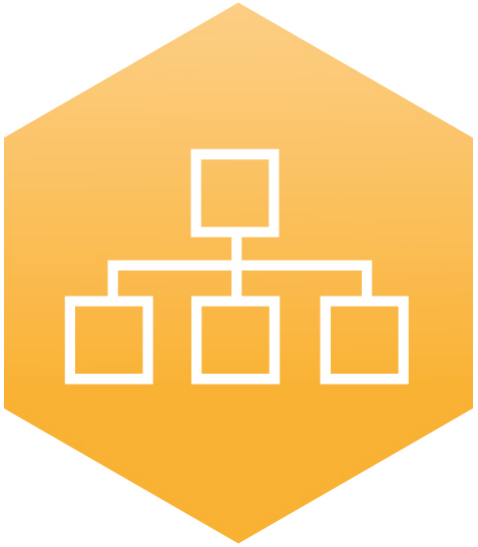
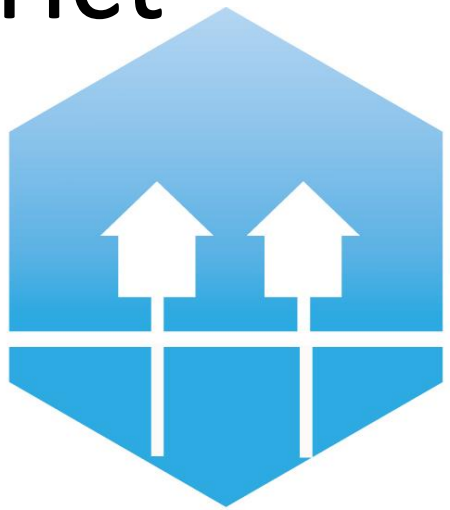
2nd International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 26-28 September 2016

Feed-in from distributed heat sources in district heating systems





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4DH
4th Generation District Heating
Technologies and Systems

A way to develop DH by including not only heat delivery, but also decentralised heat supply

Prosumers – consumers that act both as heat users and producers of heat

Boilers and other heat sources that is owned by the DH-company or by a third part

A part of

Fjärrsynsprojekt: Små värmekällor – kunden som prosument

Small heat resources – the customer as prosumer

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Final report, in Swedish, in summer 2016
http://www.energiforsk.se/program/fjarrsyn/rapporter/sma-varmekallor-kunden-som-prosument-2016-289/

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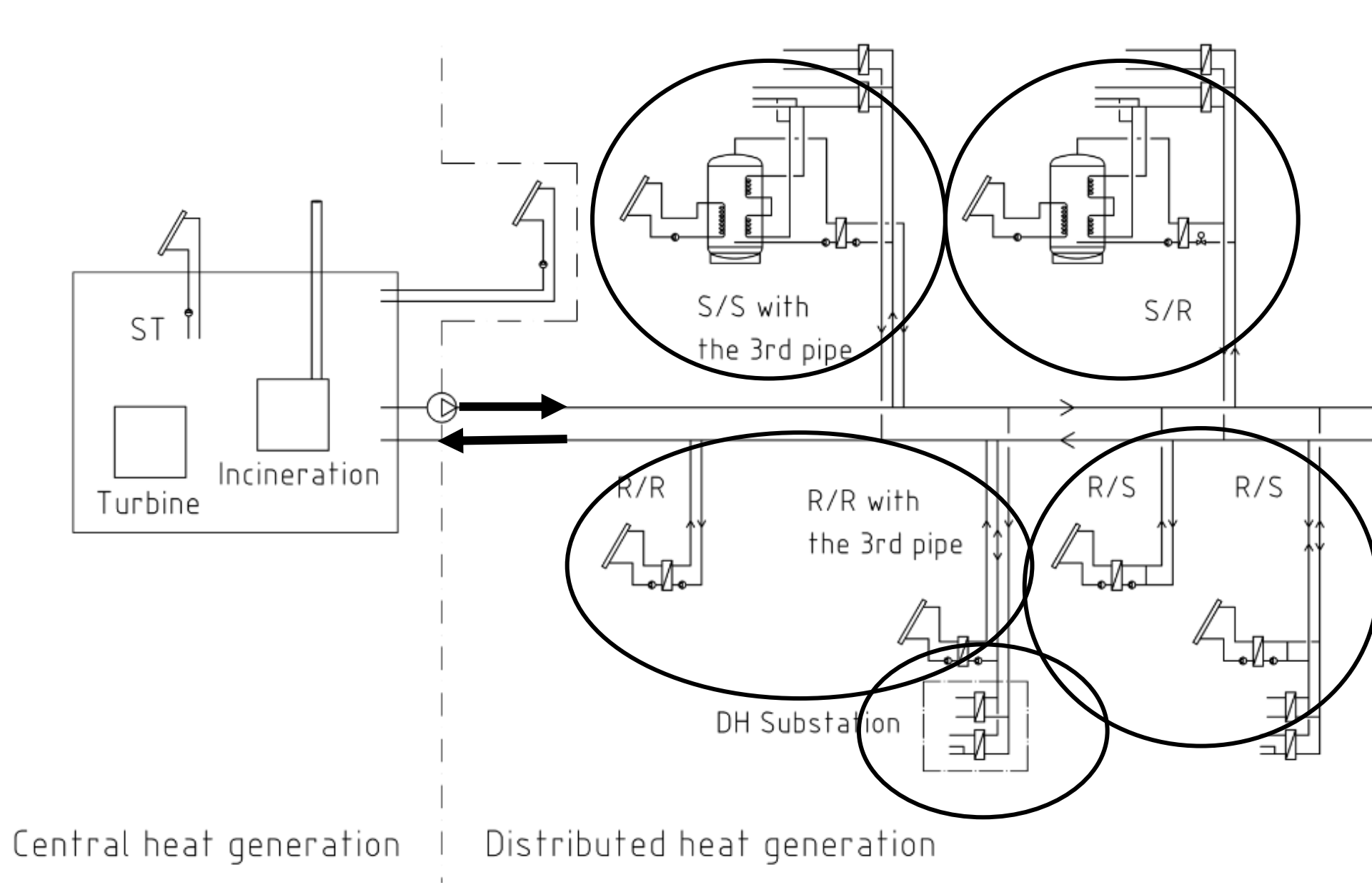
Central connection – distributed connection

