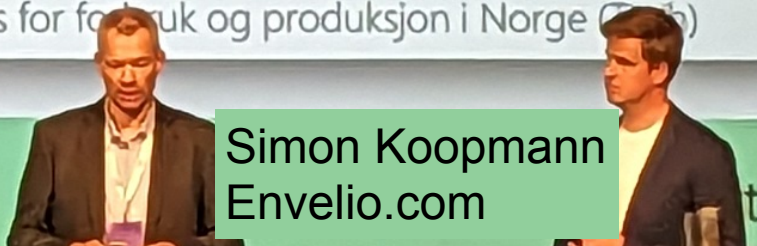
Source: Statnett LMA 2022



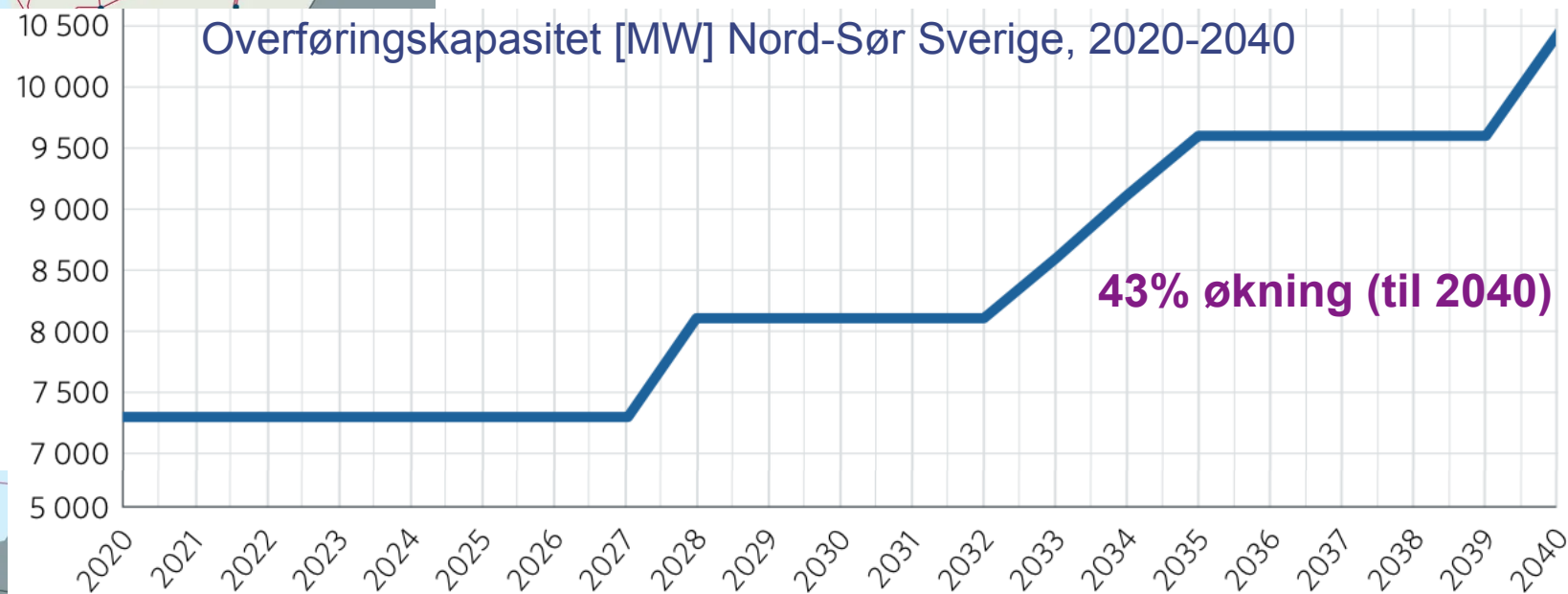
