SUSTAINABLE TRANSFORMATION OF DANISH SINGLE-FAMILY HOUSES

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Danish Single Family Houses (SFH) have a central role in the green transition

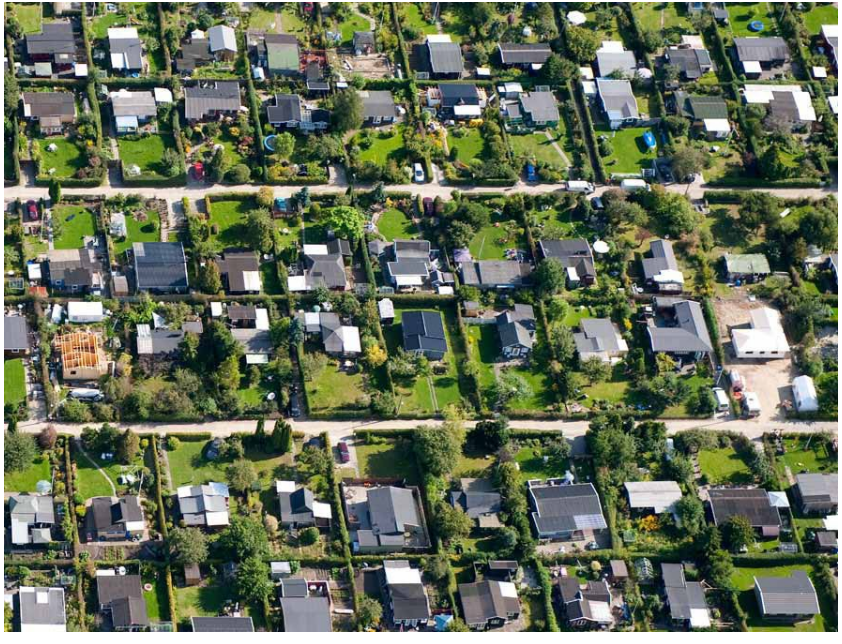
- The building sector represents app 30% of CO2-emissions in DK – 20% from operation of buildings (energy use), 10% from producing building- and construction materials
- Single-family houses represents 23% of the built space area (m2) in DK
- Local authorities (municipalities) are the primary agents to promote initiatives towards owners of SFH
- Interventions in SFH is difficult due to various reasons: Private and non-professional owners, dispersed housing stock, low organisational level => difficult to make outreach to SFH-owners
- SFH are excepted from new regulation on LCA-calculations (< 12 kg/CO2/m2/yr over 50 years), only applies to buildings +1.000 m2.

A New Research agenda: Using space smart. E = m2

- Consumption of built space is increasing
- Unefficient use of space (e.g. 11 mio vacant buildings in EU. 60% of Danish single-family houses inhabited by 1 or 2 persons)
- High level of tear-down and build-new activities

