

RBSA

Residential Building Stock Assessment

Analysis of public power sample in BPA territory using single-family and manufactured homes databases

July 25, 2013



Introduction and Overview

About the RBSA

Assessment of residential buildings which audited the major energy-related components of homes from a representative sample of more than **1,850** single-family, manufactured, and multifamily homes in the Pacific Northwest.

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Introduction and Overview

Research Objective of This Study

This analysis of single-family and manufactured home RBSA data characterizes BPA's territory and identifies program opportunities for future energy efficiency activities.



Methodology

Sampling

- A representative sample of single-family and manufactured homes in the PNW (1,404 single-family homes and 321 manufactured homes).
- Sample size large enough to achieve 90%+/-10% confidence and precision within:
 - *Entire PNW, BPA region, and each of the BPA's five sub-regions*
 - *MH sample not large enough within BPA's sub-regions*
- All analyses are weighted to describe the population.

Data Collection

- Two-hour on-site visits by two auditors between late 2011 and mid 2012.

Unit of Analysis

- The unit of analysis for this study is an occupied housing unit or a house.
- For analyses that involves multiple instances of a particular component, we used a selected component as a unit or weighted proportion.

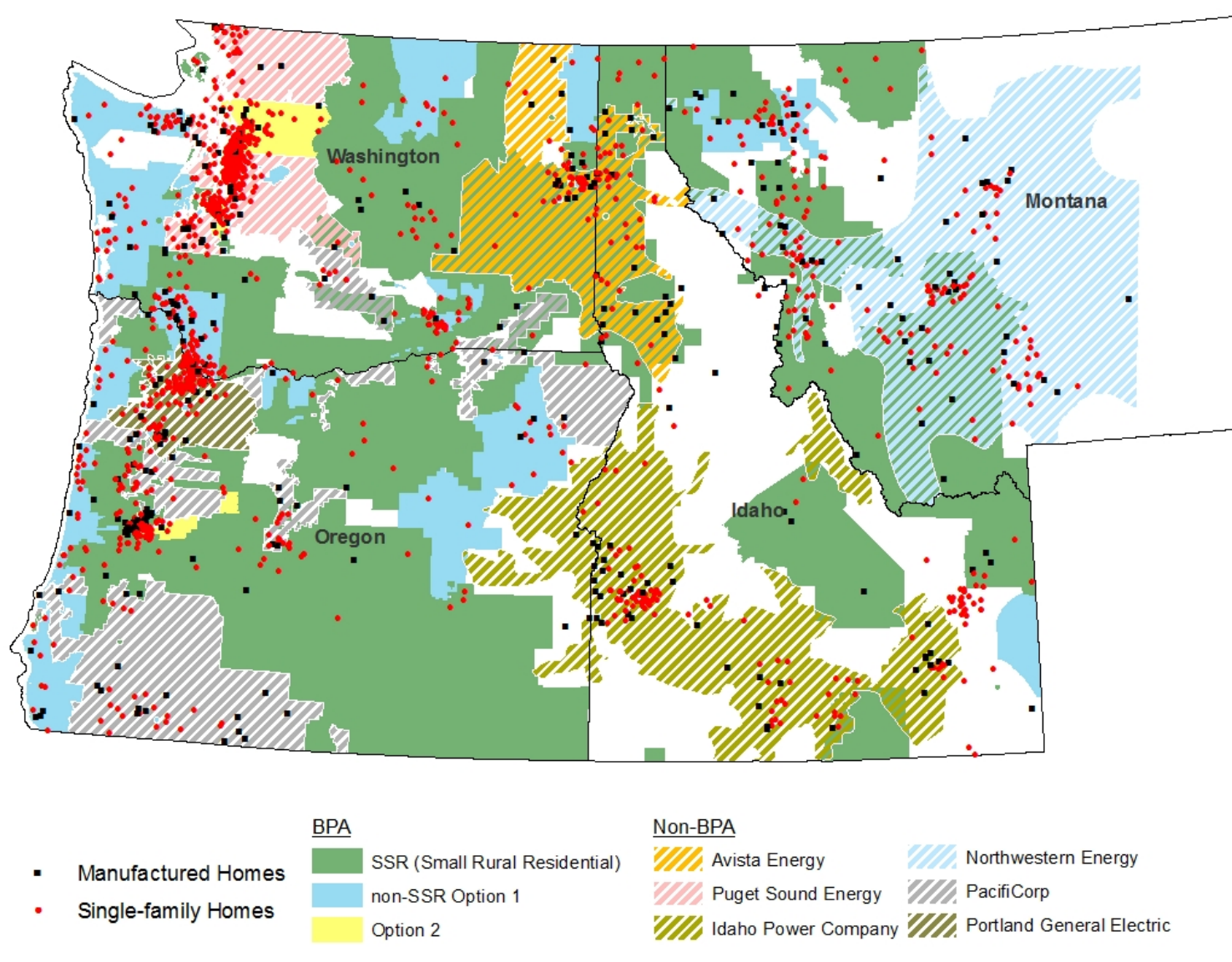
Methodology

	Analysis by building type	Analysis aggregated
Building Characteristics	YES	
Envelope	YES	
HVAC	YES	
Lighting		YES
Water Heating		YES
Appliance		YES
Consumer electronics		YES