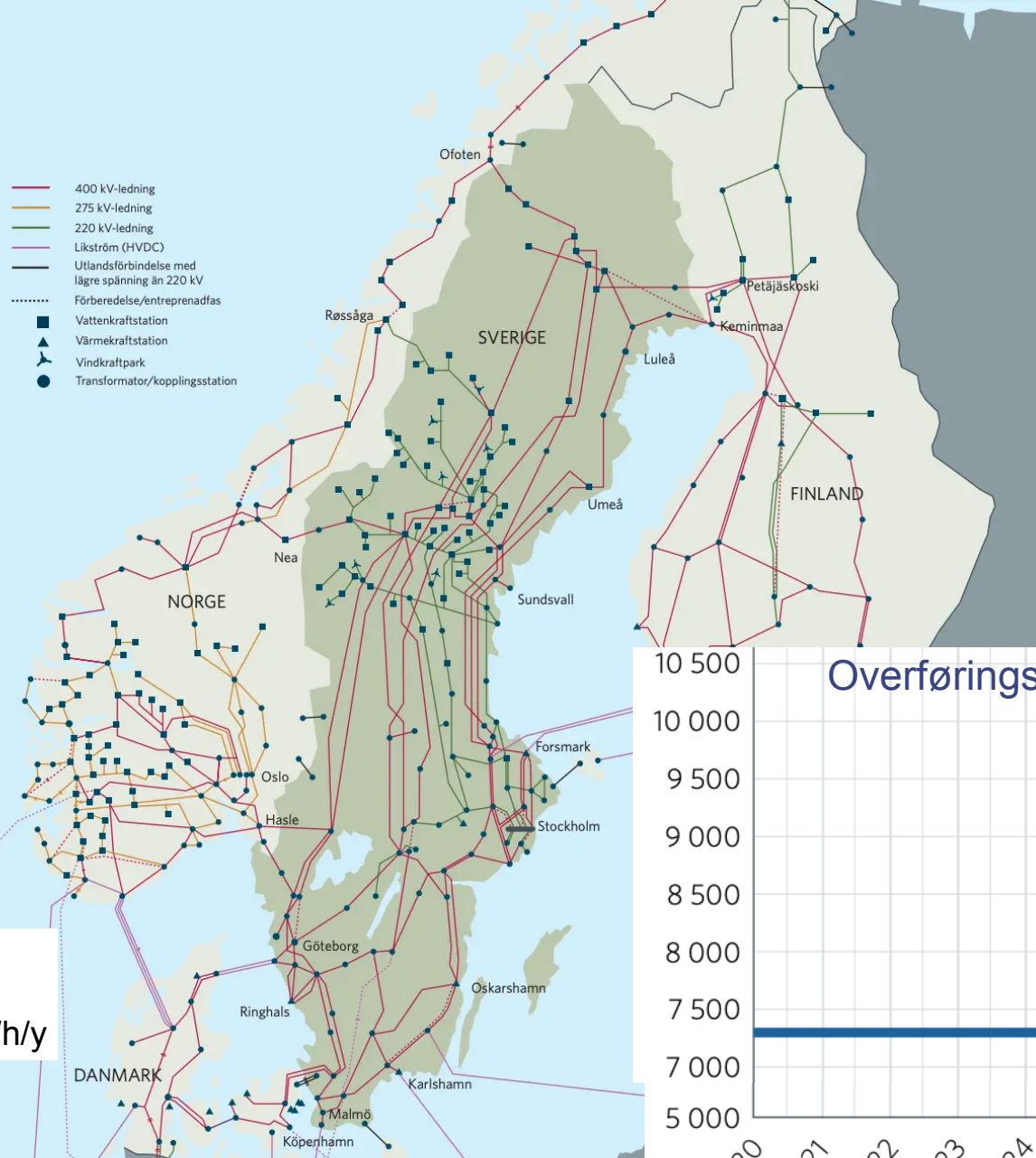
[Source: SmartGrid Conference 27Sep2023]

