



TRONDHEIM KOMMUNE

# Energy efficiency at the local level - practical dimension and experiences from Trondheim Municipality

Ukrainian, Polish and Norwegian experience in the field of energy efficiency increasing in the municipal economy - Kiev 25-26 January 2018



Foto: Carl-Erik Eriksson

Øystein Lindland – Energy advisor, Trondheim eiendom (Trondheim property services)

# Trondheim eiendom

- Trondheim eiendom (Trondheim property management) are responsible for development, management, operation, maintenance and cleaning of municipal buildings
- Manages a building lot of over 1 million m<sup>2</sup>
  - schools
  - kindergartens
  - nursing homes/health centers
  - sport facilities
  - administration buildings
  - apartments for disadvantaged
- Trondheim property management currently has two energy advisors, four employees in building automation system and over 100 operators

# Energy management

1. Anchoring in management
2. Energy monitoring
3. Building automation system
4. Goals and reports



# Anchoring in organisation

- Political
- Management
- Operational organisation
- Building users

## Energy and climate action plan

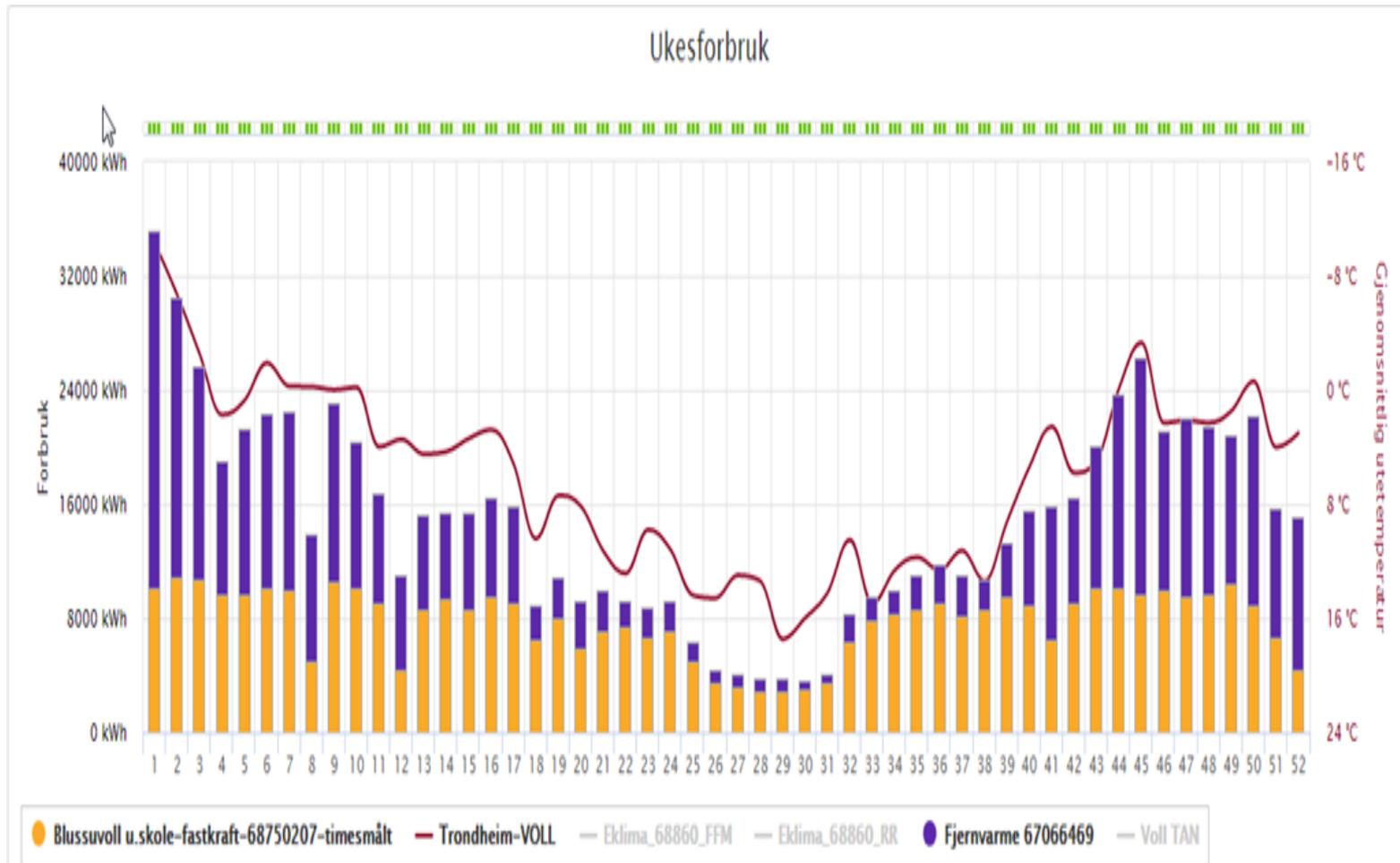
- 50% reduction in direct climate gas emissions in 2020 (compared to 2012)
- Climate gas emission neutral in 2030 (direct emissions)