Utility Domains for Analyses

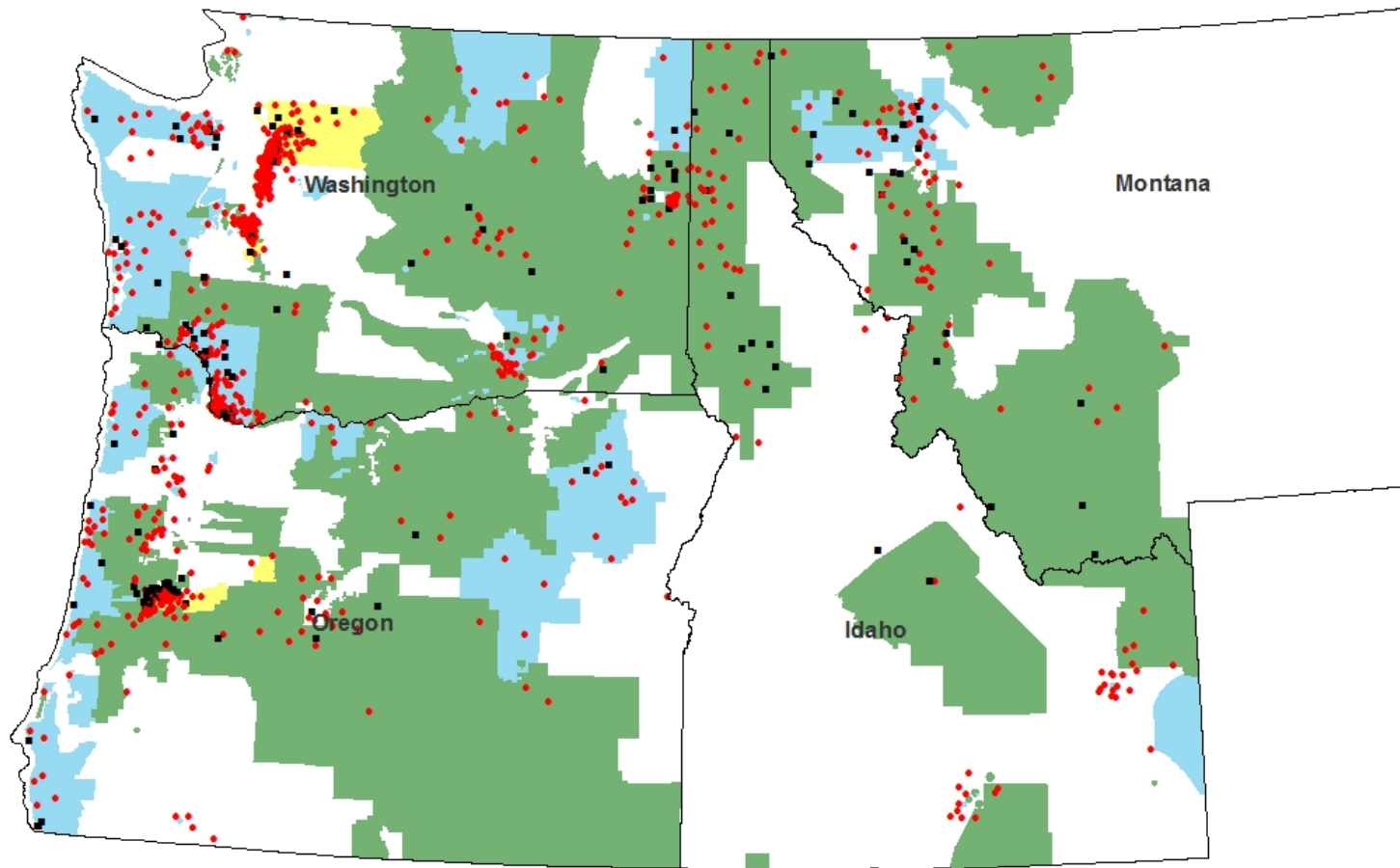
- BPA status: Utilities in BPA service territory vs. non-BPA territory
- BPA sub-region: BPA utilities in Puget Sound, Western Washington, Western Oregon, Eastern Oregon and Washington, and Idaho and Montana
- SRR status: BPA utilities serving SRR (rural), non-SRR Option 1 (suburban), and Option 2 (urban)
- Rate design: BPA utilities with slice block power purchase vs. load following agreement

Final Sample Distribution – Entire Pacific Northwest



Note: Colored areas represent utility boundaries. Locations of sampled homes are approximated by zip code.