Per-Oddvar Osland  
GlitreNett.no

Simon Koopmann  
Envelio.com



# Grid utviklingen



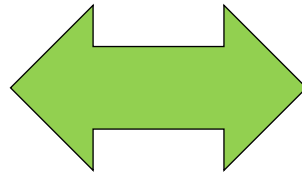
cables:  
8970 MW  
max 78 TWh/y

<https://www.aftenposten.no/norge/politikk/i/z7vWJw/statnett-vil-ha-mer-flyt-av-kraft-mellom-nord-og-soer-men-det-vil->



# The power is at the edge of the grid

***The green transition***  
*of society is about reducing greenhouse gas emissions, preserving and restoring nature, reversing environmental degradation and ensuring that the energy of the future comes from renewable sources.*



***The digital transition***  
*of society consists all processes at all levels in society producing and applying infrastructure, services, applications and human behaviour that depend on digital representation of knowledge and computer power.*

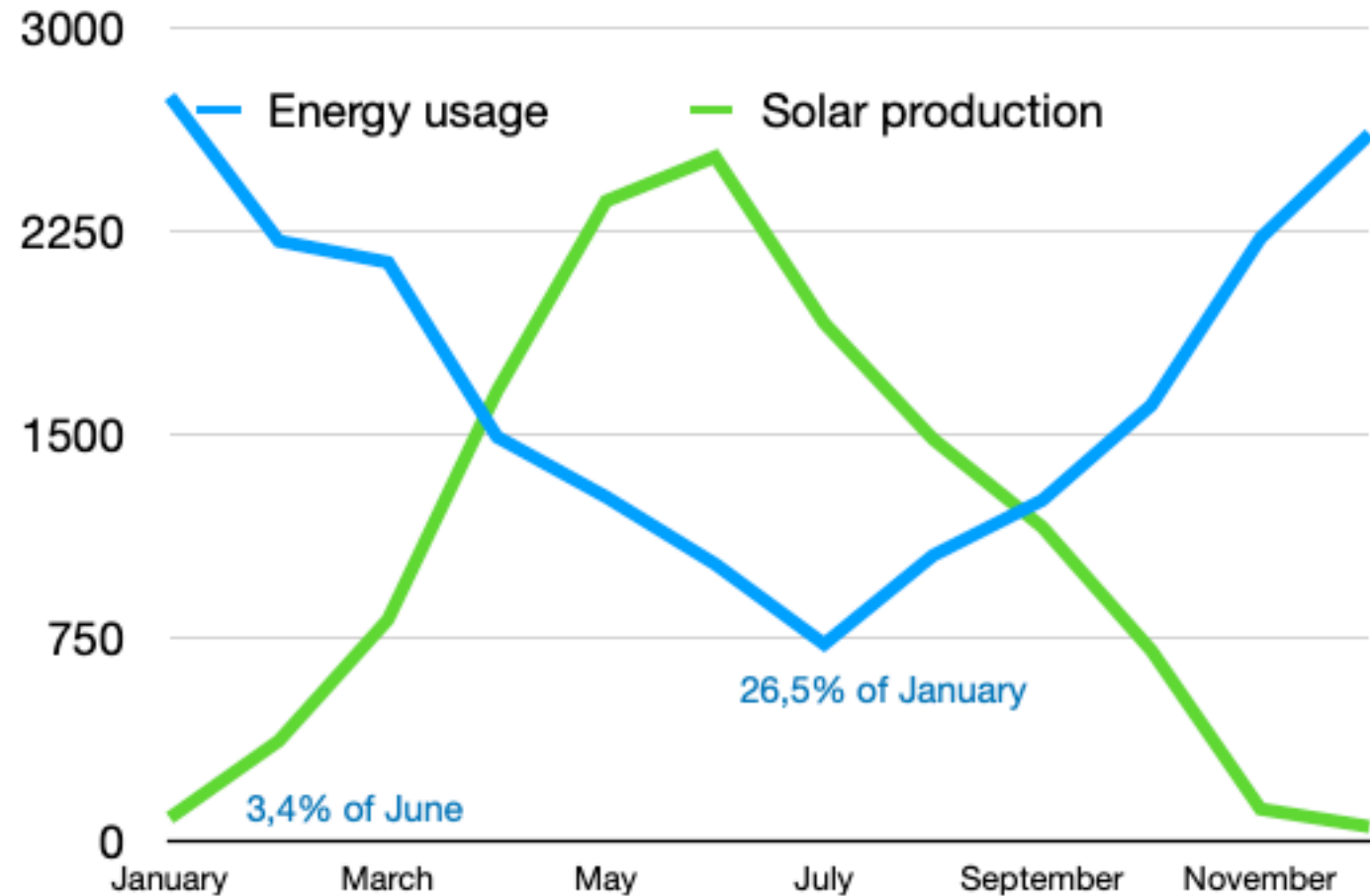
and municipalities & mediators are our partner to empower citizens