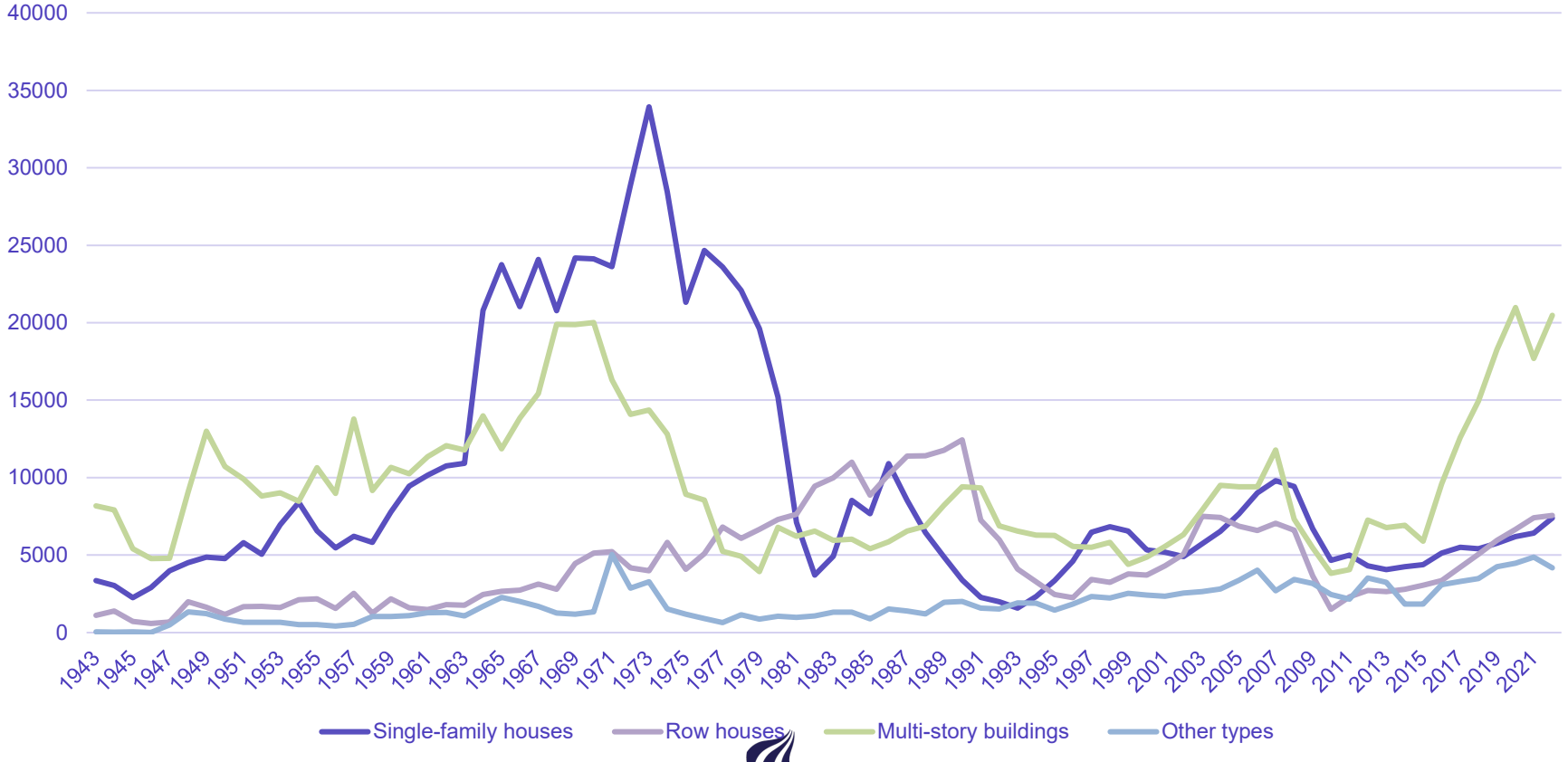
- Develop strategies for better use of existing space – ”smart squaremeters” (shared spaces, shared functions, densification…)
- Develop strategies for re-use of existing buldings
- Improve conditions for small-space concepts, e.g. microhomes, tiny houses, co-housing, co-living, shared housing
- Applying the LCA-perspective on production and demolition of buildings

- Linking to NEB (Non Energy Benefits):
  - Increase affordability
  - Reduce loneliness
  - Increase synergies
  - Increase urban life



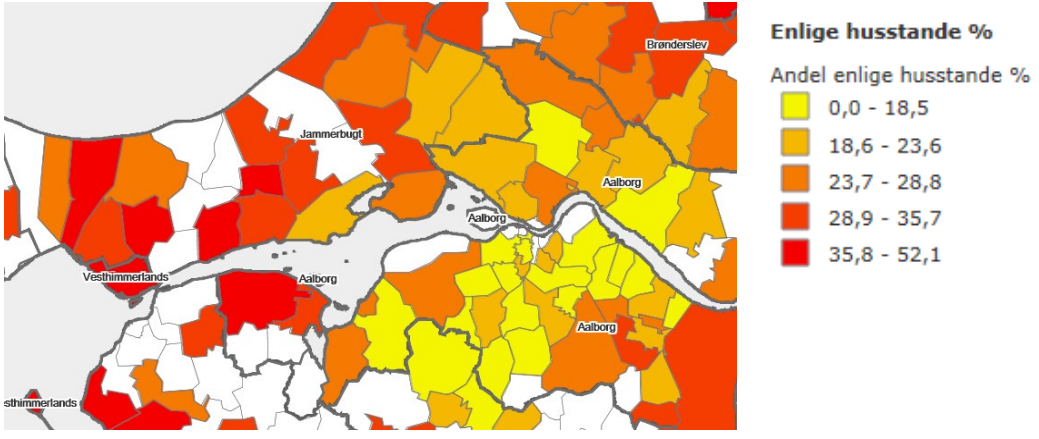
”The most sustainable building is the one that you don’t build”

New-built housing units per year, 1919-2017



Large geographical differences in demography of SFH..