4 different way for distributed connection R/R, R/S, S/S and S/R (do not show combinations in this presentation)

R/S – two different connection and control principles;

- flow controlled and
- temperature controlled

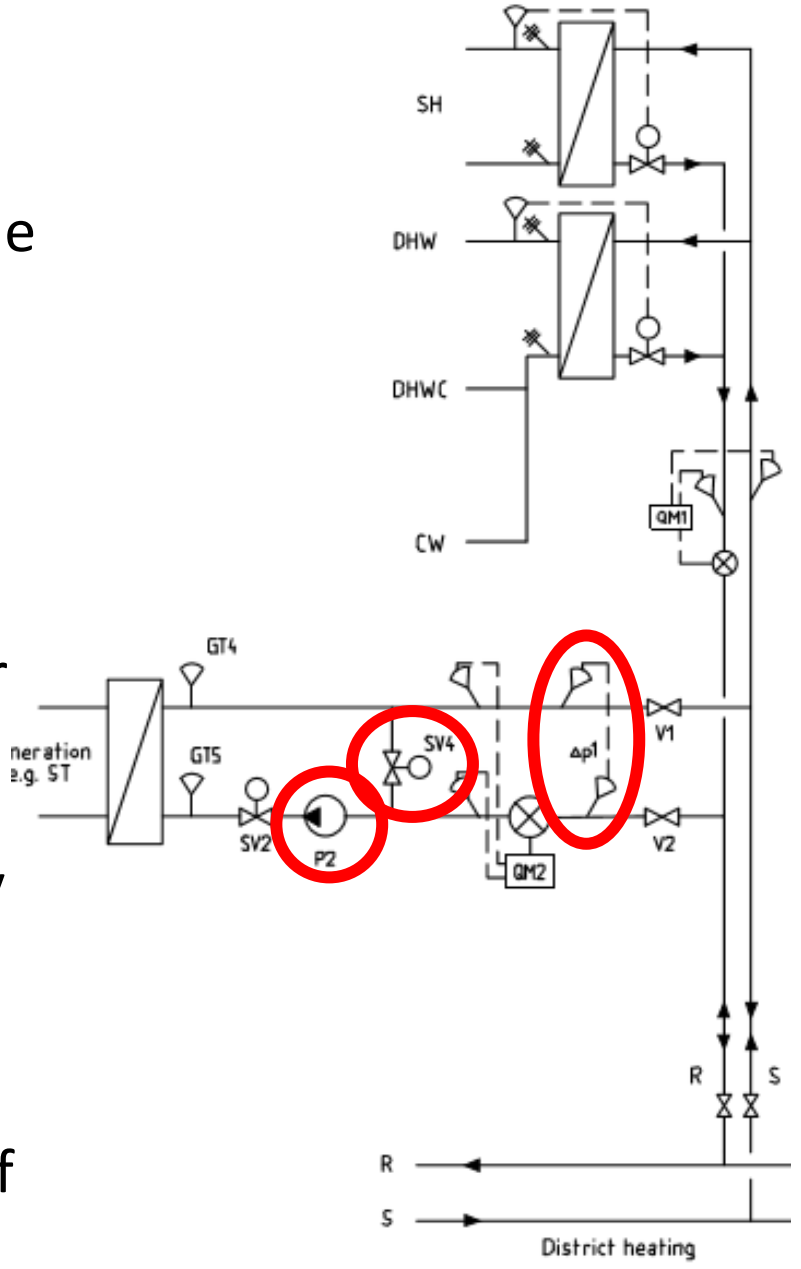

ST
Turbine
Incineration
S/S with
the 3rd pipe
S/R
R/R
R/R with
the 3rd pipe
R/S
R/S
DH Substation
Central heat generation
Distributed heat generation

Distributed heat generation	R/R	R/S	S/R	S/S
Most common	X	X		
Can create a flow in the DH network		X	X	
Need a feed-in pump (in brackets, can function without a pump)	(X)	X		(X)
Increase DH return temperature	X		X	
Simple control strategy	X		X	X
Must produce a temperature above a certain level		X		