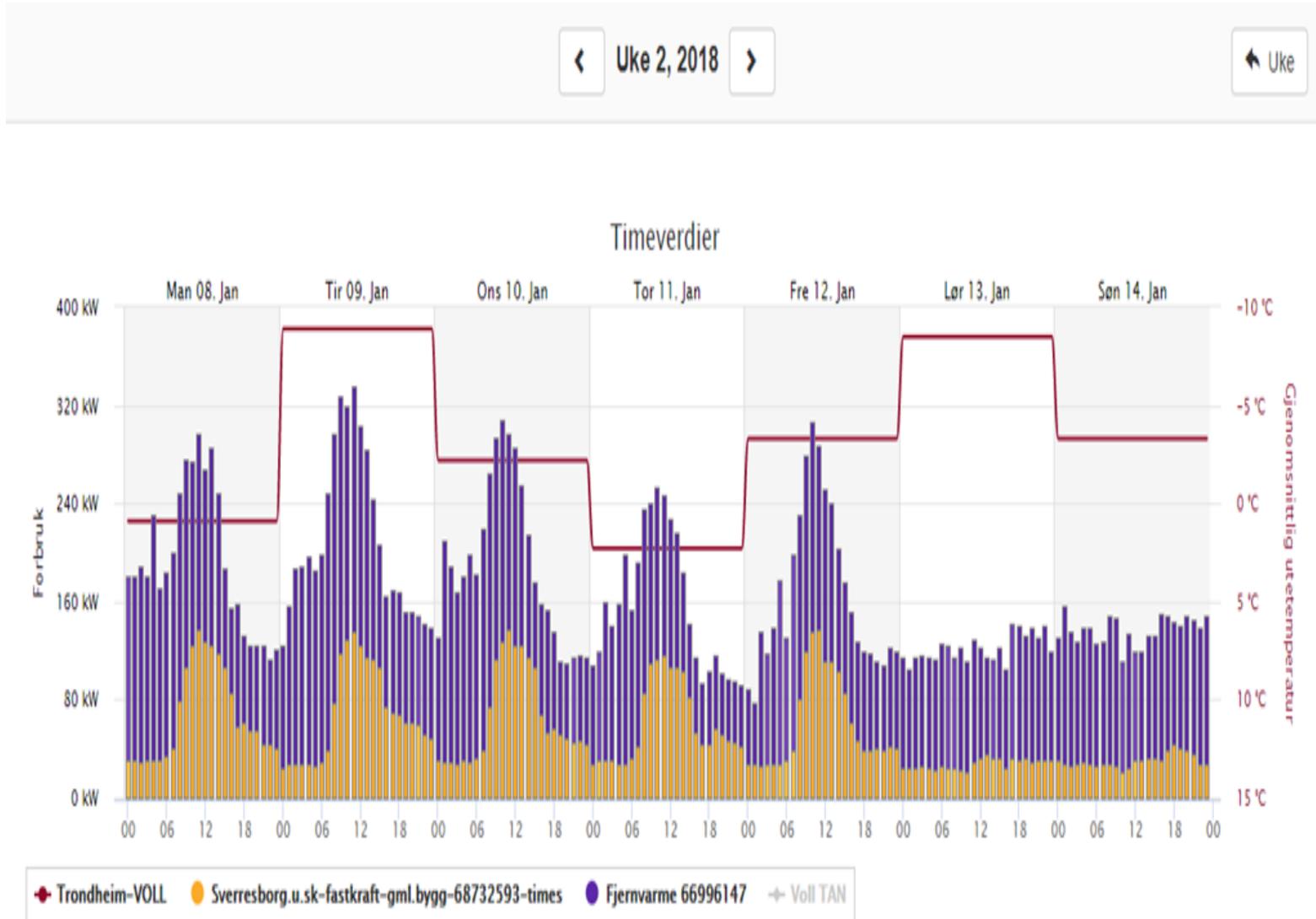
# Energy monitoring

- Every meter that measures energy for expense is registered automatically
- Energy Monitoring System (EMS)
  - The energy company sends the consumption data to an EMS-supplier
  - Temperature data from official weather station i Trondheim
  - Esave - New supplier to Trondheim Municipality from 2017

# EMS – Esave

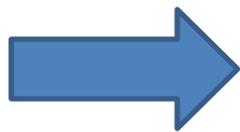


# Hourly consumption for one week in a school



# Energy monitoring

- Energy monitoring 236 buildings every week
- Does our buildings consume more energy than we expect?
- Energy – Temperature –curve