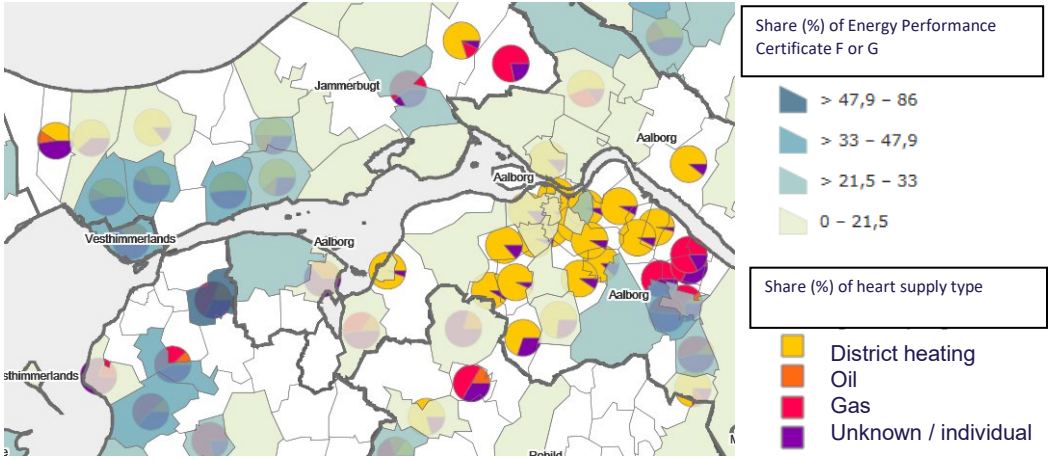
- 61% of single-family houses without children
- Empty-nesters the dominating group in single-family houses today
- More single households living outside the cities
- In many areas the share of +80 years singles in 25% or more



Share of single person households in single-family houses in parts of the municipalities of Aalborg, Jammerbugt and Vesthimmerland. The map shows large differences with many singles living outside the city (Aalborg) and a high proportion in the vicinities.

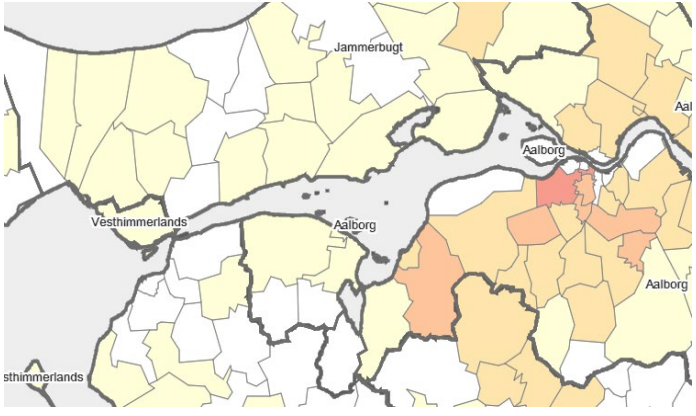
In the energy performance of SFH….

- Poorer standard of Energy Performance Certificates (EPC) in SFH in peripheral regions
- Smaller share of district heating (collective supply) in peripheral regions



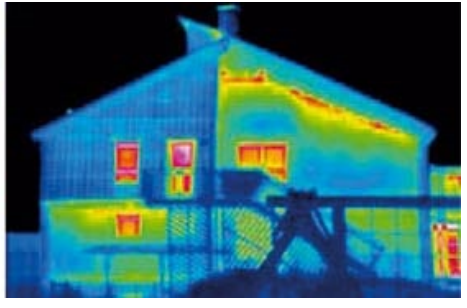
And in the economic value of SFH

- Large differences between cities and villages in peripheral regions: Houses in villages with long distance to the cities typically a factor 5-10 lower than in cities
- Many elderly end singles living in villages
- Households median income largely reflects value of houses



In recent years there have been several initiatives from Danish municipalities and energy suppliers on promoting energy retrofit towards single-family houses

- Consultation
- Energy-check
- Collaboration with craftsmen, SME's and organisations
- Demonstration events
- Remote energy measuring
- Thermo photographies
- Financial arrangements
- Adressing villages (energy supply, energy optimisation)
- + various development projects



