3RD INTERNATIONAL CONFERENCE ON
SMART ENERGY SYSTEMS AND
4TH GENERATION DISTRICT HEATING
COPENHAGEN, 12–13 SEPTEMBER 2017
R/R or R/S feed-in plants

What is most important for a feed-in plant, solar thermal or any other heat source?

• Generate as much heat as possible?
• Produce useful heat, at a correct temperature?
• Disturb the central heat production as little as possible?
• Generate heat as economically as possible?
A Feed-in Solar Thermal plant in Ystad

Owner – Ystad Fjärrvärme (public owned company)
Area – 36 collectors, 534 m² aperture area
Collector brand – SavoSolar
Contractors – 3 parts,
  SavoSolar – all parts and all work on roof
  Absolicon – deliver of feed-in sub-station, with control unit
  Ystad fjärrvärme (DH) – all the rest with sub-contractors and own staff
Responsible for tender documents and system design

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• A feed-in plant – connected to the DH network outside the main pumps in the system

www.4dh.eu  www.reinvestproject.eu  www.heatroadmap.eu
Central heat generation | Distributed heat generation/Feed-in system

R/S and R/R with the 3rd pipe

DH Substation

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• A feed-in plant – connected to the DH network outside the main pumps in the system
• A combination between Return/Return and Return/Supply feed-in
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• A combination between Return/Return and Return/Supply feed-in
• Use a Flow controlled R/S-feed in system
• Have main control options regarding
  – Flow control in the solar circuit
  – Feed-in flow control, temperature or flow
  – Feed-in pump and control valve for flow adjustment
R/R – water is withdrawn from the return pipe and feed back to the return pipe

• Need a third pipe when installed together with a sub-station
• Do not need to feed-in at given lowest temperature
• Increase the return temperature in DH network
• Need very little pump pressure heed to give correct flow
• A very simple control function
• Can not create a flow in the main DH-network
R/S – water is withdrawn from the return pipe and feed back to the supply pipe

• Can be installed separate and together with a substation without any extra piping
• Do not affect the temperature in the DH system
• Need much more feed-in pressure head to overcome the differential pressure than a R/R system
• Must feed in a given temperature or at least higher than a given temperature
• More advanced control system
• Can create its own flow in the DH network
Two basic R/S control systems

• Temperature controlled – with a short circuit
  SV4 is never allowed to close to 100 %. P2 guarantees a feed-in flow but SV4 control it.

• Flow controlled – without short circuit
  SV4 do not exist
  The feed-in flow is controlled by P2 and/or SV2

A small plant and a high differential pressure gives a more severe control
Solar circuit control at R/S mode

The desire is to have a stable temperature at T2 independent of the radiation, 2 to 3 degrees higher than feed-in set-point, T4. Variable flow can provide a very long response time.

- Adjust the ST-pump speed to have a stable temperature at T1 (= T2 + 2°C)
- Adjust the ST-pump speed relative to the radiation with help of the solar equation
- Fixed ST-pump speed variate T3 relative to the radiation with help of the solar equation

Laminar or turbulent flow in the absorber??
Feed-in circuit control at R/S mode
The desire is to ?????

• Adjust feed-in-pump speed so that the temperature setpoint can be maintained at T4
Need an extra function if T2 is to low, adjusted set-value
“Might” need a shorter response-time than a standard temperature sensor can give

• Adjust feed-in-pump speed relative to the flow in the solar circuit
Do not guarantee a correct feed-in temperature at T4 if not any extra control functions is used
Need a “high” flow resolution??
Feed-in circuit control at R/S mode, flow controlled layout

How can a correct feed-in flow be created?

- Only with the feed-in pump, P2
- Only with the control valve SV2
- A combination between the feed-in pump, P2, and a control valve, SV2
  - First SV2 then P2 (Δp1)
  - First P2 then SV2

First - kind of control system, flow or temperature
Second - equipment used to gain correct temperature
Differential pressure 1.8 – 2.1 bar

Change of pump speed and control valve open to 100%

Pump speed 80% change open degree of control valve

1. A small step in pump-speed gives a big change in the flow
2. Flow below recommended work area, risk for cavitation
3. It is easier to create a proper low flow with the SV2
Experience so far, focus on R/S feed-in

• Vacuum degassing works, perhaps not necessary but strongly recommended

• It is easier to get a proper flow or temperature using a flow sensor, both in the ST circuit and at the feed-in, than using a temperature sensor

• A pump-speed related to differential pressure and flow control with a control valve is best at small flows, and pump-speed flow control at large flows

• The change between R/R and R/S, and revers, requires careful control planning
Return/Supply feed-in – demands from DH

Need a discussion (some requirements are listed below)

• Temperature tolerance, +/- X°C or only + X°C
• The cold plug at start, all at once, towards S or R
• Risk of fatigue, varying temperatures, cycles a day
• Change in feed-in heat-power, kW/minute
• Change in feed-in flow, l/s per minute
• Risk for water hammers, fast change in flow
• Maximum feed-in heat-power in relation to the current DH heat-power requirement
Thank you

Questions