Can be used as an over-heat protection system at a common DH substation without an extra pipe (the 3rd pipe)		X	X	
An extra pipe is needed when connected to a common DH substation (the 3rd pipe)	X			X
Useful in most applications		**X**		

Two different kinds of feed in system (in R/S mode)

Temperature controlled (TC)

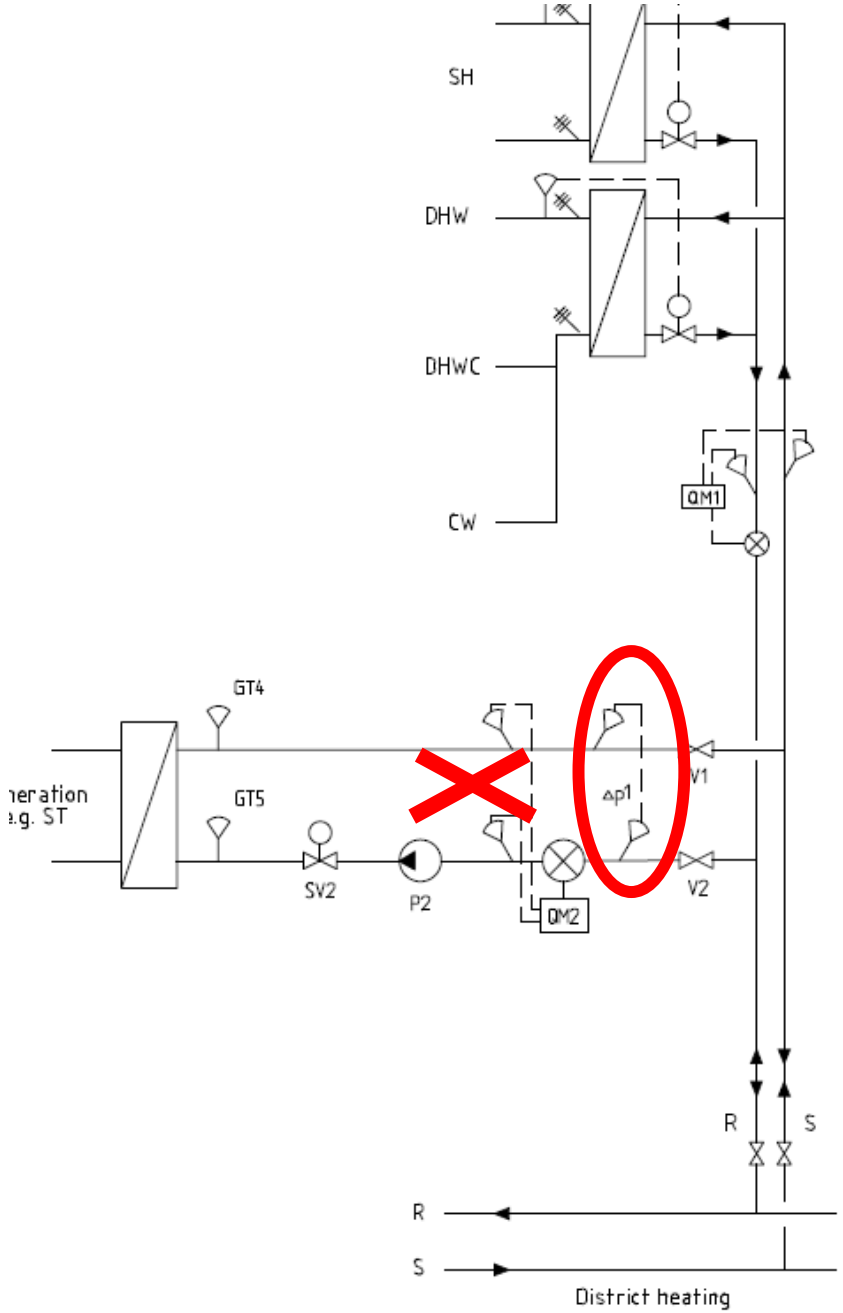
- There must always be a flow through the shunt pipe – SV4 may never close completely
- The feed-in pump, P2, shall only have enough pressure head to exceed the differential pressure, set point curve for speed is given by a value on Δp1
- Feed in flow is completely controlled by the valve in the shunt, SV4. SV2 may in some circumstances need to help.
- The cold temperature on the hot side of the HX is higher than it need to be.