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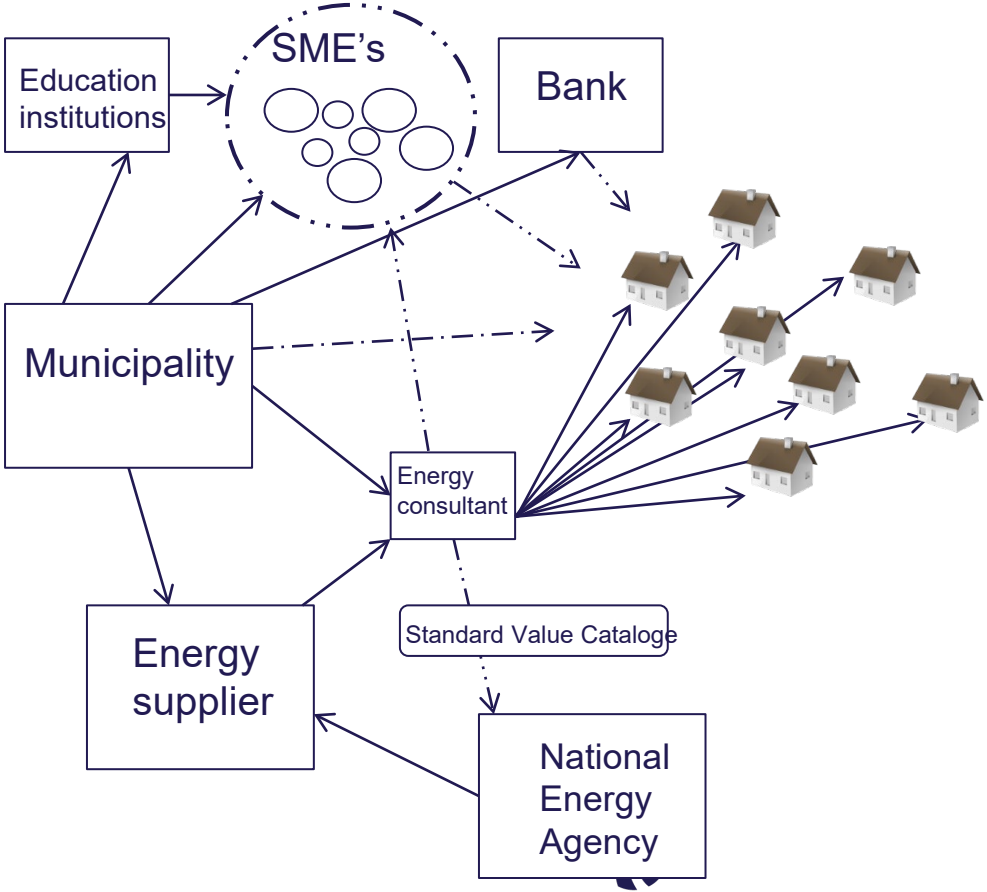
One example: Energy City, Frederikshavn

- Collaboration with local energy supplier to finance an energy consultant, contacting home-owners directly
- Raising awareness amongst home-owners on energy retrofitting (e.g. Energy exhibition and energy magasine e+)
- Re-education of local craftsmen and SME's on energy issues
- Convincing local banks to finance home-owners energy retrofitting

- Background / ambition:
  - Settlement strategy
  - Promotion of Energy City
  - Creating local jobs

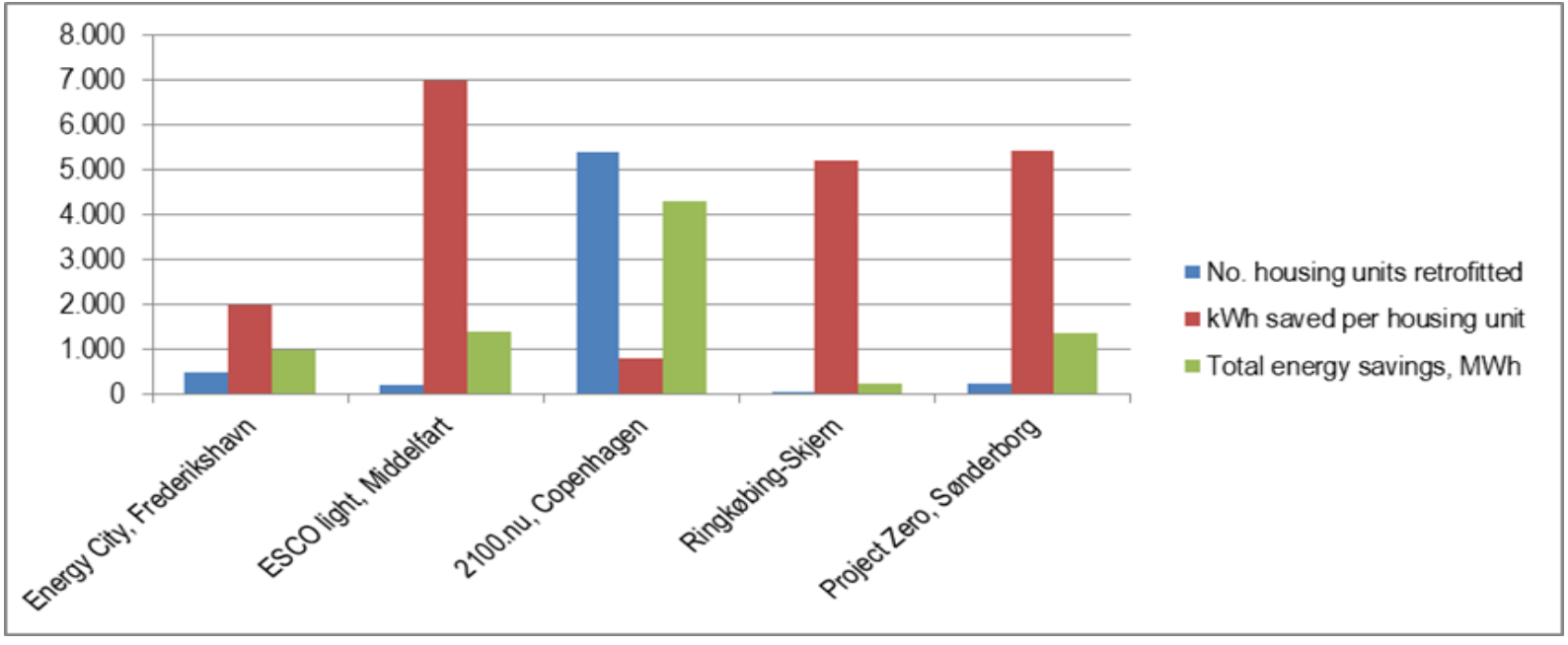
Institutional set-up to reach home-owners



