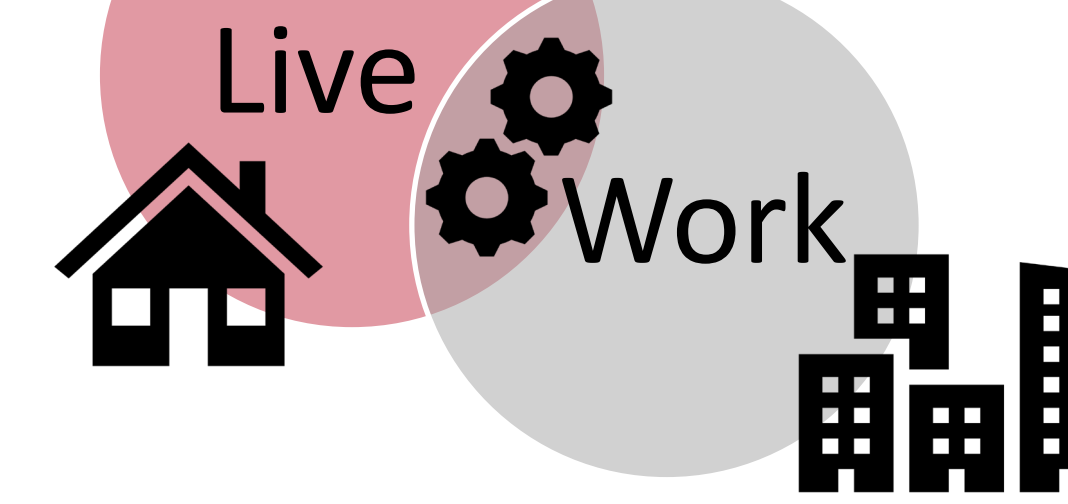


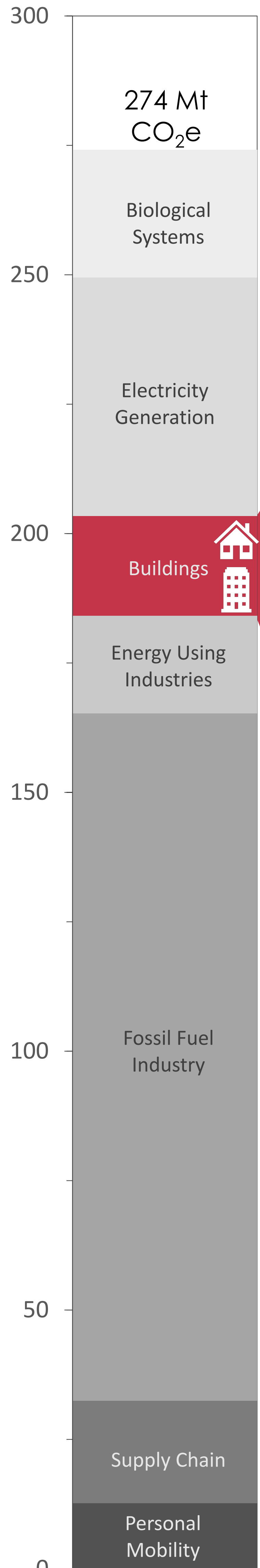


Introduction

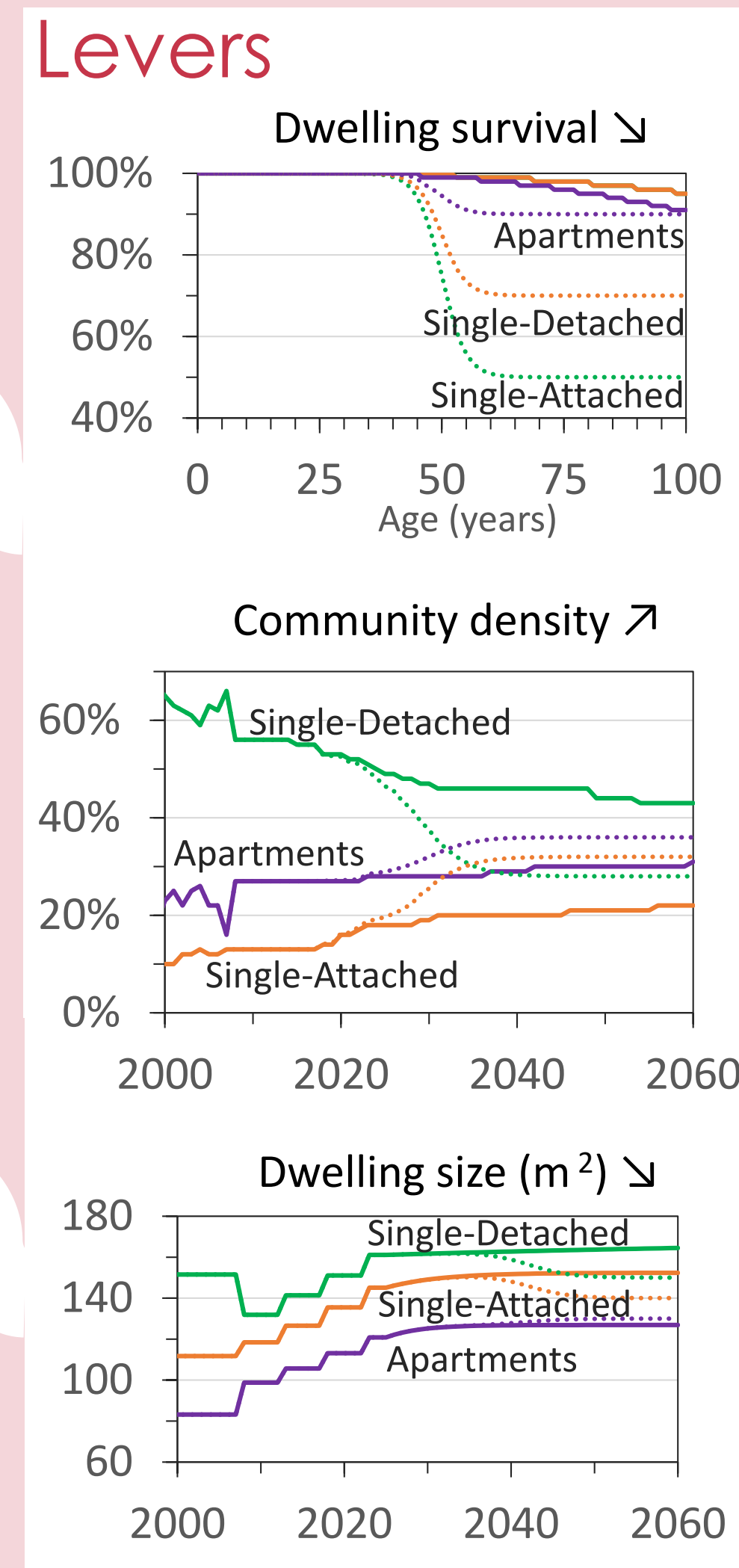
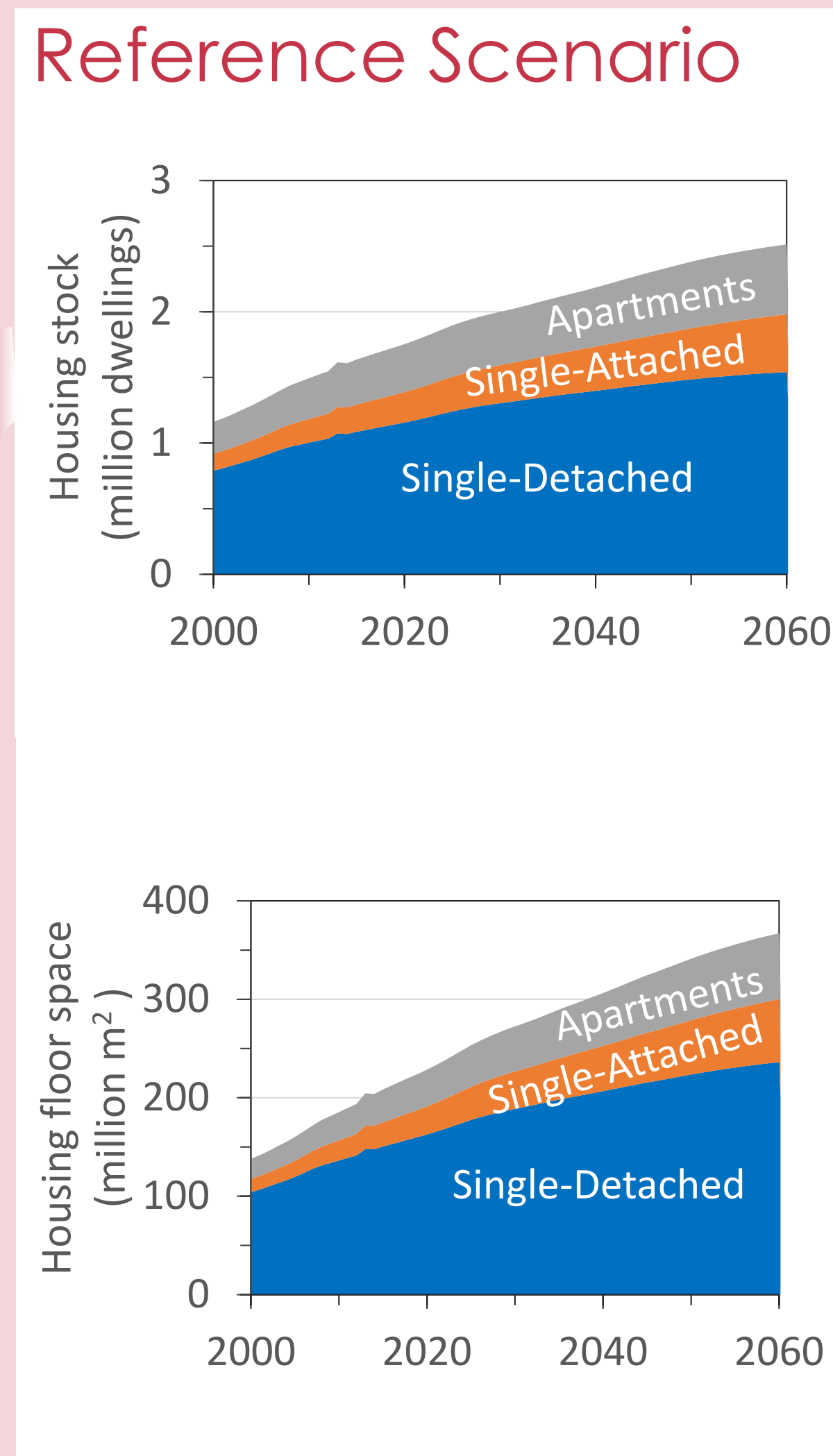
GHG emissions from heating, cooling, and hot water in Alberta buildings was 19 Mt CO₂e in 2015. Emissions from lighting and electric plug loads adds 65 Mt CO₂e; together, this equates to 25% of Alberta's total. Creating efficient spaces leverages several related disruptions, including integrated building designs, improvement in heating, cooling and lighting technologies, and changing preferences for how we live and work.