# The role of private households

- Why solar?
  - does not fit to Norway

Energy Consumption vs Solar Production (DESSI pilot house 108x)



Note: DESSI database on real-world data  
Pilot house in Oslo

# Solar variability

→ daily variation

	min	max
Apr2024	5	100
May2024	22	108
Dec2023	0	14

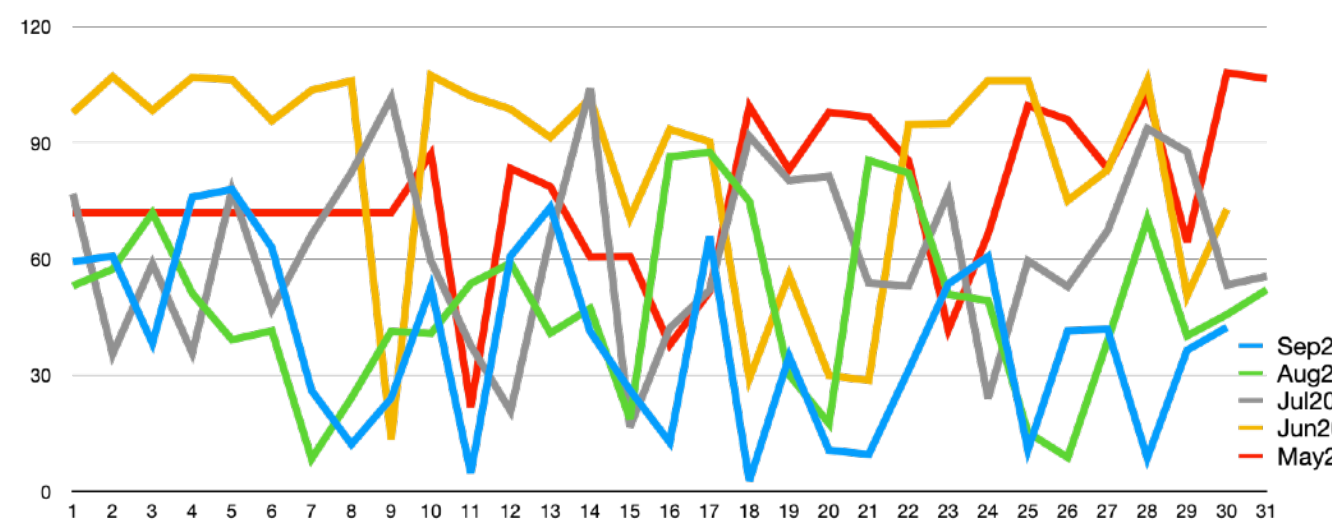
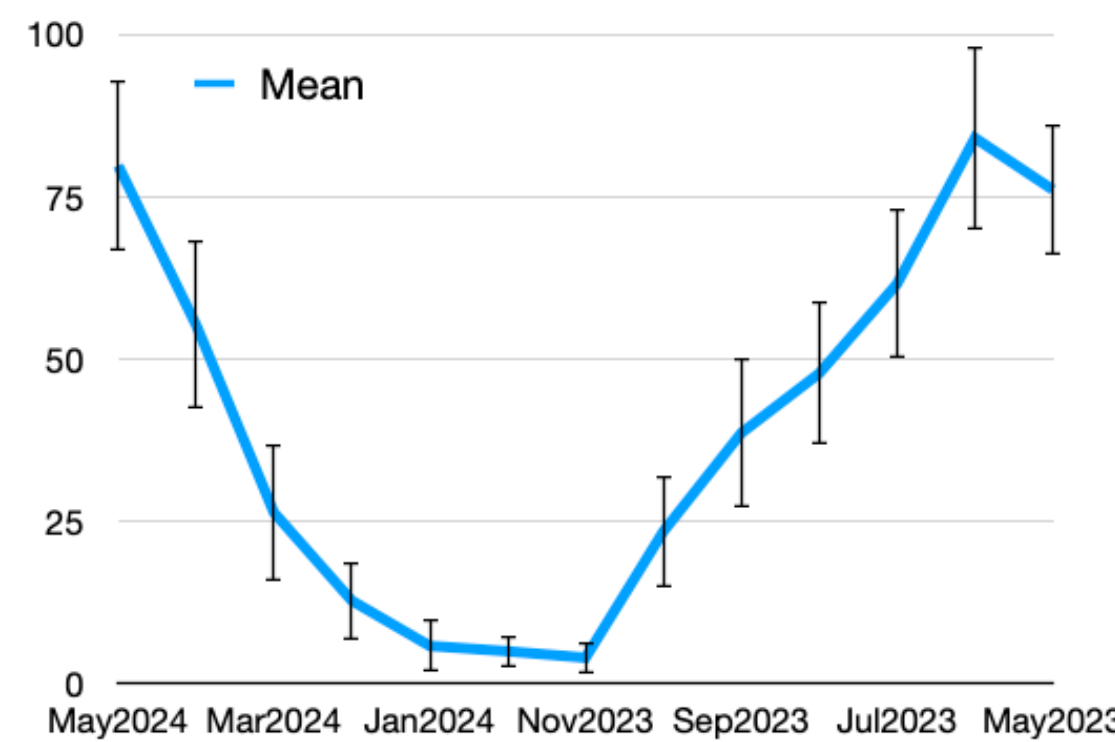
## ANDELSOLENERGIIKRAFTPRODUKSJON 2022