A survey amongst 12 municipalities on initiatives

Initiatives	Towards citizens			Towards builders		Other collaborative initiatives		
Municipalities	General communi-cation	Energy audits	Village contact	Establishing networks	Retraining	Energy suppliers	Financial institutions	
Frederikshavn	X	X	X	X	X	X	X	
Herning	X		X			X		
Hjørring	X			X		X		
Kolding	X	X	X	X	X	X	X	
Middelfart	X	X	X	X	X	X	X	
Morsø	X	X	X	X	X	X	X	
Skanderborg	X				X			
Sønderborg	X	X	X	X	X	X	X	
Guldborgssund	X	X	X	X	X	X	X	
Roskilde	X	X	X	X	X	X		
Slagelse	X	X	X	X	X			
Bornholm	X	X		X	X	X	X	

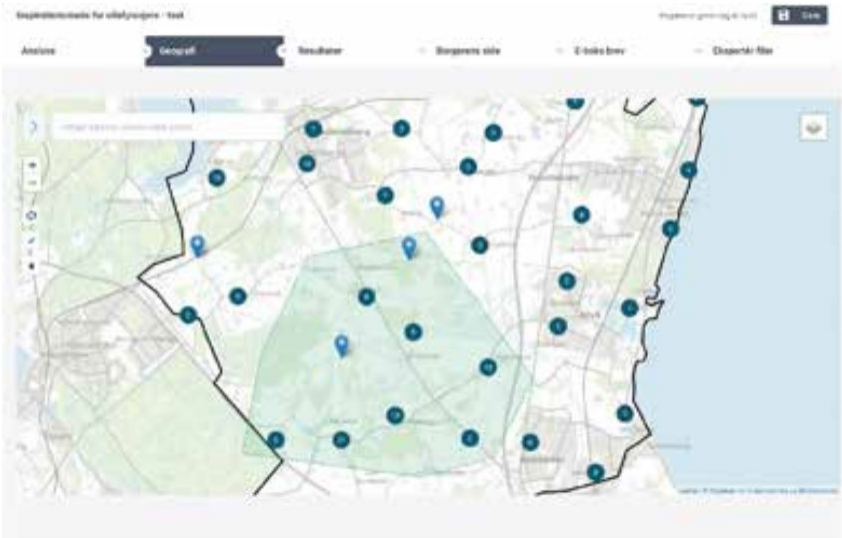
Reported energy savings



Uncertainties on reports: DIY, lack of reporting, rebound effect, additionality etc.