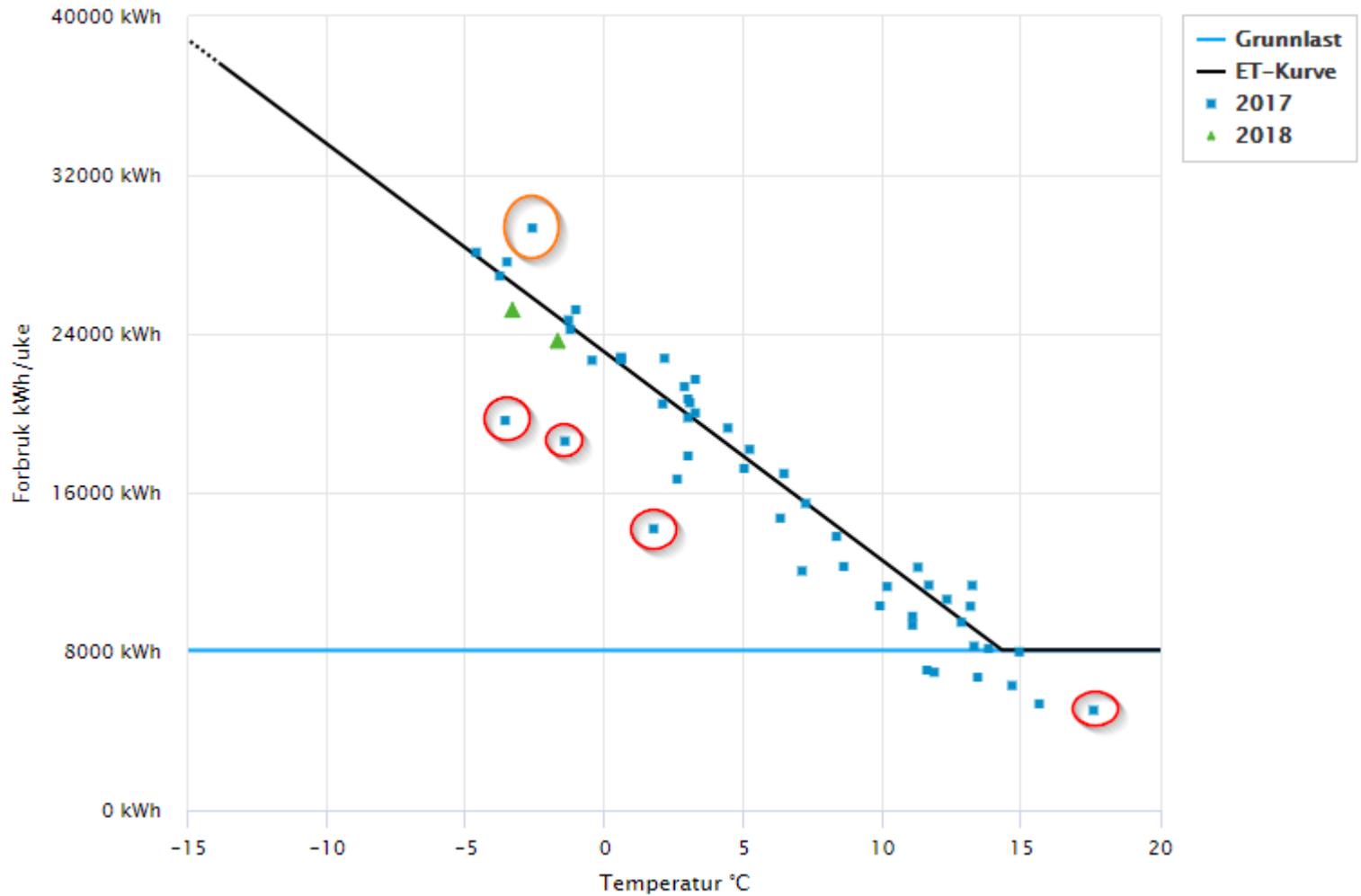
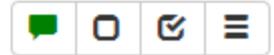


Energy signature

# Energy signature

Uke 1, 2000 +

Energi / Temperatur



# Energy monitoring

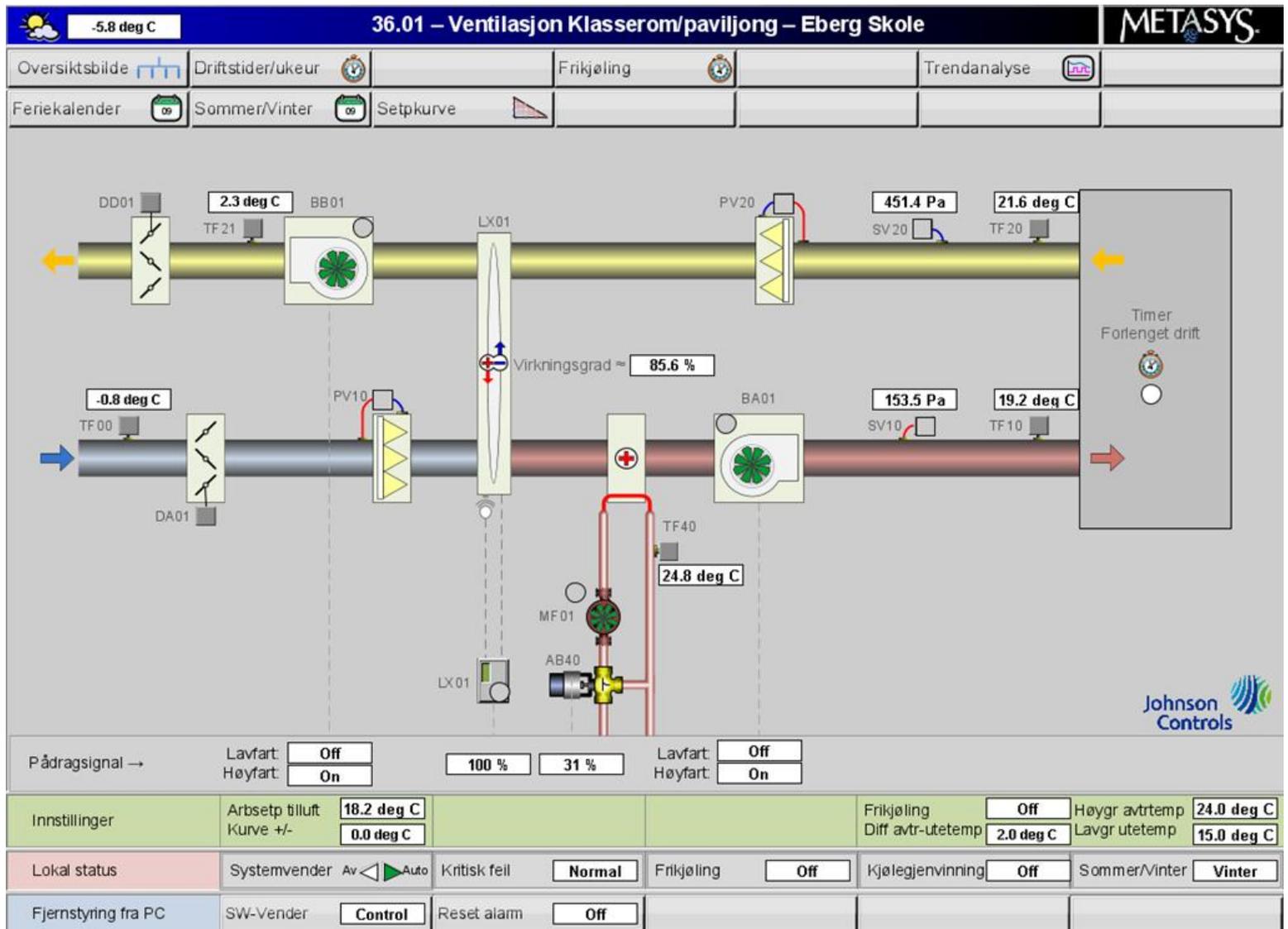
- Energy only when required!
  - runtimes (ventilation, hot water circulation)
  - Night setback
  - Heating and ventilation curves
- Energy meetings every week (energy, automation and HVAC)
- Operator involvement