2015 Alberta Emissions



Activity → Building stock changes



Building standards trigger stock retirements

- Faster turnover of housing stock
- Retrofit requirements may present too high barriers
- New dwellings at scale

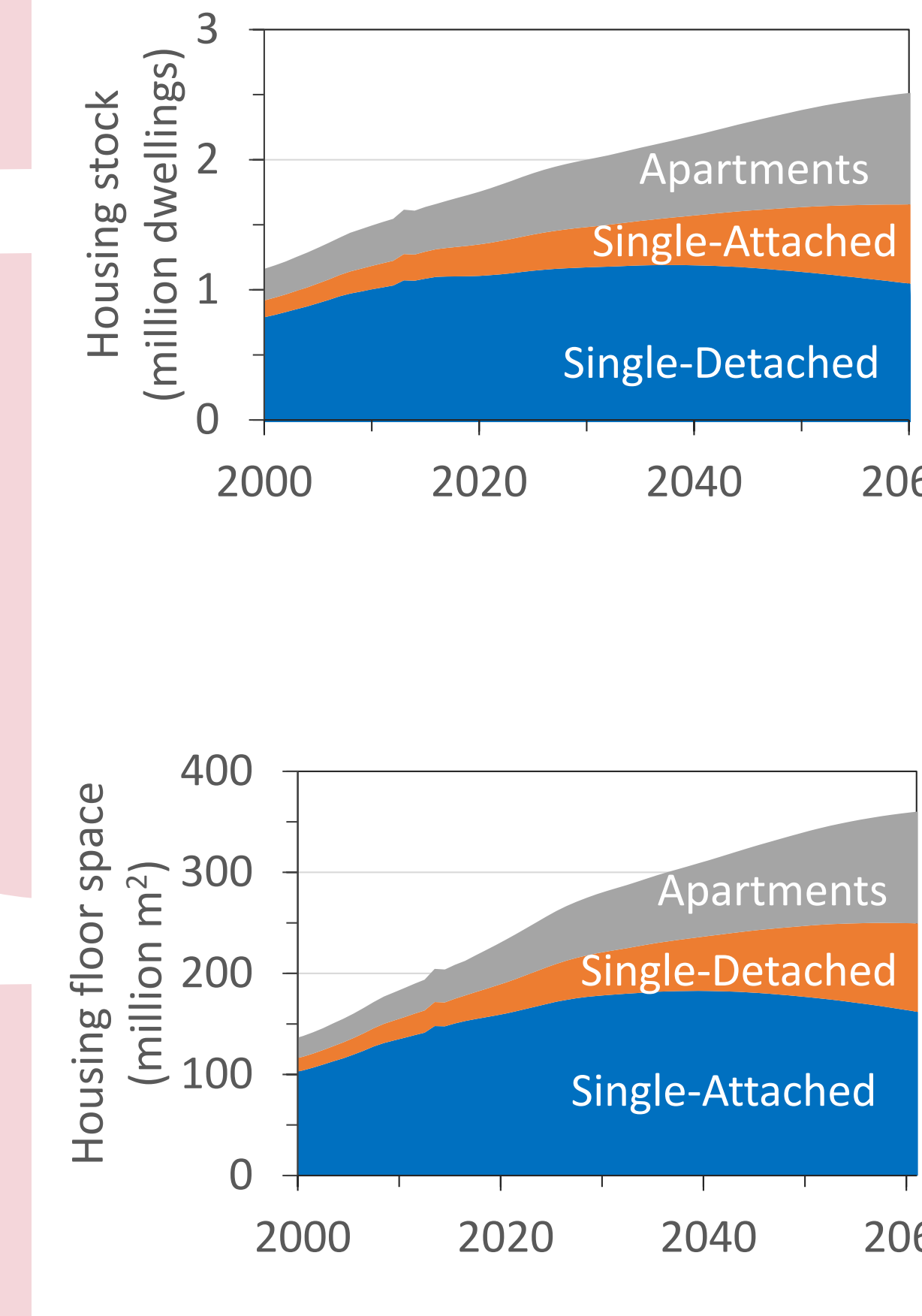
More apartments and row/town houses

- Increased density will create more walkable communities
- Attached housing is more energy and space efficient