Two different kinds of feed in system (in R/S mode)

Flow controlled (FC)

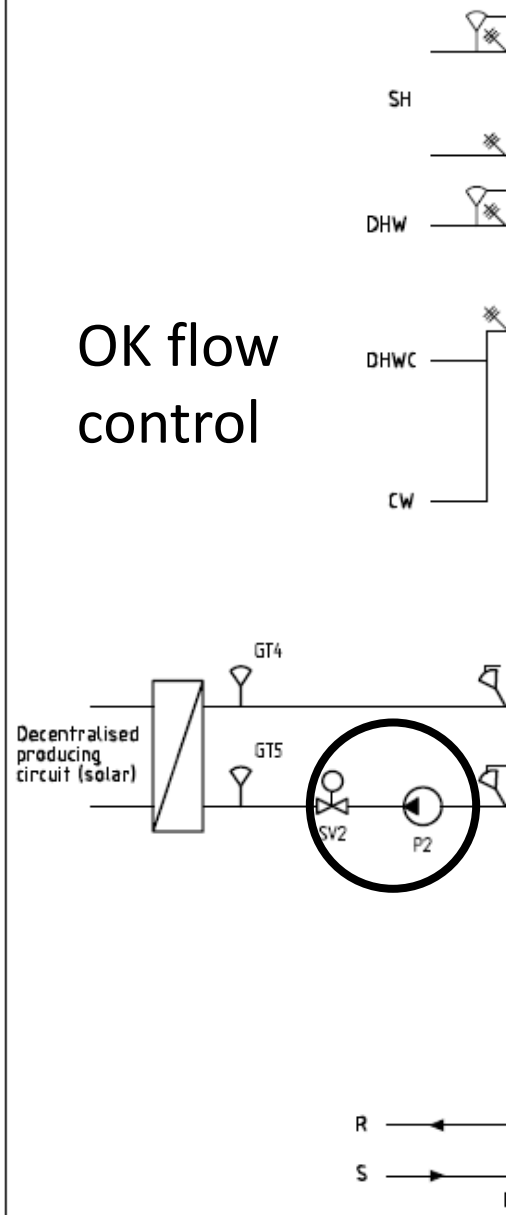
- No flow through the shunt pipe – SV4 shut or the shunt do not exist
- The flow is controlled by the feed in pump, P2, or SV2 with a fixed speed on P2, speed set point by $\Delta p1$.
- P2 the feed-in pump will work with a to low flow for a too long time, guarantee problems??
- There are control and pump problems if the feed-in flow is small and the differential pressure is high



Decentralized heat sources;

