Norway's (SINTEF & NTNU) possible applications for IBPSA prj.1-WP3

Igor Sartori, igor.sartori@sintef.no

Senior scientist, SINTEF

3 projects (++)

1. The research center on Zero Emission Neighborhoods in Smart Cities (ZEN)
2. Rockstore
3. LTTG+: Low Temperature Thermal Grid with surplus heat utilization

(++) Collecting measurements on hourly consumption from different sources (concluded measurement campaigns, data provided by industrial partners)

IDA ICE simulations of Norwegian TABULA archetypes for Apt. Blocks, both high- and low-temperature supply from DH

ZEN Pilots/Living Labs

Oslo: Furuset

Bergen: Zero Village Bergen

Elverum: Ydalir

Trondheim: Knowledge Axis

Bodø: Airport area

Steinkjer: Residental area

Evenstad: Campus

Population of 30 000 people

Built floor area of more than 1 million m^2

ZEB Flexible Lab office building, NTNU Campus

ZEB Living Lab residential building, NTNU Campus

Campus Evenstad

Photo: Statsbygg

- Located ca. 200 km N of Oslo
- Campus of the Inland Norway University of Applied Sciences
- Facility owned by Statsbygg – the State's building company
- Pilot in the research centre ZEN – Zero Emission Neigborhood in Smart Cities

SINTEF

Main features

Buildings	About 10 000 m^2 of floor area, different building types and efficiency standards (1 new highly efficient)
Energy use, yearly	~700.000 kWh electricity + ~620.000 kWh heat
Electricity sources	CHP (biomass), PV-system, grid
Thermal energy	CHP (biomass), bio-boiler, solar collectors, electric boiler

Photovoltaic (PV) system

- Installed capacity 60 kWp
- Annual generation ~ 45 000 kWh
- Battery package being installed

  Capacity: 204 kWh

  Dis/Charging rate: 108 kW

EV charging station

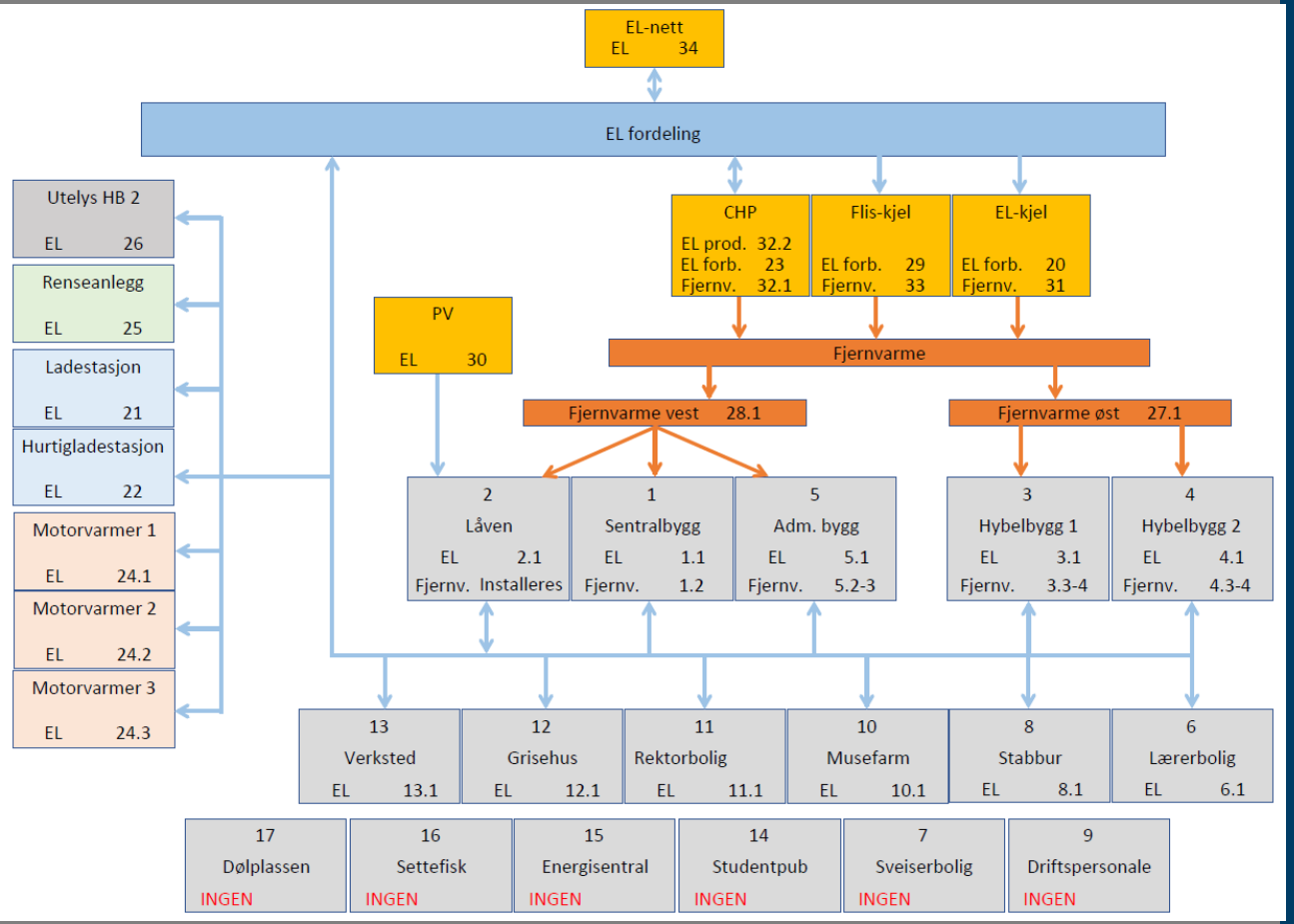
- Charging station (normal and semi-fast) for Electric Vehicles
- 5 EV per today
- But > 90 cars at the campus
- Vehicle-to-grid (V2G) charger being installed

