How low can the heating supply temperature be in single family houses in Norway?

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### Age classes:

1. Built before 1955
2. 1956 – 1970
3. 1971 – 1980
5. 1991 – 2000
6. 2001 – 2010
7. 2011 – 2050

### Building types:

- Single family house (SFH)
- Small house (TH)
- Apartment block (MFH/AB)

### Table:

<table>
<thead>
<tr>
<th>Region</th>
<th>Construction Year Class</th>
<th>Additional Classification</th>
<th>SFH Single-Family House</th>
<th>TH Terraced House</th>
<th>MFH Multi-Family House</th>
<th>AB Apartment Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>National (not region specific)</td>
<td>… 1955</td>
<td>generic</td>
<td>NO. N. SFH.01. Gen</td>
<td>NO. N. TH.01. Gen</td>
<td>NO. N. AB.01. Gen</td>
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</tr>
<tr>
<td>National (not region specific)</td>
<td>1971 … 1980</td>
<td>generic</td>
<td>NO. N. SFH.03. Gen</td>
<td>NO. N. TH.03. Gen</td>
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<td>National (not region specific)</td>
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<td>NO. N. SFH.06. Gen</td>
<td>NO. N. TH.06. Gen</td>
<td>NO. N. AB.06. Gen</td>
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</tr>
</tbody>
</table>

Source: EPISCOPE project (Intelligent Energy Europe) Energy Performance Indicator Tracking Schemes for the Continuous Optimization of Refurbishment Processes in European Housing Stocks (http://episcope.eu)
SFH 1971 – 1980

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
<th>U-value initial built (W/m²K)</th>
<th>Specification</th>
<th>U-value standard renovation (W/m²K)</th>
<th>Specification</th>
<th>U-value TEK10 renovation (W/m²K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>Double-glazed window, regular glass, air</td>
<td>2.60</td>
<td>Double-glazed window, one LE-coating, air</td>
<td>1.90</td>
<td>50 mm additional min wool in cold attic</td>
<td>0.16</td>
</tr>
<tr>
<td>Roof</td>
<td>48x198mm beam 200mm min wool</td>
<td>0.20</td>
<td>50 mm additional min wool in cold attic</td>
<td>0.16</td>
<td>150 mm additional min wool on the outside</td>
<td>0.19</td>
</tr>
<tr>
<td>External wall</td>
<td>Light timber framework, 48x98</td>
<td>0.41</td>
<td>50 mm additional min wool on the outside</td>
<td>0.29</td>
<td>TEK10-window</td>
<td>1.20</td>
</tr>
<tr>
<td>Floor</td>
<td>48x148mm beam 150mm min wool</td>
<td>0.22</td>
<td>50 mm additional min wool in cold basement</td>
<td>0.20</td>
<td>100 mm additional min wool in cold basement</td>
<td>0.15</td>
</tr>
<tr>
<td>Fixed infiltration (ACH)</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Limitations

- 4 occupants
- Only space heating: double string system
- Oslo climate
- Dimensioning for a normal year without internal heat loads
- No outdoors temperature compensation of DH
- Maximal water flow rate 800 kg/h
Impact of DH temp. reduction in older buildings without adaptation (focus on heating)
Impact of DH temp. reduction in older buildings without adaptation (focus on heating)

Non-renovated building

- Radiator area not increased, limitation on the supplied water -> comfort temperature 20 degrees not achieved
- With the original radiator we need to increase supply temperature (local) about 10-15 degrees
- Otherwise increase water flow rate (almost doubling) to achieve 20 degrees
Use of low temperature DH, new window and standard renovation

Renovated building
- Return temperature profile varies
- Return temperature to the net is most affected of renovations on the building envelope, windows and airtightness
Use of low temperature DH in Tek10 renovation

Building that are adapted to low temperatures

- Reduced heating demands
- Return temperature can be highly reduced
Limitations

– People are not happy with "only 20 degrees" => want higher temp in certain rooms. Especially after renovation
– Water quantity and pipe diameter
– Investing in networks

Possible solutions

– Local supply in buildings to avoid increase on DH pipe
– Local networks connected to DH
– Connections in supply and return
Conclusions

• Simulations of several types of buildings still remain
• Capacity:
  – Low supply temperature → Low return even more important
  – If the building is not renovated and the temperature is reduced in the net, local peak load systems are needed
  – If the house is renovated, return temperature to the grid can increase and it becomes more important to check if the house can be connected to supply or return
Thank you for your attention!