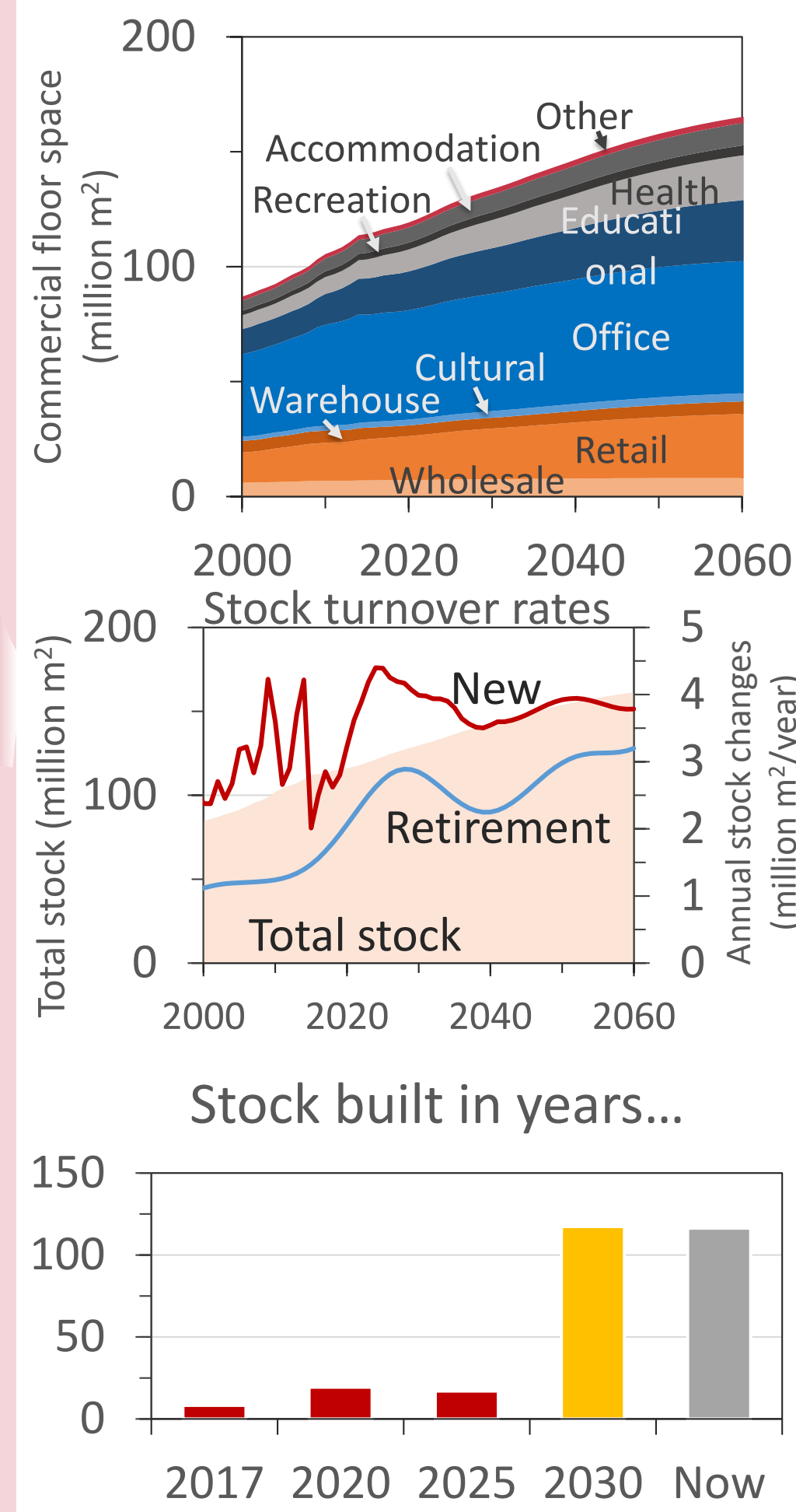
Dwelling size de-growth

- Size of dwelling has grown remarkably in past decades
- Growth in apartment sizes are complemented by smaller new single and attached houses