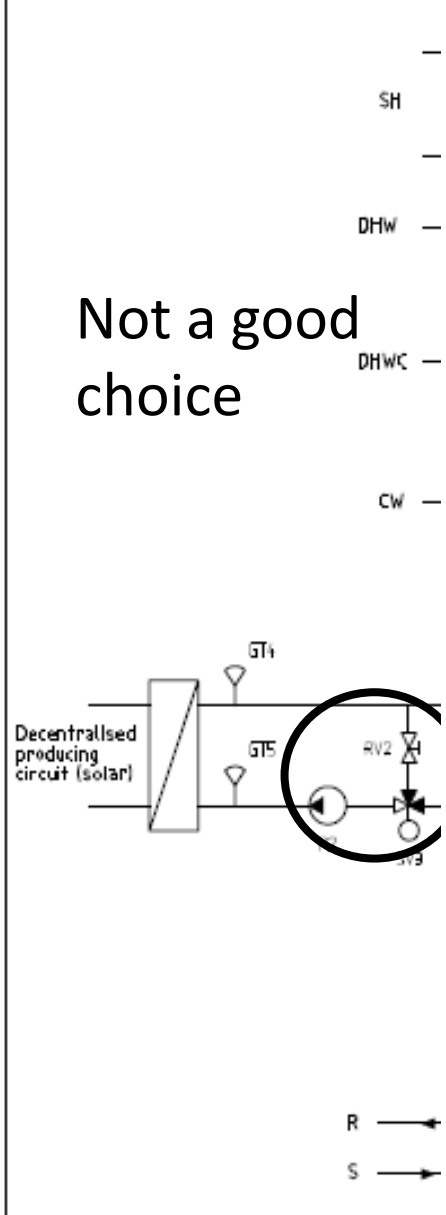
• Solar thermal	FC or TC or both
• Excess heat from cooling machines, (data centres, shopping centres and sports arenas).	TC (single machines) FC (in series)
• Excess heat from industrial processes, (casting, moulding or excess steam)	FC (maximum Δt)
• Old boiler that no longer is in permanent use but could be used temporarily	TC
• Waste dump with methane aggregation and burning	TC
• Crematorium	TC
• Heat pumps (when cheap electricity)	TC/FC
• And a lot more	

OK flow control



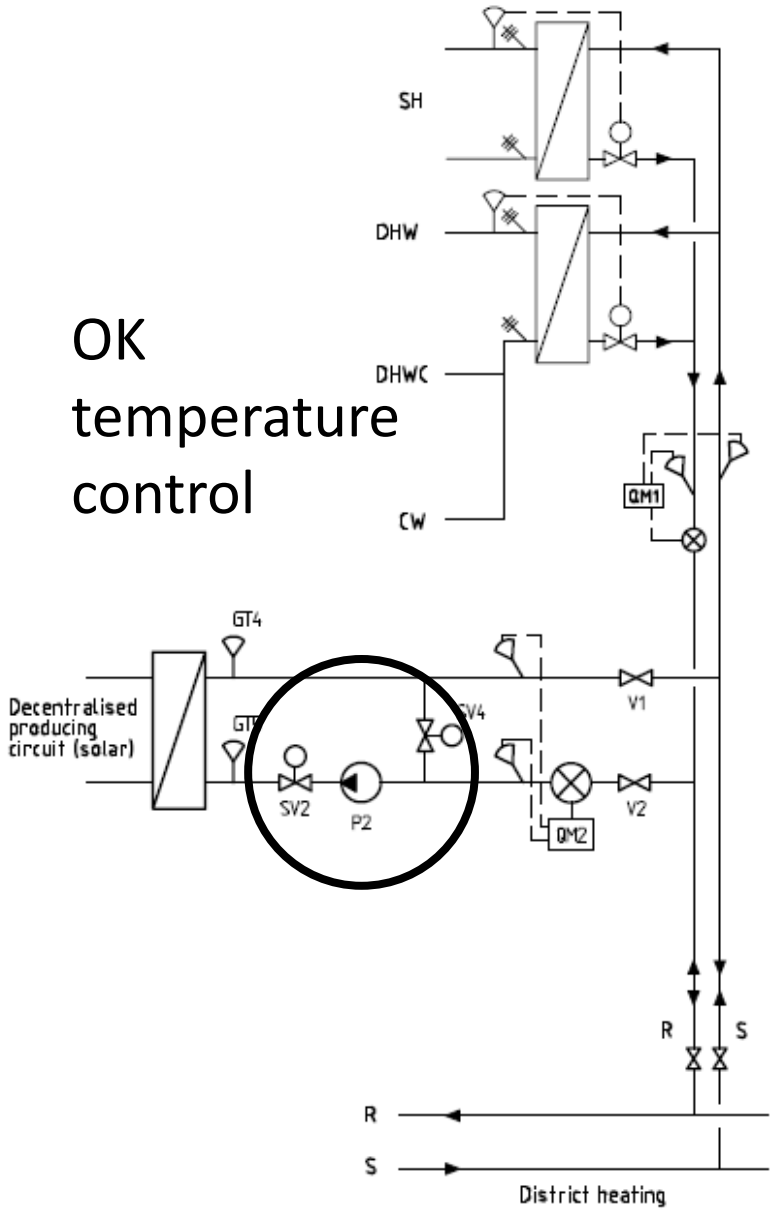
System layout 1

Not a good choice



System layout 2A

OK temperature control



System layout 3A

Rev. 2015-01-26

Thank you for your attention