SINTEF

Local district heating

- Combined Heat and Power (CHP), base heating
  - 100 kWth – 40 kWe
- Biomass boiler, top heating and reserve
  - 350 kW
- Wood chips from regional production
- Electric boiler, reserve
  - 315 kW
- Buffer tank
  - 1000 l

SINTEF



Overview of meters

- Electric meters in all buildings
- Thermal meters in some buildings
- Some buildings have sub-metering:
  - Space heating
  - Domestic Hot Water
  - Lighting
  - Ventilation fans
- Indoor temperatures in some buildings

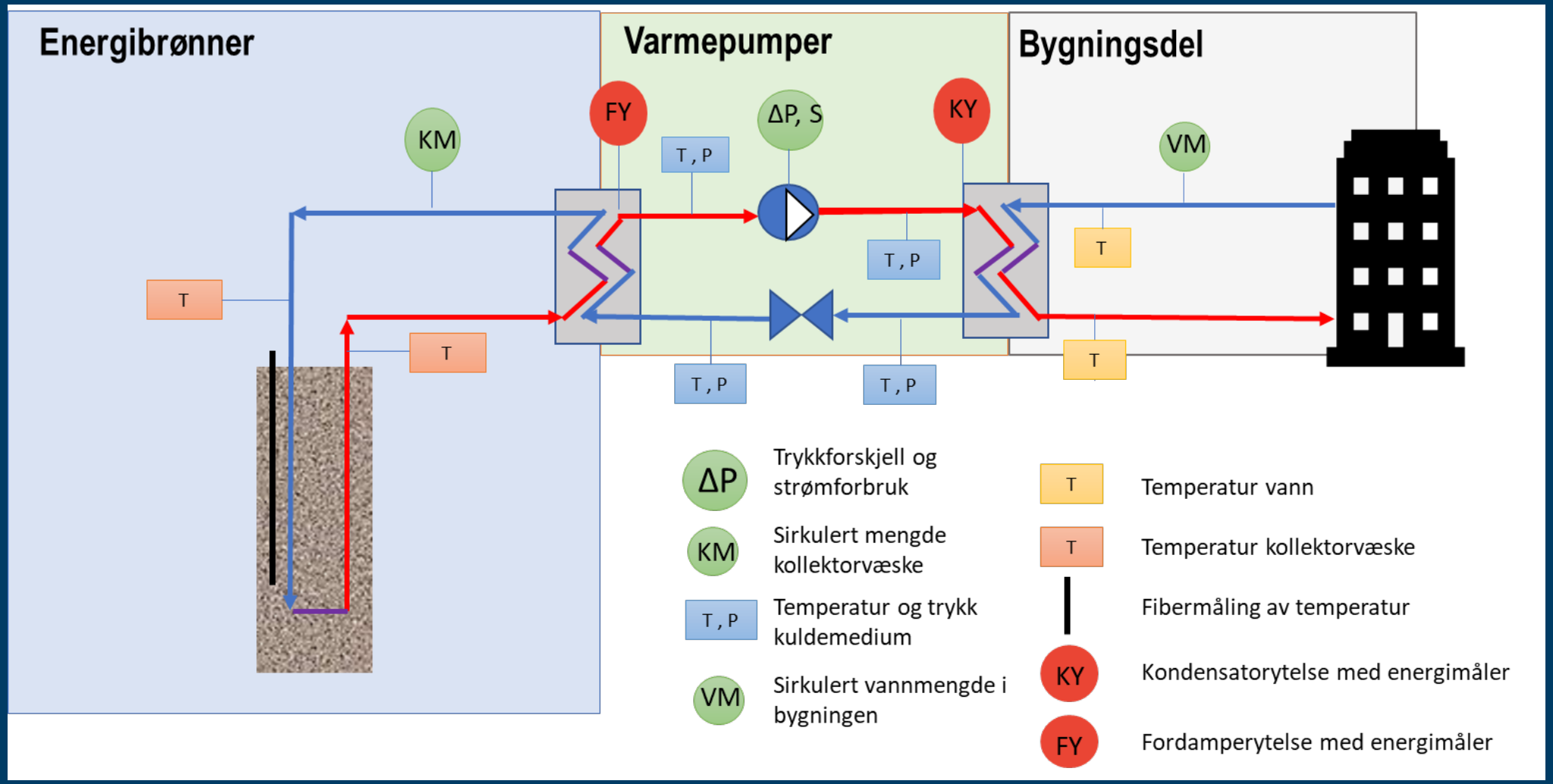
SINTEF

ROCKSTORE
Pilots for Rockstore and Annex 52 (provided founding)

Utvalgte norske testanlegg					
Testanlegg	Byggeår	DTS	Mål med prosjektet	Antall brønner	Dimensjonerings grunnlag
1. Scandic Flesland, Bergen	2017		Nytt konferansehotell med brønnpark og solfangere. Dobbel-U kollektor	50	Dekking av varmebehov
2. Vensmoen Eiendom, Saltdal	2015	x	Svært høy grunnvannsstrømning i enkelte av energibrønnene (typisk innlandsklima og anlegg konvertert fra oljefyring)	24	Dekking av kjølebehov
3. Fellesbygget, Bergen	2018	x	Nytt grunnvarmeanlegg med installert fiber i flere av brønnen for temp. overvåkning (typisk kystklima)	14	Dekking av varmebehov
4. Stavanger 2020	2016		Integrert energiløsning med brønnpark, PV, varmepumpe (luft+ avløp) og mulighet for kobling av brønnpark til fjernvarme	8	Dekking av kjølebehov
5. Fjell skole, Drammen	2018	x	Innovativt energilagringskonsept med grunne energibrønner for kombinasjon med bl.a. sollagring.	100	Energilagring og dekking av varmebehov
6. Utvalgte anlegg ORMEL2, Melhus	1998 -		Anlegg basert på oppumpet grunnvann fra filterbrønner etablert i sand- og grusakviferer.	Varierer	Dekking av varme og kjølebehov