# Weekly log

UKE / ÅR	Forbruk	Avvik	Ukekommentar	
2, 2018	18345.00 kWh	202.52 kWh	1.12 %	5F6 (15.01.2018 07:34): Utleie lør/søn. Utbytting av lyskilder, til LED
1, 2018	17721.00 kWh	869.37 kWh	5.16 %	5F6 (08.01.2018 08:53): Startet å bytte ut kompaktlyskilder og over til led plater i himling
52, 2017	14441.00 kWh	-3927.38 kWh	-21.38 %	5F6 (08.01.2018 08:51): SFO 27,28 og 29 des.
51, 2017	16131.00 kWh	2417.76 kWh	17.63 %	5F6 (08.01.2018 08:50): 20/12 Gjennomspyling dusjer (legionella) Utleie helg
50, 2017	19567.00 kWh	343.44 kWh	1.79 %	5F6 (18.12.2017 07:24): 14/12 rep. lekkasje på/rundt VV bereder. Utleie Søndag
49, 2017	16841.00 kWh	1836.90 kWh	12.24 %	5F6 (12.12.2017 07:29): Julebord i helga
48, 2017	18872.00 kWh	568.17 kWh	3.10 %	5F6 (04.12.2017 08:37): 1.des - Julelysene har begynt å komme frem på arealer. Utleie lør/søn
47, 2017	17157.00 kWh	837.85 kWh	5.13 %	5F6 (27.11.2017 07:40): 20/11 SDK skrudd opp temp 3trinn. Utleie Søndag
46, 2017	16916.00 kWh	1903.84 kWh	12.68 %	5F6 (21.11.2017 08:20): Utleie lør/søn.
45, 2017	14362.00 kWh	1382.93 kWh	10.66 %	5F6 (13.11.2017 07:35): 8/11 åpen skole (kveld), Utleie - helg, Varmekabler påslått trapper ute
44, 2017	12827.00 kWh	912.88 kWh	7.66 %	5F6 (06.11.2017 12:01): Stille og rolig. Bravida monterte sparedusjhoder på alle dusjgarderober i kjeller 3/11