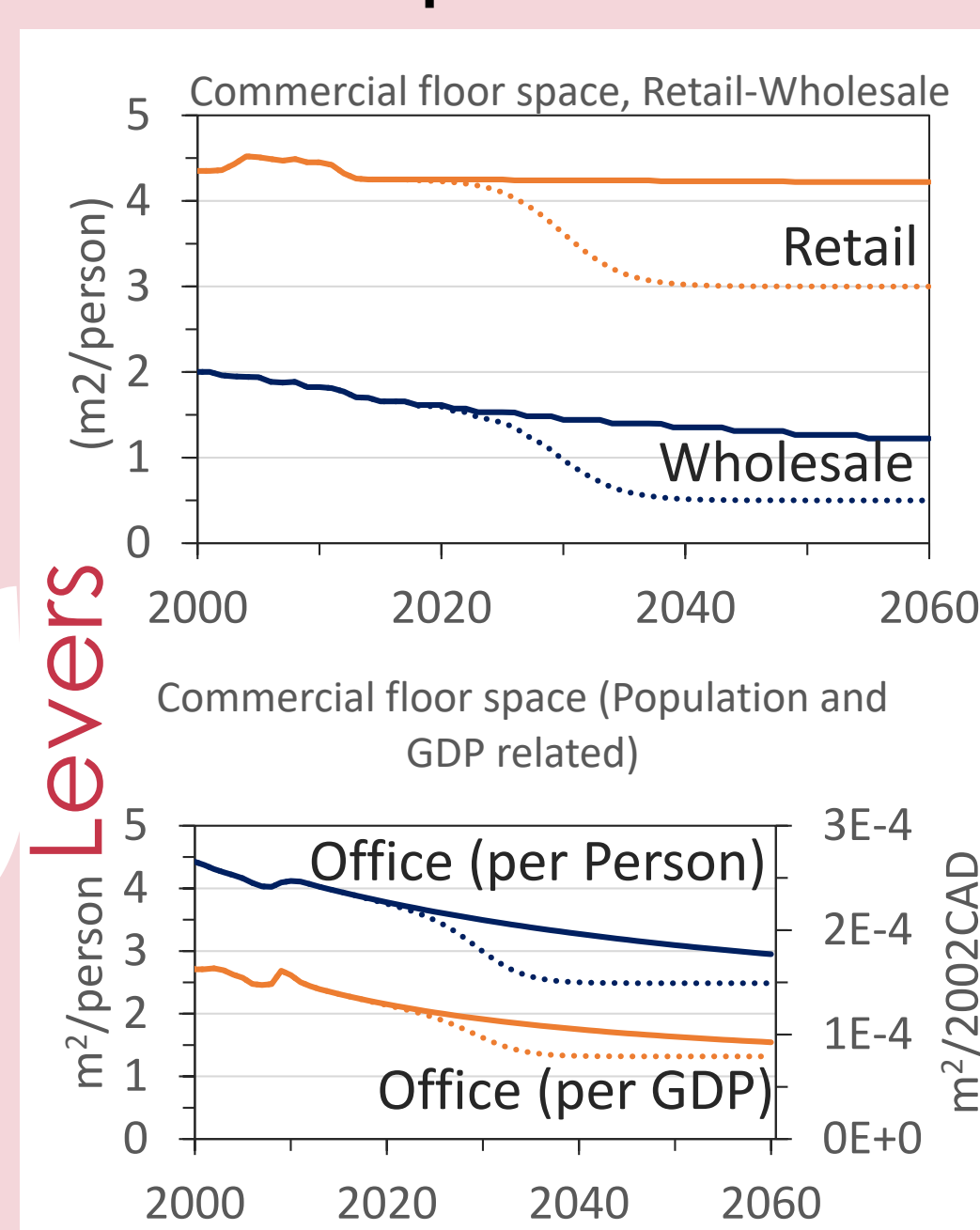
Deep Decarbonization



Stock & turnover



Floor space changes



Online shopping & Direct-to-Consumer Sales

- Product & Service providers will increasingly interact directly with consumers vs. traditional retail-wholesale channels

Virtual work spaces

- Service economies require less office space and enable employees to work virtually
- Health & education can also leverage virtual, remote services

Building standards need to quickly address performance

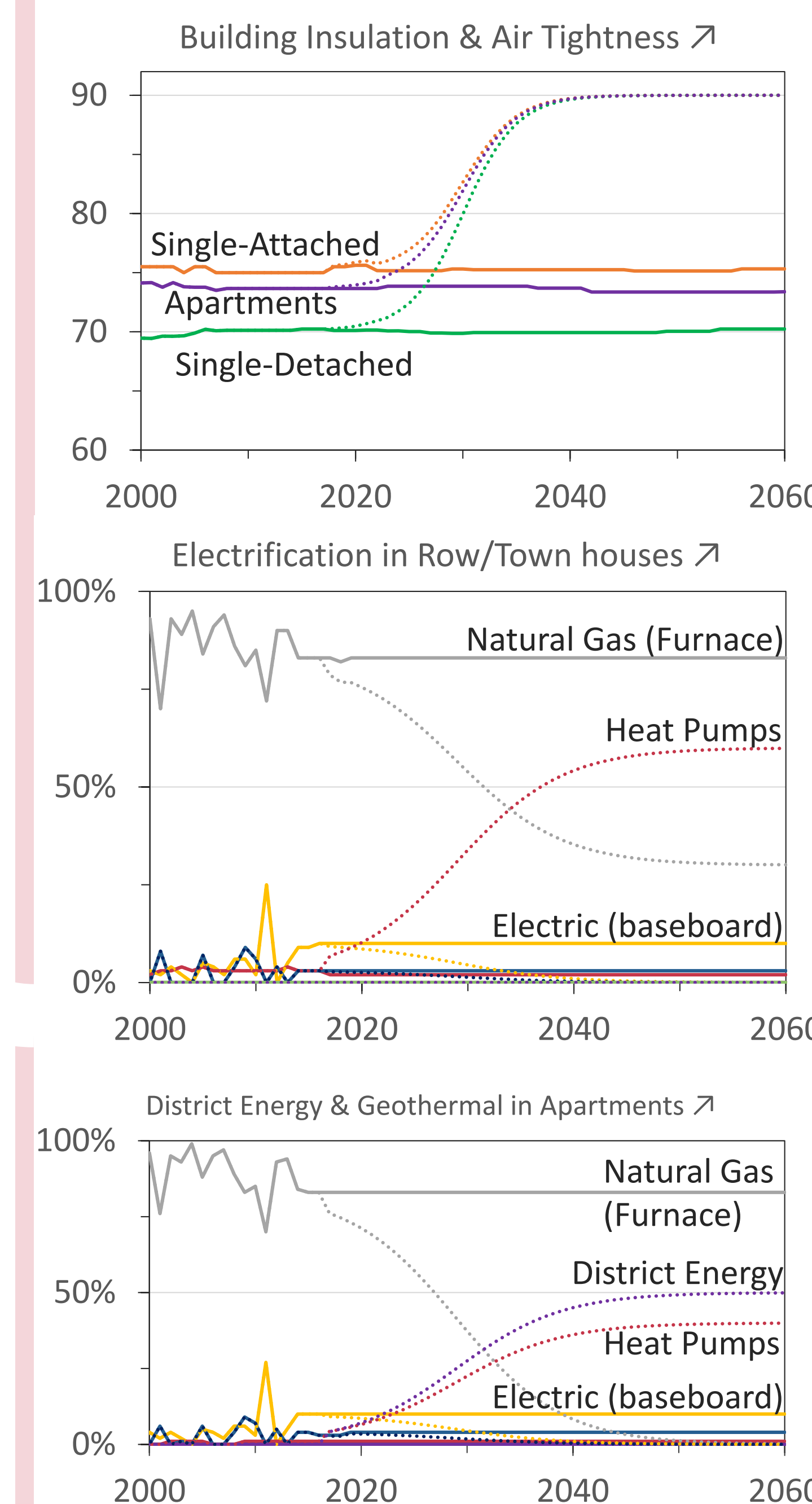
- New commercial buildings between now and 2030 will double the stock
- Poor building standards will significantly reduce ability to decarbonize
- Performance-based standards allow developers to choose the design that's right for them, and ensure overall energy & GHG performance