SINTEF

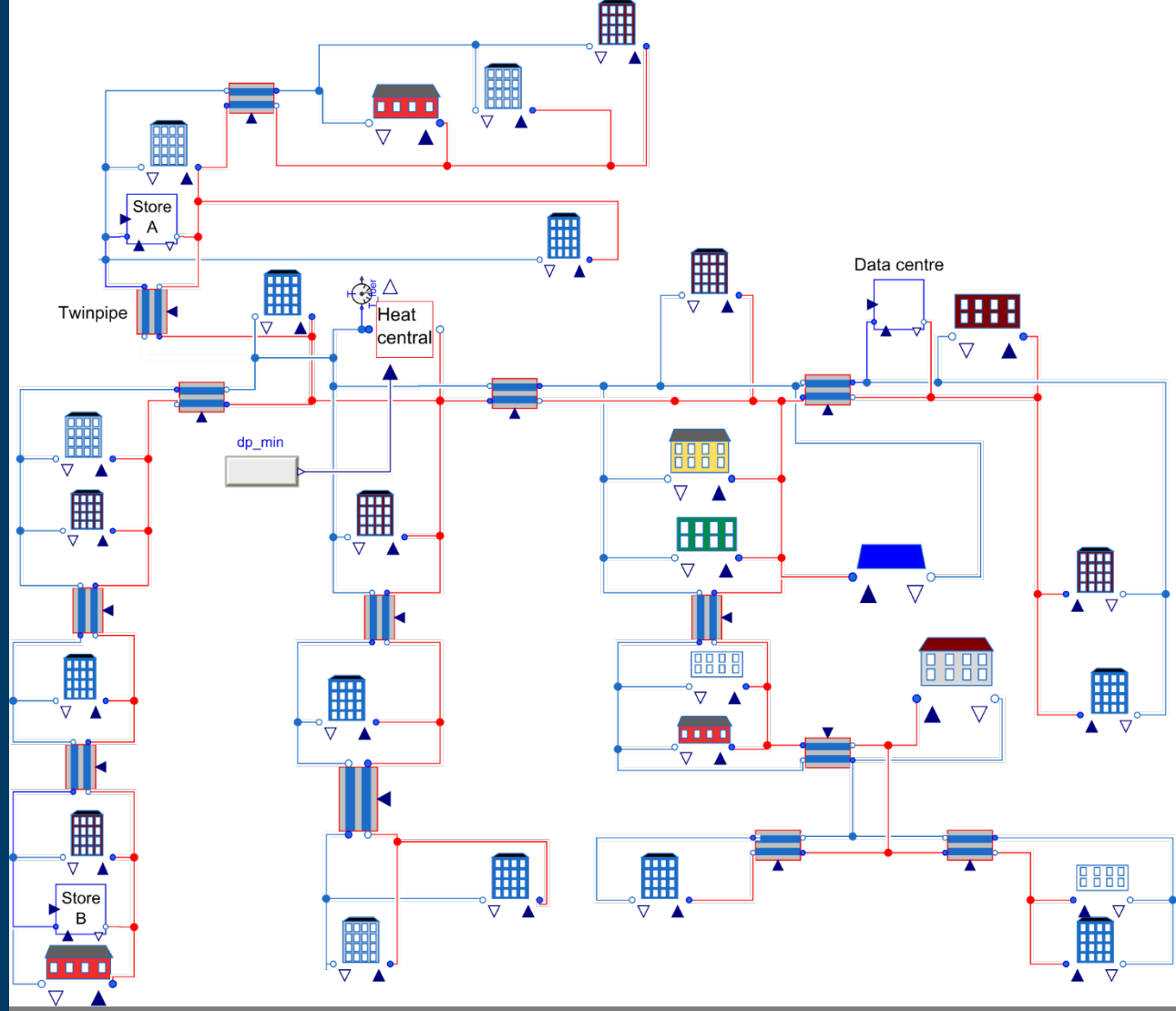
ROCKSTORE
Typical measurements in each pilot



SINTEF

Dymola modelling of local thermal grids

- **DSTG:** Nationally funded project in collaboration with Statkraft Varme (local DH company) & Trondheim Municipality (2015-2017)
- SmartThermalLibrary
  - Modelica library for modelling thermal systems
  - Main components
    - Customer substation
    - Twin pipes
    - Heat central
    - Prosumer
- Main project objectives: to study
  - the benefits of low-temperature DH
  - the effect of having local prosumers in different parts of the network