Land	MW	GWh	% Total
Tyskland	68 451	57 610	11,7 %
Nederland	17 966	17 680	14,9 %
Storbritannia	14 289	13 921	4,3 %
Danmark	3 940	2 176	6,4 %
Sverige	2 212	1 507	0,9 %
Finland	607	633	1,0 %
Norge	320	225	0,1 %

Kilde: IEA PVPS, IRENA, BP, Fraunhofer ISE.

Source: Energeia-Solkraft, 2023

Daily Solar Production, (Mean & StdDev)



**Forget solar in Norway**

**or?**

# Future Perspective

- Costs & Readiness
- Combination of solutions
  - Solar & Battery (autonomy)
  - Solar & Hydrogen
  - Solar & Thermal storage
- Societal aspects

## SOLANLEGGISANDEFJORDI2023

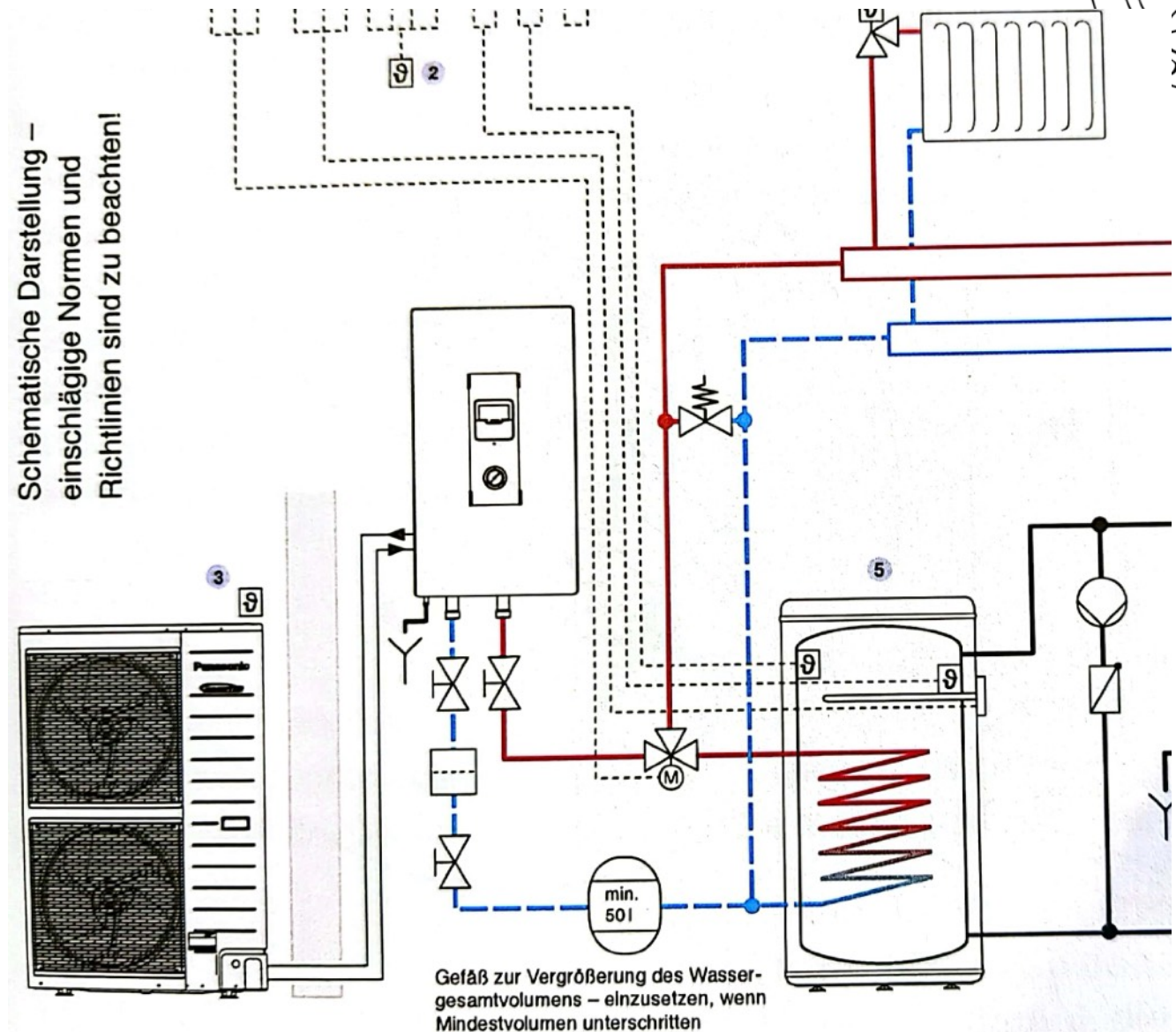
	kWh/m <sup>2</sup>	NOK/kWh
Hustak (22°)	221	0,69
Industritak (30°)	229	0,44
Fastbakkeinstallasjon (45°)	235	0,24
Én-akse bifacial	349	0,16