Opportunities to create "Energy Districts" incorporating Smart Grids

- Smart thermal and electrical grids will help balance energy loads with clean sources, high reliability and lower costs

Energy Efficiency → Results

Levers



Thermal Archetype (TA)

- Describes the amount insulation & air tightness
- A "perfect" TA means there are no thermal losses between inside and outside building (= 100)
- New buildings have radically higher TAs, meaning 90 or more, to be considered passive design.
- Existing buildings may also be retrofitted when standardized solutions are scaled, a process called "Energie Sprong" = Energy Leap

Space Heating

- Single detached houses from 2017 stock are predominantly heated by natural gas furnaces
- Alberta's infrastructure to produce and distribute natural gas is well developed, and low prices are "lock-in" bates for inefficient / higher GHG heat

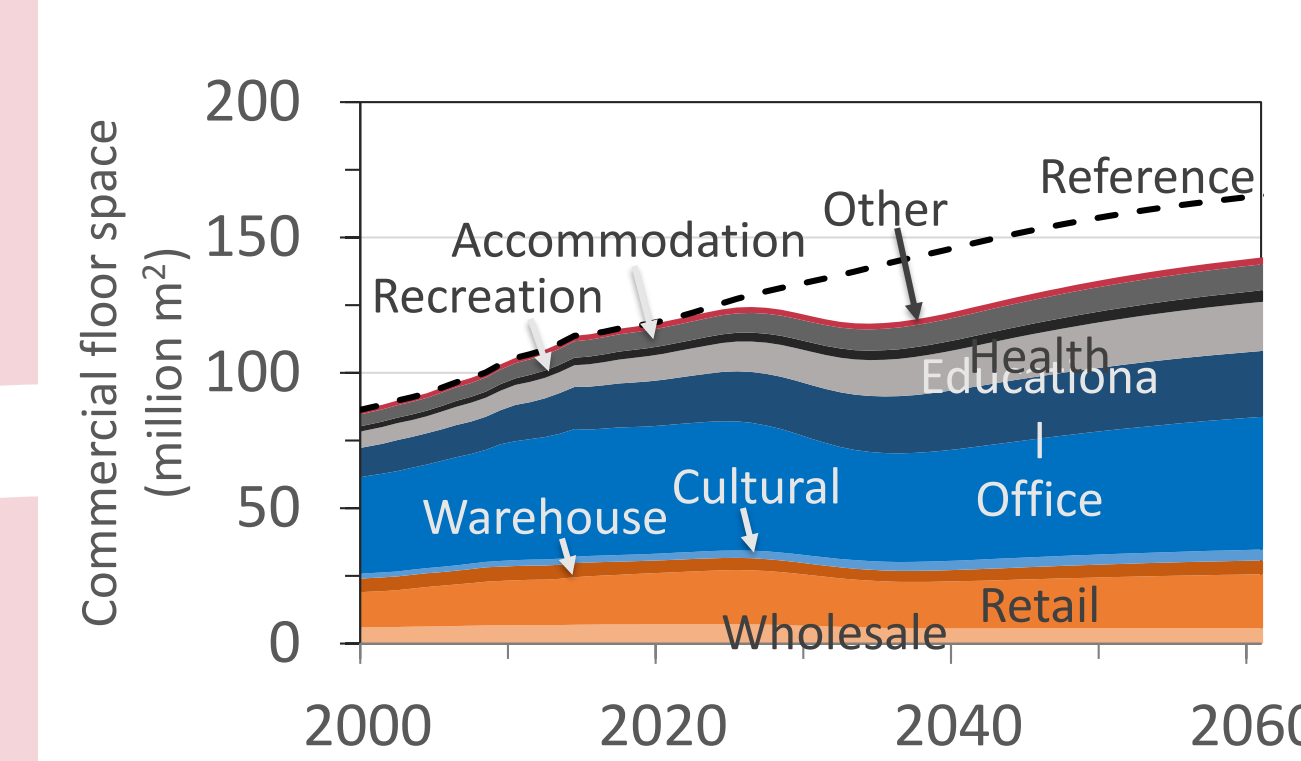
Row/Town houses and single detached homes