# Building automation system (BAS)

## (Building management system - BMS)



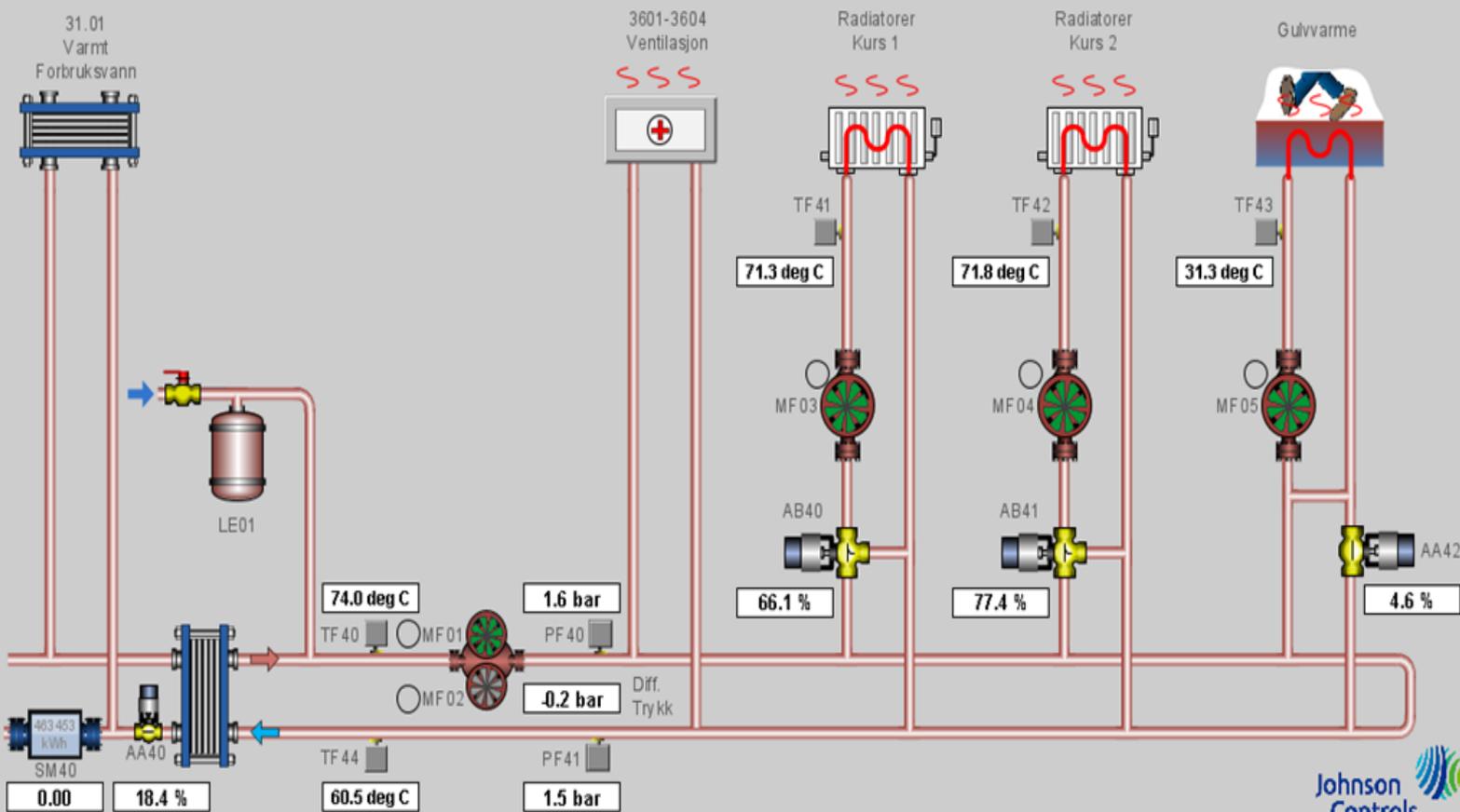


-5.7 deg C

### 32.01 Varmeanlegg – Eberg skole



Oversiktsbilde				Trendanalyse	
	Setpkurve Hov edstokk		Setpkurve Rad.kurs 1	Setpkurve Rad.kurs 2	Setpkurve Gulvvarmekurs



	TF40 turtemp	TF41 Radiatorkurs 1	TF42 Radiatorkurs 2	TF43 Gulvvarmekurs
Arbeidende settpunkt turtemperatur	Arb.setp Kurve +/- <b>75.5 deg C</b> <b>0.0 deg C</b>	Arb.setp Kurve +/- <b>70.6 deg C</b> <b>0.0 deg C</b>	Arb.setp Kurve +/- <b>70.6 deg C</b> <b>0.0 deg C</b>	Arb.setp Kurve +/- <b>30.2 deg C</b> <b>0.0 deg C</b>
Stopp sirkulasjonspumpe ved høy utetemperatur	Setp <b>15.0 deg C</b>			
Lokal status				Sommer/Vinter <b>Vinter</b>
Softwarevender sirkulasjonspumper	Vender <b>Auto</b>	Vender <b>Auto</b>	Vender <b>Auto</b>	Vender <b>Auto</b>