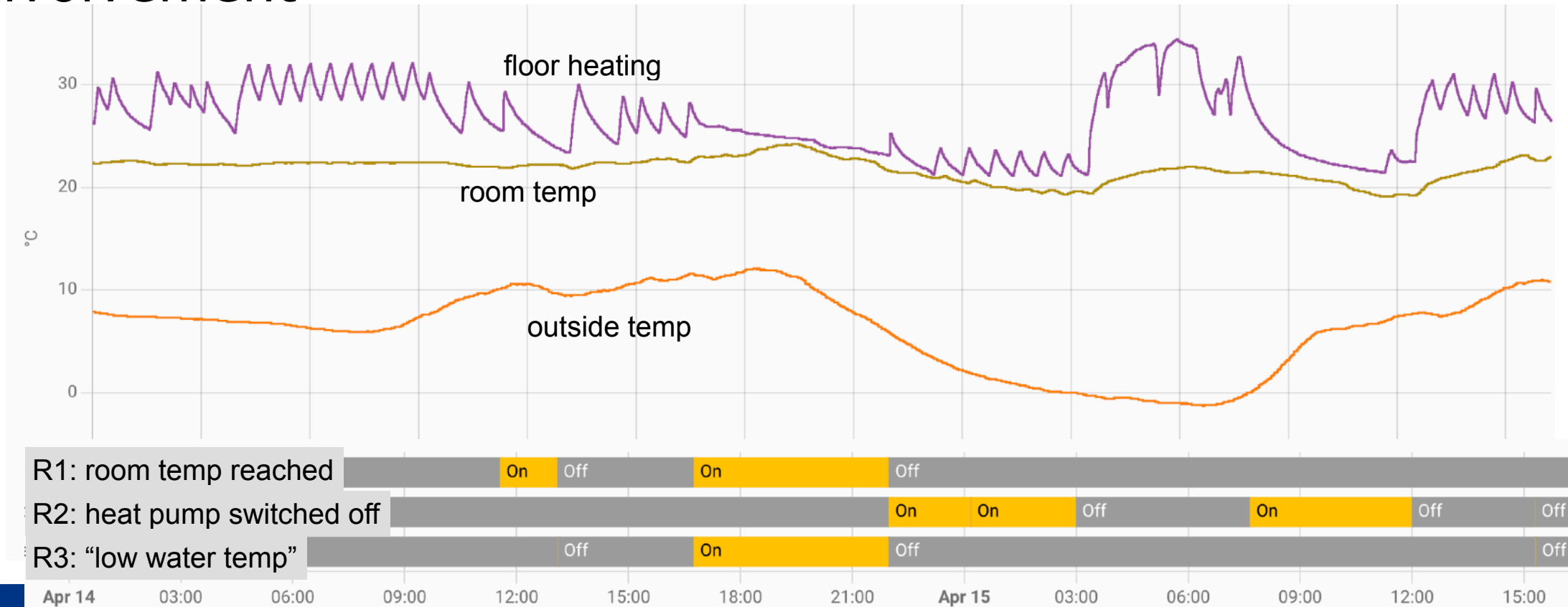
# Real world assessment Heat pump control

- ➔ Heat pump drives tank
  - Top: 240 l hot water
  - Bottom: 120 l floor heating
- ➔ Goal:
  - set temperature of water
  - price, convenience,



# Optimising tank temperature

- 40% reduction electricity bill (Mar/Apr)
- reduced battery size (ongoing)
- user involvement



# Conclusions

- Electrical energy usage in Norway
  - Need for 100-150 TWh more (by 2050)
  - Centralised solution not feasible (upgrade of the grid)
  - “the power is at the edge”
- Solar in combination
  - Sodium/salt batteries (daily variations)
  - Geothermal storage (seasonal storage)
- Societal aspects
  - Energy neighbourhood
  - from PV production to digital

“Vi klarer ikkje 34 TWh,  
men vi klarer mykje”  
Terje Aasland, Energiminister, on 34 TWh more  
electrical energy in 2030

EU Directive EU/2023/2413 (Nov)  
at least 42.5% renewables by 2030

Right to get connected  
within 12 months (EU/  
2018/2001)