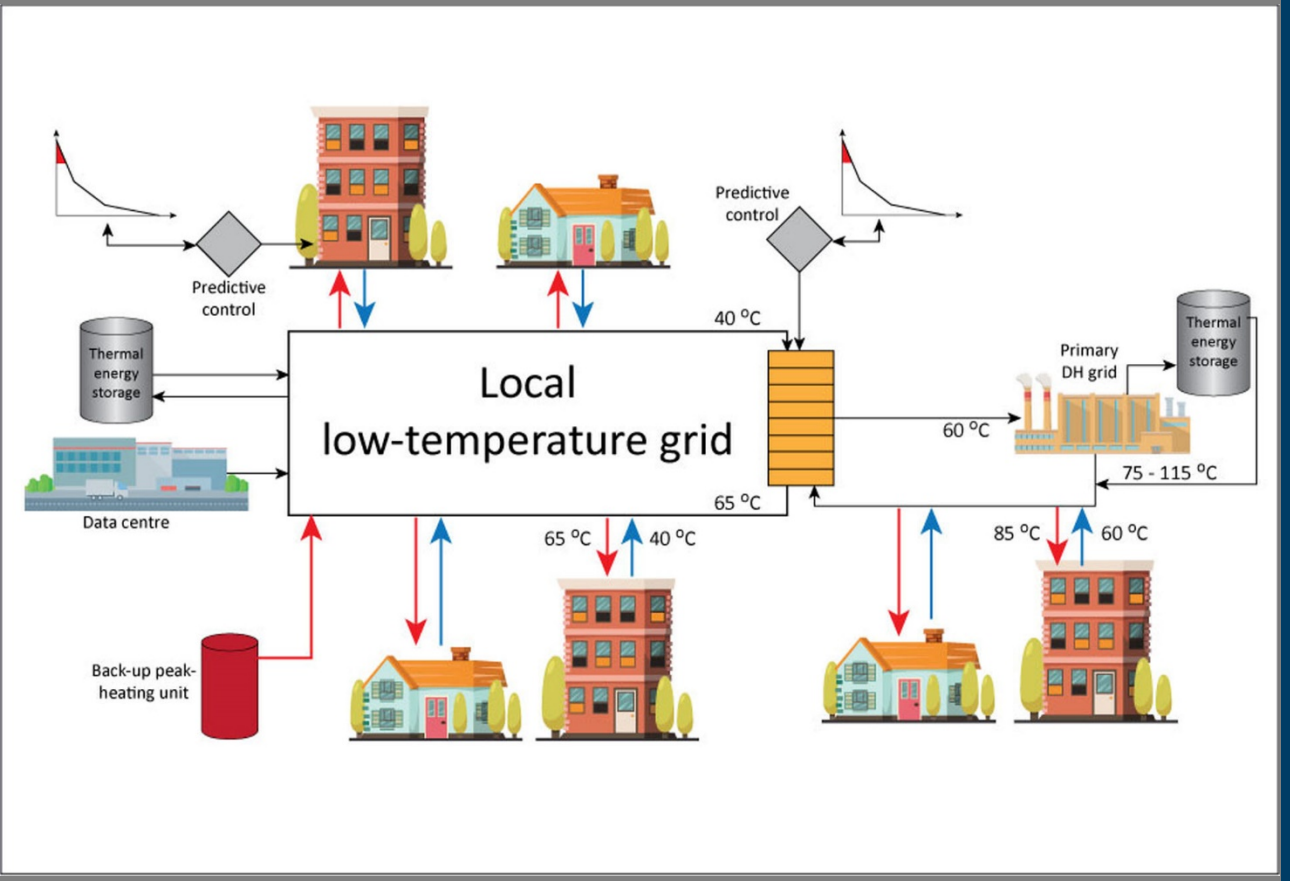


Kauko, H.; Kvalsvik, K.; Rohde, D.; Nord, N.; Utne, Å. (2018) Dynamic modeling of local district heating grids with prosumers: A case study for Norway. *Energy.* vol. 151.

SINTEF

LTTG+

Low-temperature Thermal Grids with surplus heat utilization



Primary objective:

The primary objective of *LTTG+* is to provide the knowledge to design and operate cost effective and flexible low-temperature thermal grids with surplus heat utilization, thermal storage and connections to the conventional DH network.

SINTEF

SINTEF

Teknologi for et bedre samfunn