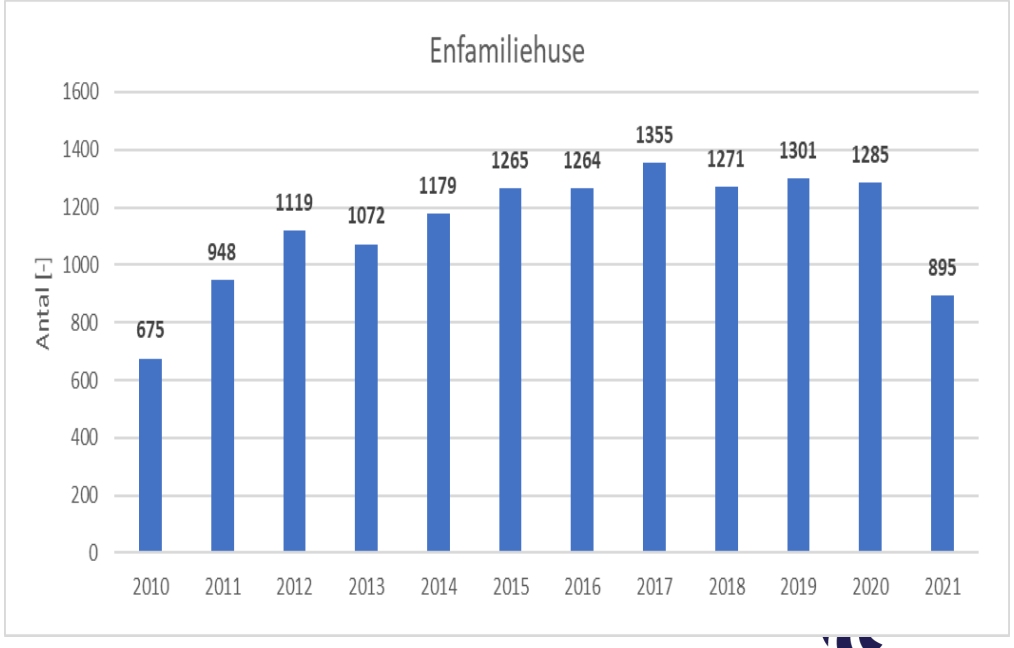
New initiatives, approaches and tools

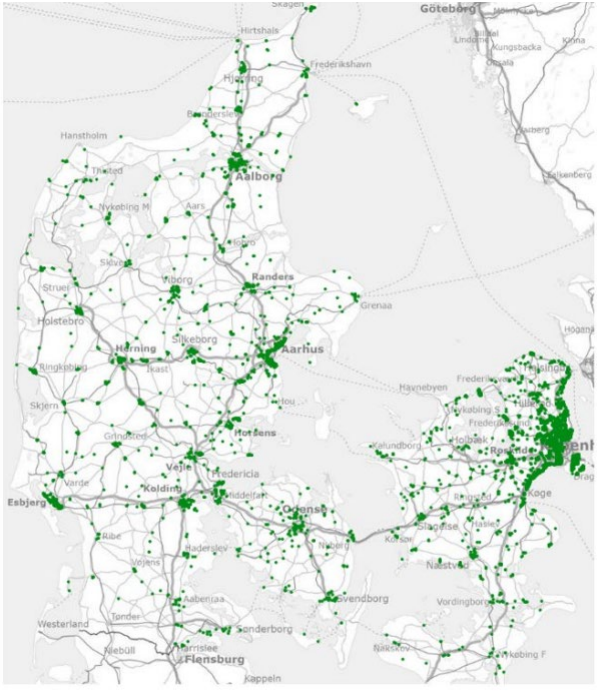
- DK 2020: A national initiative to support municipalities developing climate actions plans. Some municipalities include initiatives towards SFH (and other don't)
- Energy Agency: "Building Hub" and "Housing Analysis", data-driven tools for out-reach to housing owners for energy optimization
- Single Family House Atlas 2.0: Supplying the tools above with social data



Circular economy in single family houses

- On national level, the share of demolition-based newbuild has grown 17% in 2011 to 21% in 2019 (share of all SFH new-build).
- The share of demolition-based newbuild in the Metropolitan Region is 54%.



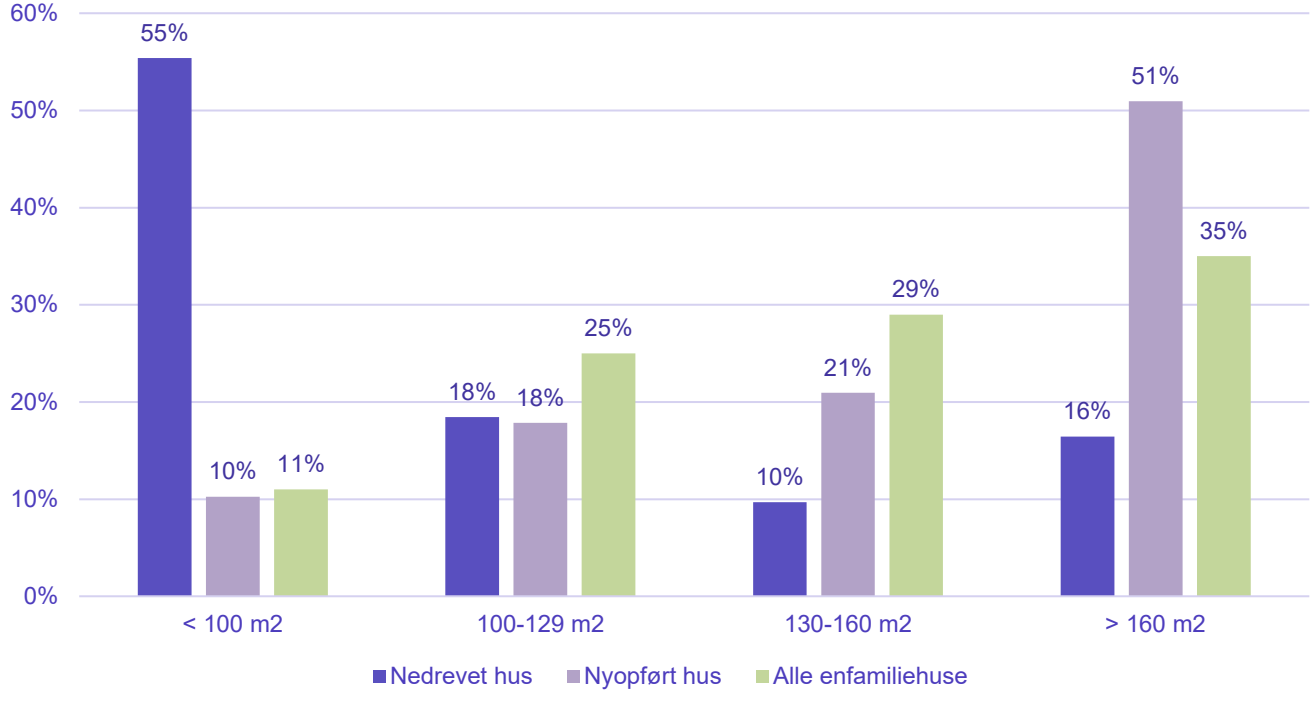


Is there a potential for less demolition and more renovation?