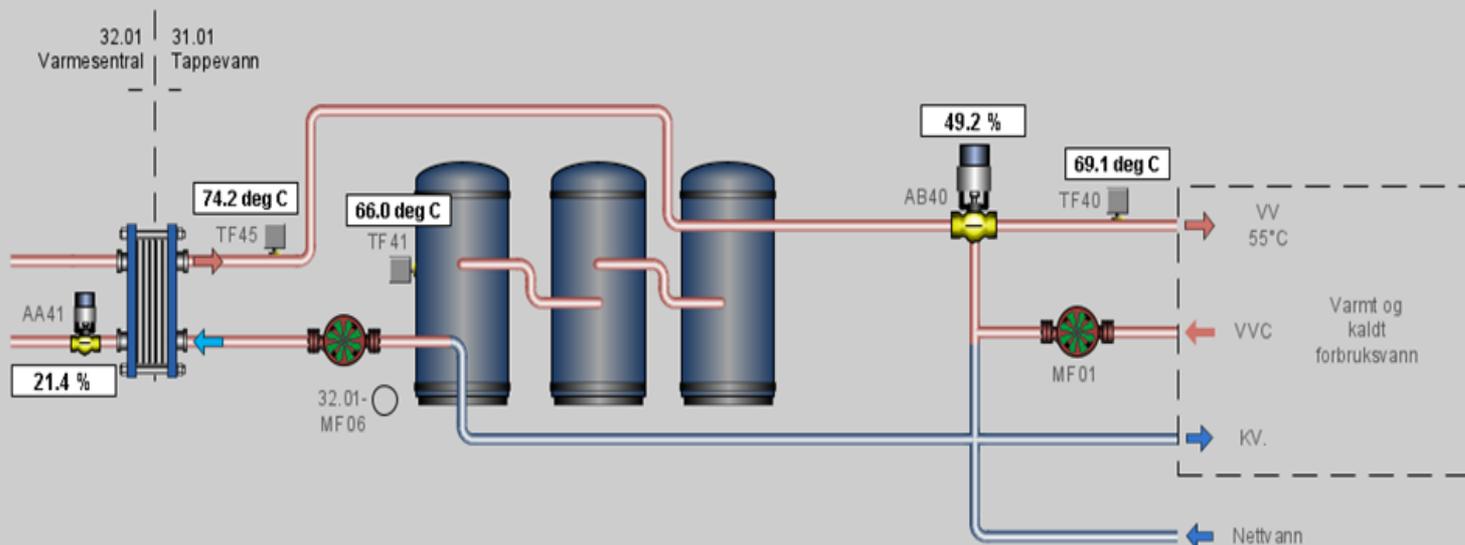
-5.7 deg C

# 31.01 – Tappevann – Eberg skole

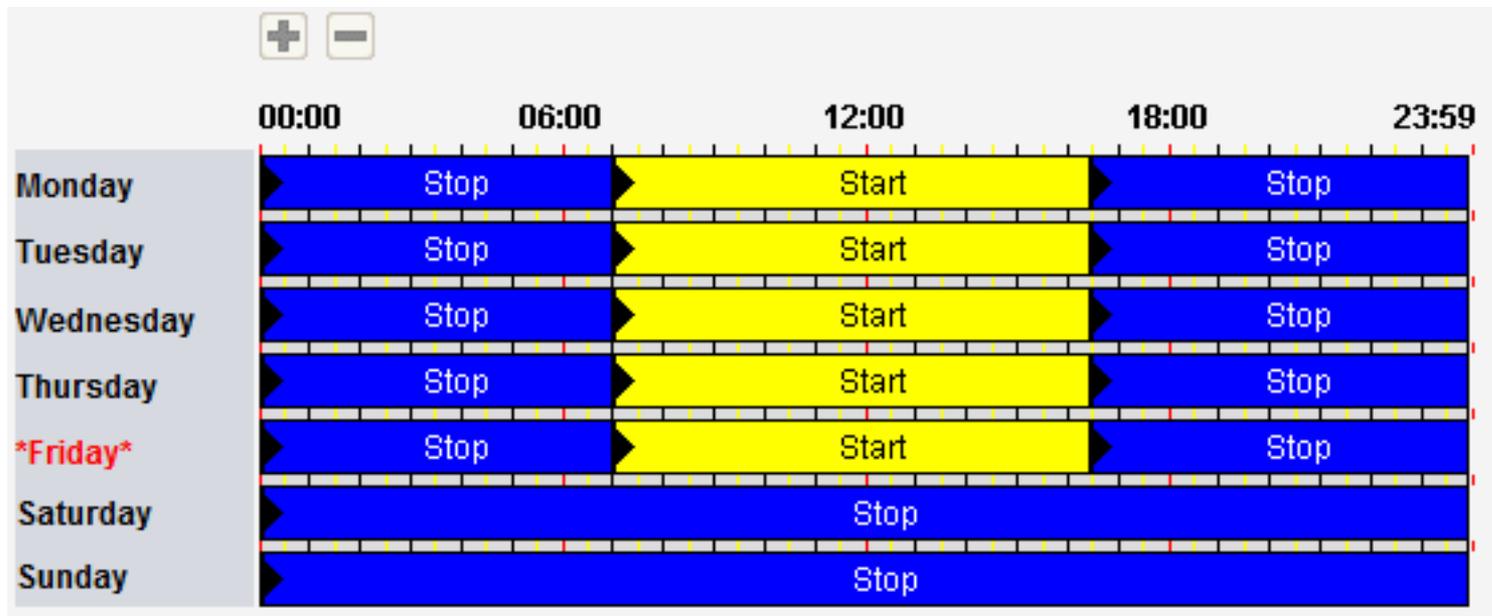


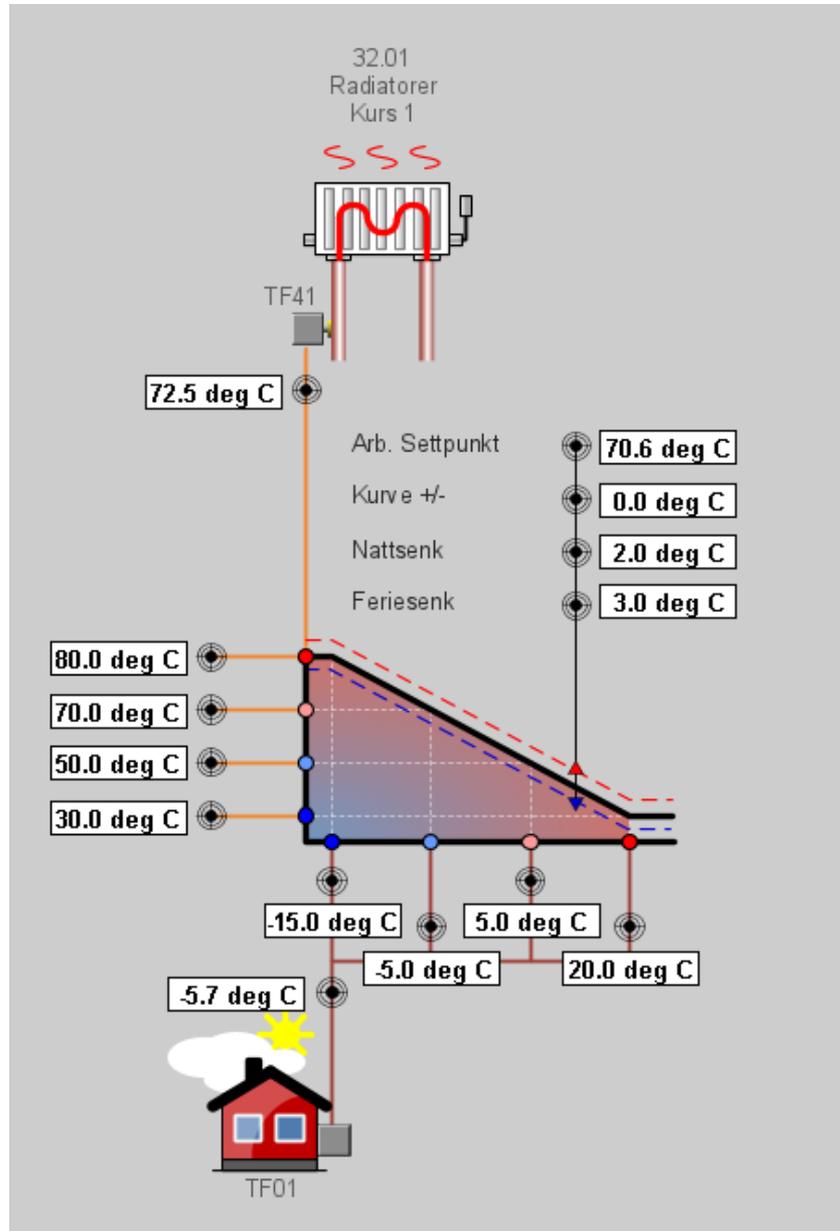
Oversiktsbilde

Trendanalyse



Innstillinger	Setp temp TF40 <b>65.0 deg C</b>	Setp temp TF45 <b>70.0 deg C</b>		
Lokal status				
Fjernstyring fra PC	MF06 <b>Auto</b>	MF01		