- These can replace existing furnaces with heat pumps from 2025 onwards when electricity is increasingly decarbonized
- Some new row houses may consider ground-source heat pumps to increase efficiency

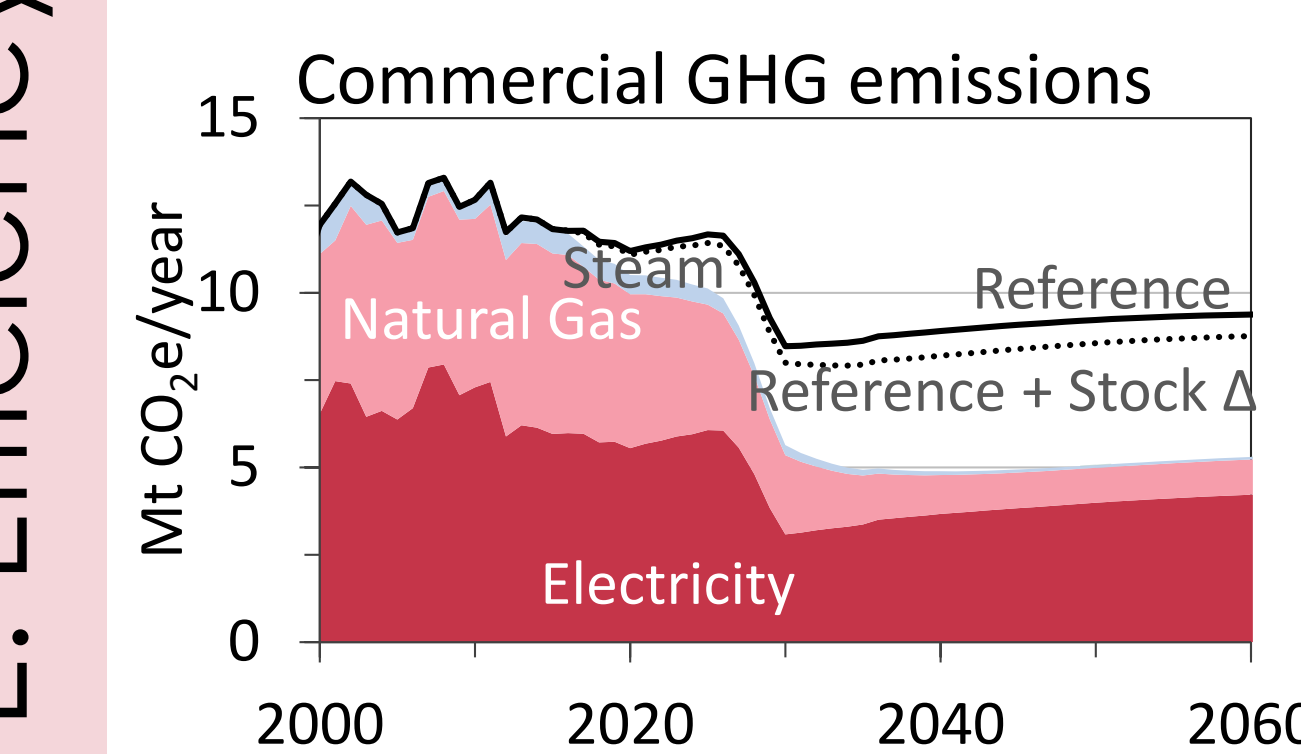
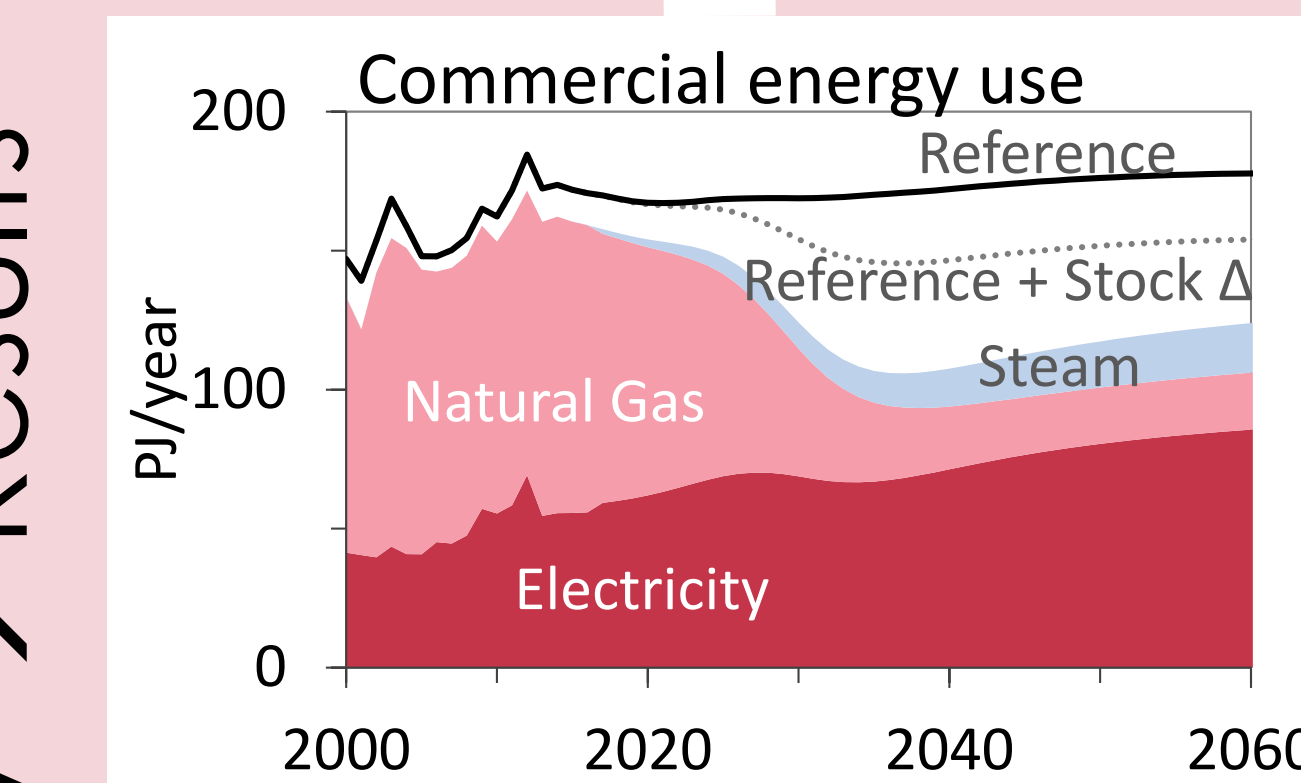
Apartments

