Review comments:
Downscaling European decarbonization scenarios of the heating sector

Reviewer: Andreas Müller

- Generally speaking, well written paper with a good overall structure

Possible Improvements

Abstract:

- I would prefer more on the mythology. After reading the abstract, I still couldn't say anything on the methodology

- I got the impression, that the "narrative" of the abstract was missing. Sentences somehow not connected.

- Subjectivity: I didn't see an argumentation why we should use district heating network, nonetheless Author in favour of district heating networks and calls policy makers to act on policy framework to improve the economics of district heating networks

- Efficiency gap of at least 7.4 GWh/km² to reach the proposed 10 GWh/km²

- Maybe efficiency is better than district heating?

- 2nd sentence of introduction: 2°C below pre-industrial level not 1990

Possible Improvements

- Check the text for subjectivity (without argumentation or reference) : e.g line 40: To achieve the goal, we need a massive expansion of centralized heating

- Proper references, also for web links (e.g line 34), add sources if you use numbers (e.g. line 36/37).

- Sometimes it is not clear, if you or the references author are making the claim: e.g. line 106, 121-125

- Table 2: What is the reference? Is this your assumptions.

Possible Improvements

- Aim of paper:
  - Results for region? Implication of results?
  - Presenting the methodology? Comparing with other methodology?
- Check argumentation, e.g paragraph line 72:
  - However, the concrete implementation to achieve…. Followed by: For this reason, numerous studies go beyond show roadmaps….

- Introduction is to long. Especially part on IAMs

Possible Improvements

- If you use formulars, describe/explain variables (e.g. (1)) and units
- Algorithm 1: Population density: Unused

- Algorithm 2: I had difficulties to understand the methodology: What are the nodes and edges. Use simplified, stylized figure to explain.
- Methodology of paper should explain it self. Page 16: To much referencing to other papers. So, I don't understand the methodology if I don't read the other papers.
- Removing nodes with lowest indicator value: Are you just removing a certain technology
- Graphs for district heating networks: (Why) is there an advantage if nodes are connected?

Possible Improvements

- Generally:
  - Discuss the impact of detailed analysis of regional analysis on the national level.
  - As mentioned before: Results are far (-75%) from the targeted benchmark indicator of 10 GWh/km². What is the implication?