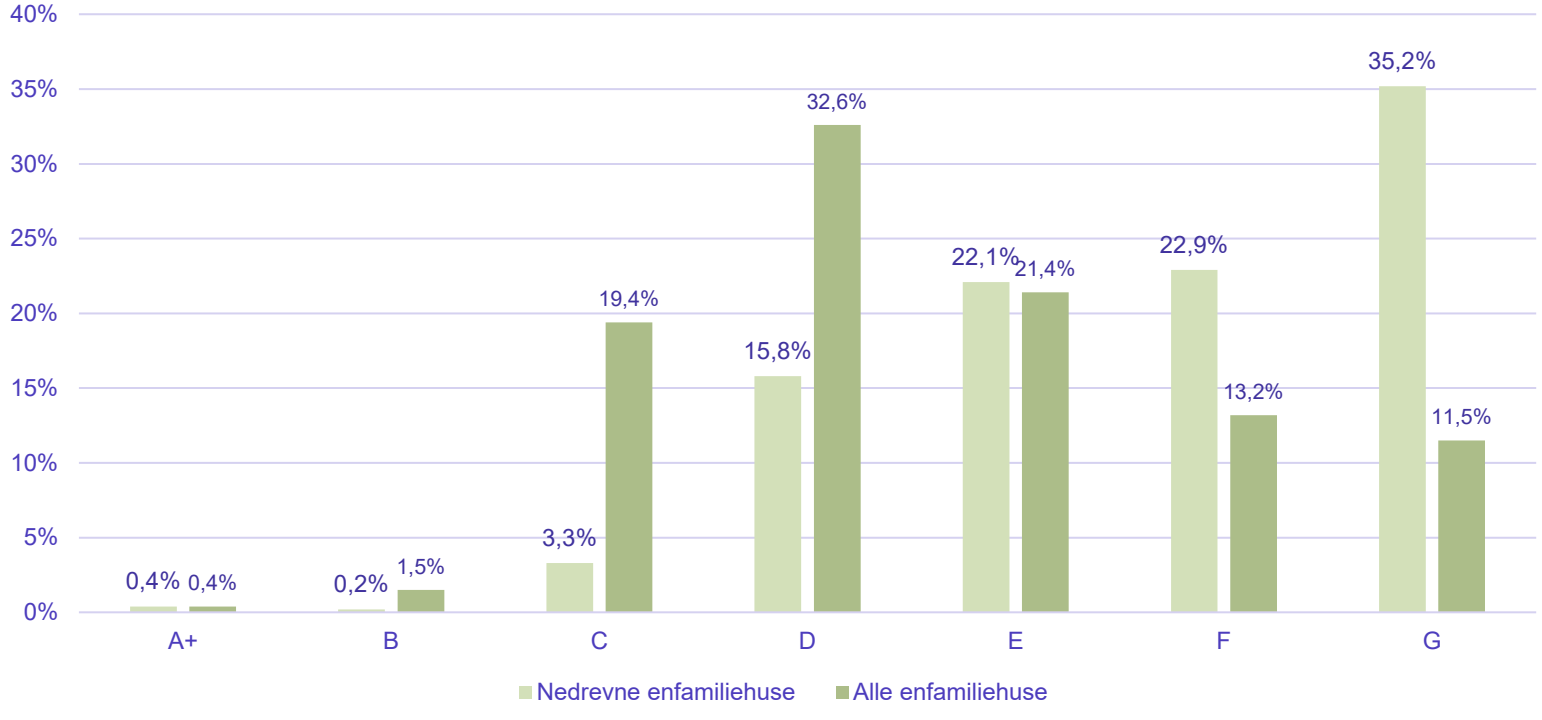
- BUILD did a research project in 2022 for the Housing Agency and Energy Agency on assessing deomlition/newbuild vs renovation – including a suevey amongst house-owners on reasons for demolishing their SFH
- It showed that the demolished houses are smaller, have a poorer Energy Performance Certificate and more individual heating. However, an improvement of housing qualities could also have been acheived by renovation
- It also showed that 30% of the owners thought the demolished houses were ”good” to ”medium” quality
- Demolition-newbuild activities are to a large extent supply-driven (building companies collaborating with banks and realestate-agents) - no similar products exist for SFH renovation

Demolished houses are generally smaller – new houses larger.