- New apartment buildings may be both connected to district energy systems and ground-source heat pumps, thereby integrating clean heat into district energy loops; complimented with CHPs and heat recovery from municipal infrastructure

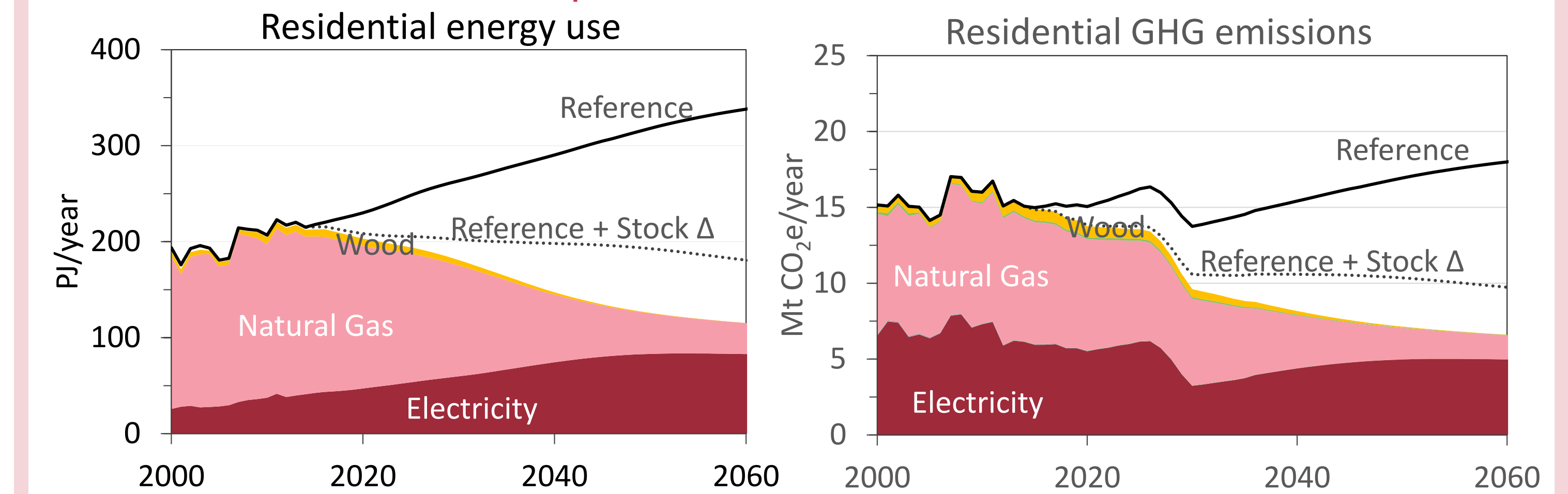
Deep Decarbonization



District Energy with Heat Recovery, Geothermal and CHP



Deep Decarbonization



Opportunities for Heat Pumps, Heat Recovery and Smart Energy Grids

- As parking lots are decommissioned / replaced with new buildings and community infrastructure, the cost of installing ground-source heat extraction loops may be greatly reduced.
- Ground source heat pumps will play a significant role in balancing thermal loads in dense urban areas.

Conclusion

New homes and commercial spaces must apply aggressive insulation and air tightness standards.

Existing buildings must also retrofit their envelopes where possible. Building lifetime may be shortened when new standards are too expensive to enforce. Electrification using heat pumps, and investing in district energy, including limited use of CHP in institutional buildings results in near 60% reduction in total GHG emissions by 2060.

Acknowledgments

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References

This data was sourced through CanESS

E. Efficiency → Results