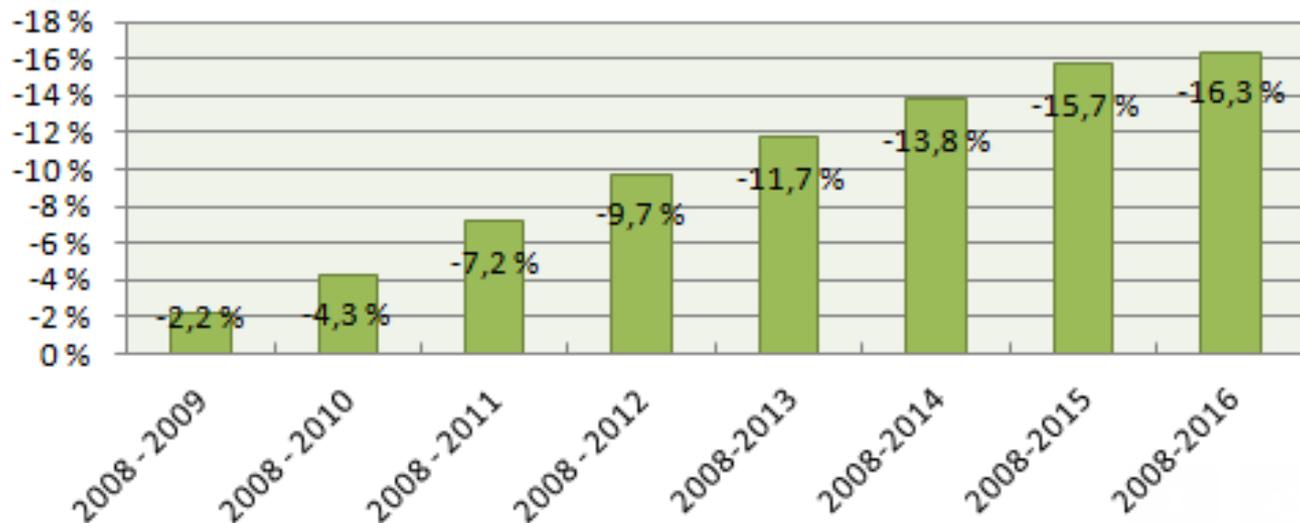




# Goals and reports

- Reduce energy consumption in our buildings

## Energibesparelser hos Trondheim eiendom



# Financial solutions

1. EE funds
2. Special circumstances
3. ENOVA



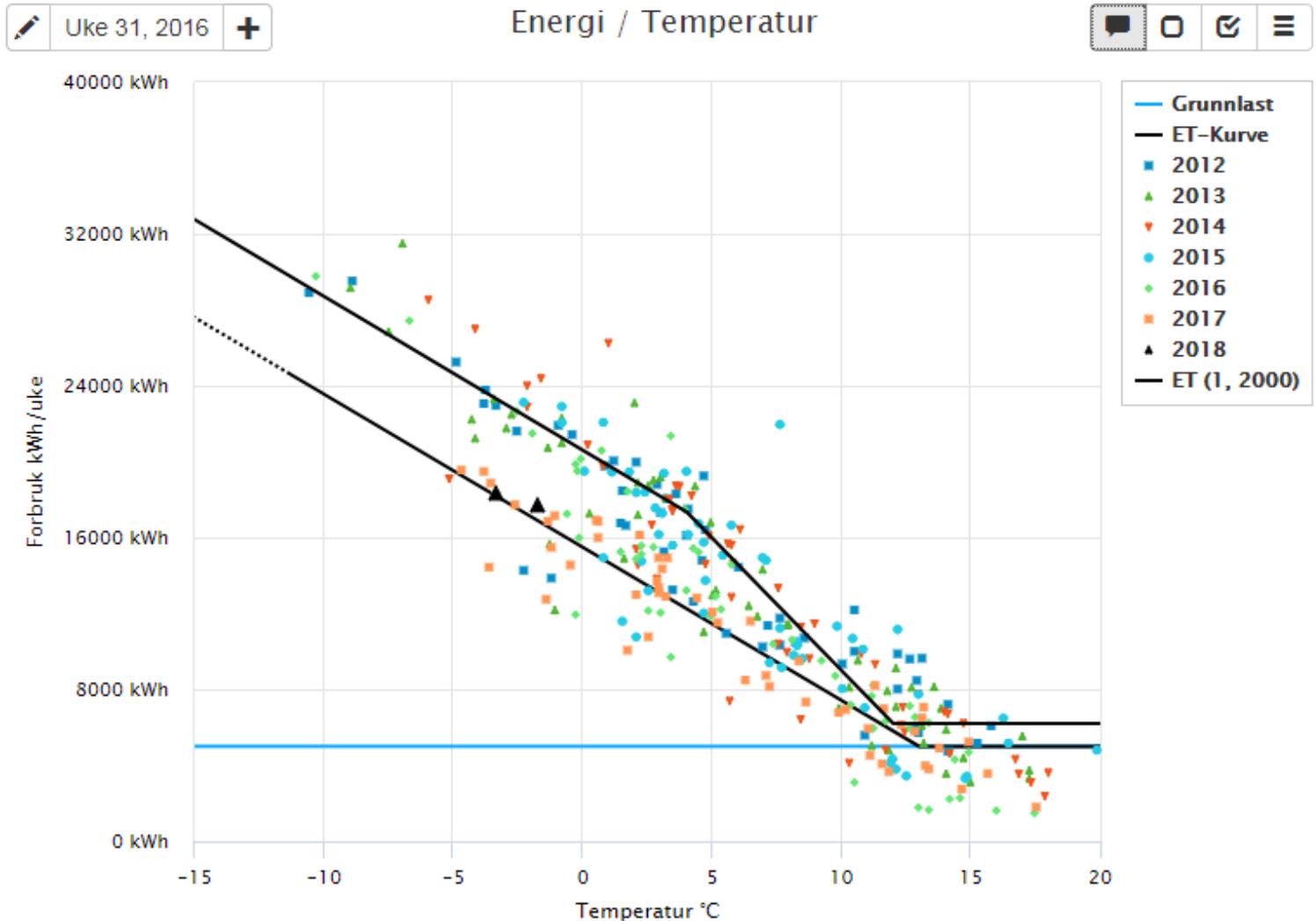
# EE funds

5 MNOK (520.000 euro) to spend every year on EE in our own buildings

- Rotating heat recovery units
- Heat pumps
- Separate heat exchangers for heating system and tap water
- LED lights
- Commissioning and tuning
- Installation of timers



# From glycol to rotating heat recovery unit



# From glycol to rotating heat recovery unit

- Replace the heat recovery unit on 4 ventilation units
- Price: ~1.000.000 NOK (100.000 euro)
- Estimated energy saved: ~250.000 kWh/yr
- Repayment period: <5 years



# Special circumstances - Oil burner prohibition from 2020

From 2020 the use of oil burners for heating of buildings will be prohibited in Norway (exception for energy companies, industry, biofuels etc.)

In 2017 Trondheim Property Service was granted 1,5 MNOK (150.000 euro) for removal of oil burners and buried fuel tanks

# ENOVA

Enova SF is a Norwegian government enterprise responsible for promotion of environmentally friendly production and consumption of energy. Its stated purpose is to explore new sources of clean energy, reduce overall energy consumption, and to provide educational materials to the public promoting energy-efficient practices. Established in 2001, it is financed through government funding in addition to a tariff of 1 øre per kWh of electricity to consumers. The company is owned by the Norwegian Ministry of Petroleum and Energy.





Thank you!  
Дякую!  
Dziękuję Ci!  
Tusen takk!