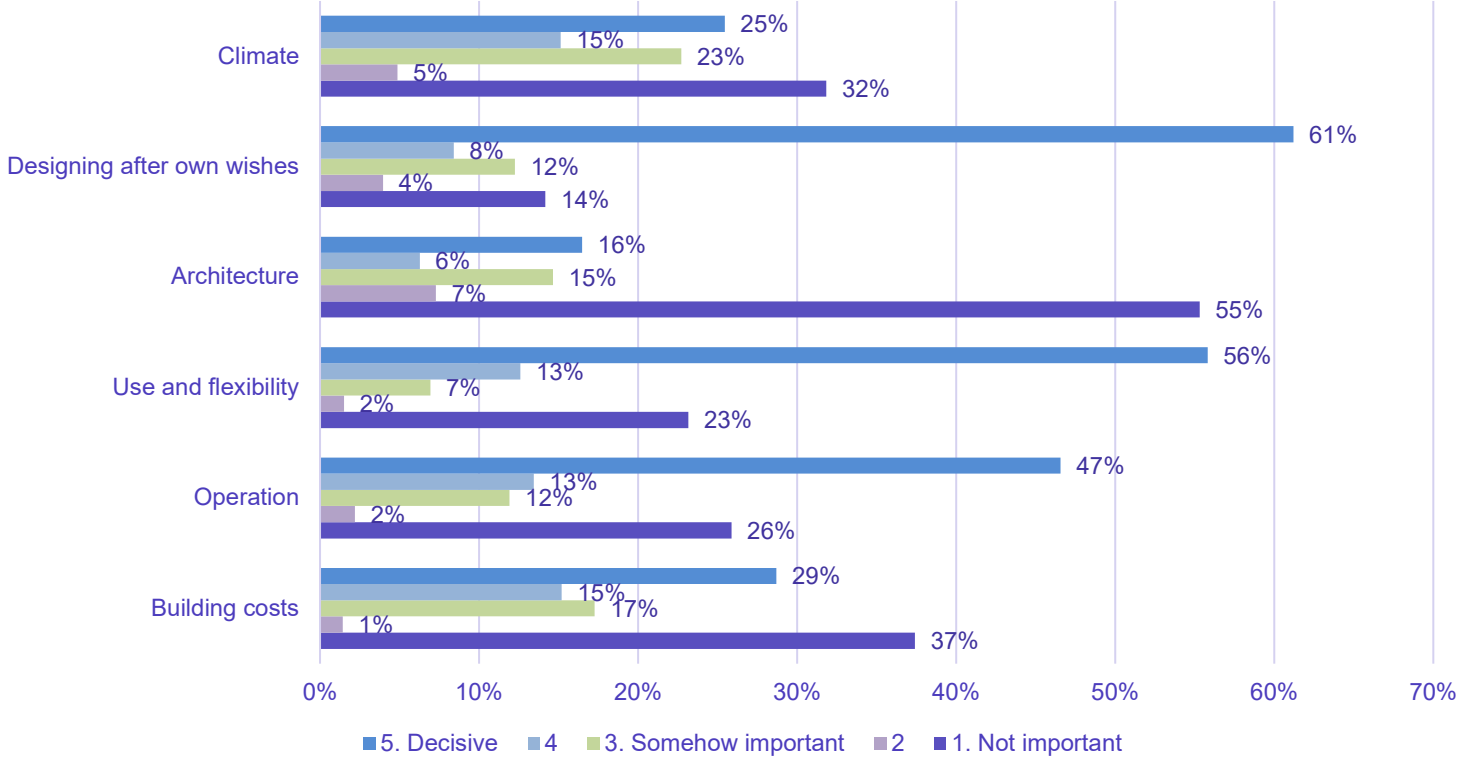
But a large new house could also have been acheived by retrofitting/rebuilding the old house



Demolished houses have poorer EPC's (compared to SFH in general). But better EPC's can also be acheived by retrofitting/rebuilding old houses



Owners reasons for choosing demolition/newbuild: Options for design, use and flexibility are important issues – building costs and climate less important



Options for increasing circularity, smarter use of space, densification etc?

- Not many ”best practices”. A ”Wicked Problem”?
- But raising public attention towards under-utilized SFH – both on national and international level, problems are similar in other countries

New research projects addressing the challenge, e.g.:

- New ways of sharing houses
- Developing a better ”supply” of SFH-renovation – knowledge, ”one-stop shop”, good examples etc on renovation (instead of demolition/newbuild)
- Building smaller with more sharing

<u>IGENBO (BUILD, DTU, Technological Institute and other partners):</u>

- Focus on the knowledge and advices the buyers receive in their process of decision-making
- Updating the SFH-atlas
- Identifying the potential for renovation of SFH