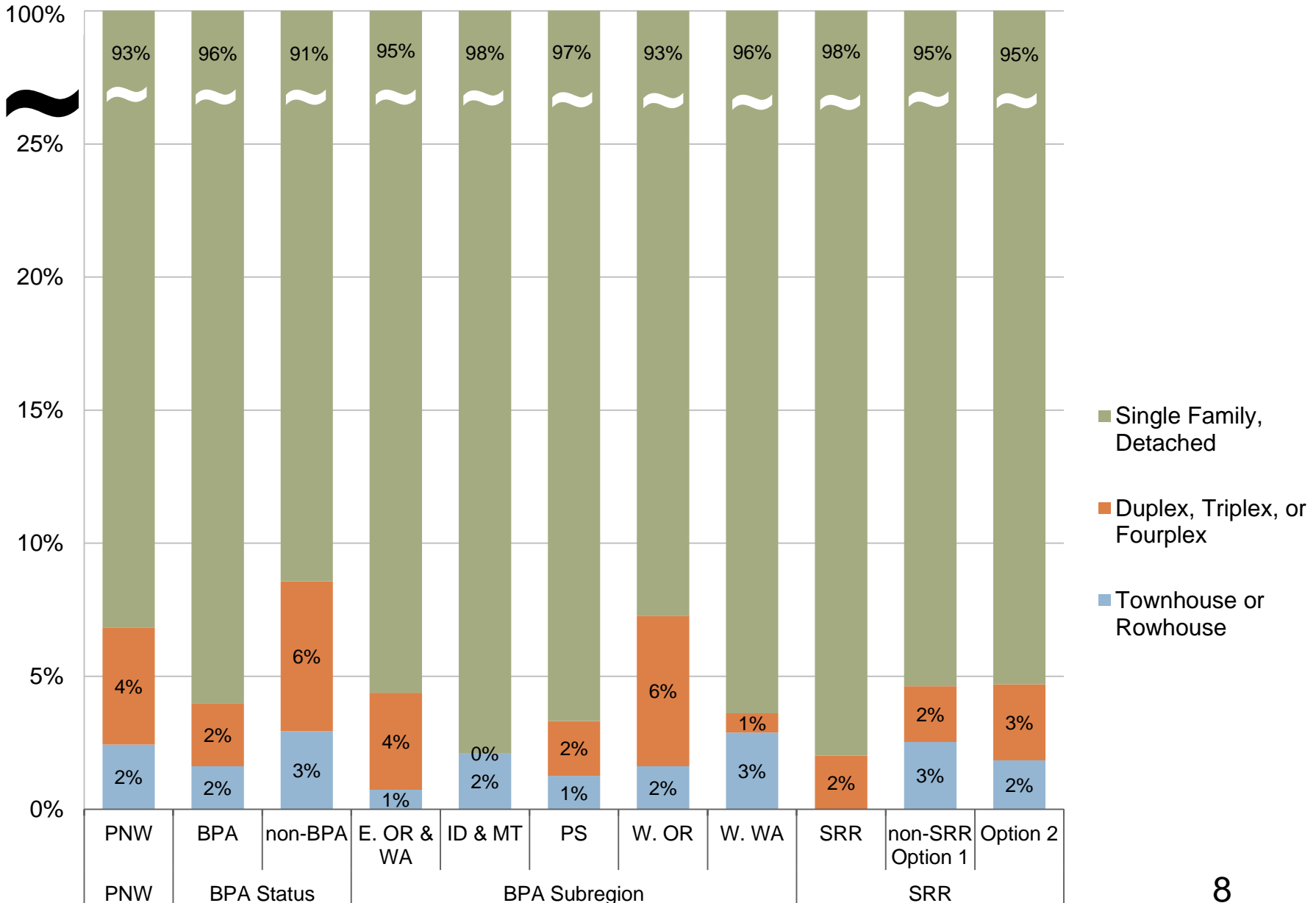
Final Sample Distribution – Within BPA Regions



- Manufactured Homes
- Single-family Homes
- SSR (Small Rural Residential)
- non-SSR Option 1
- Option 2

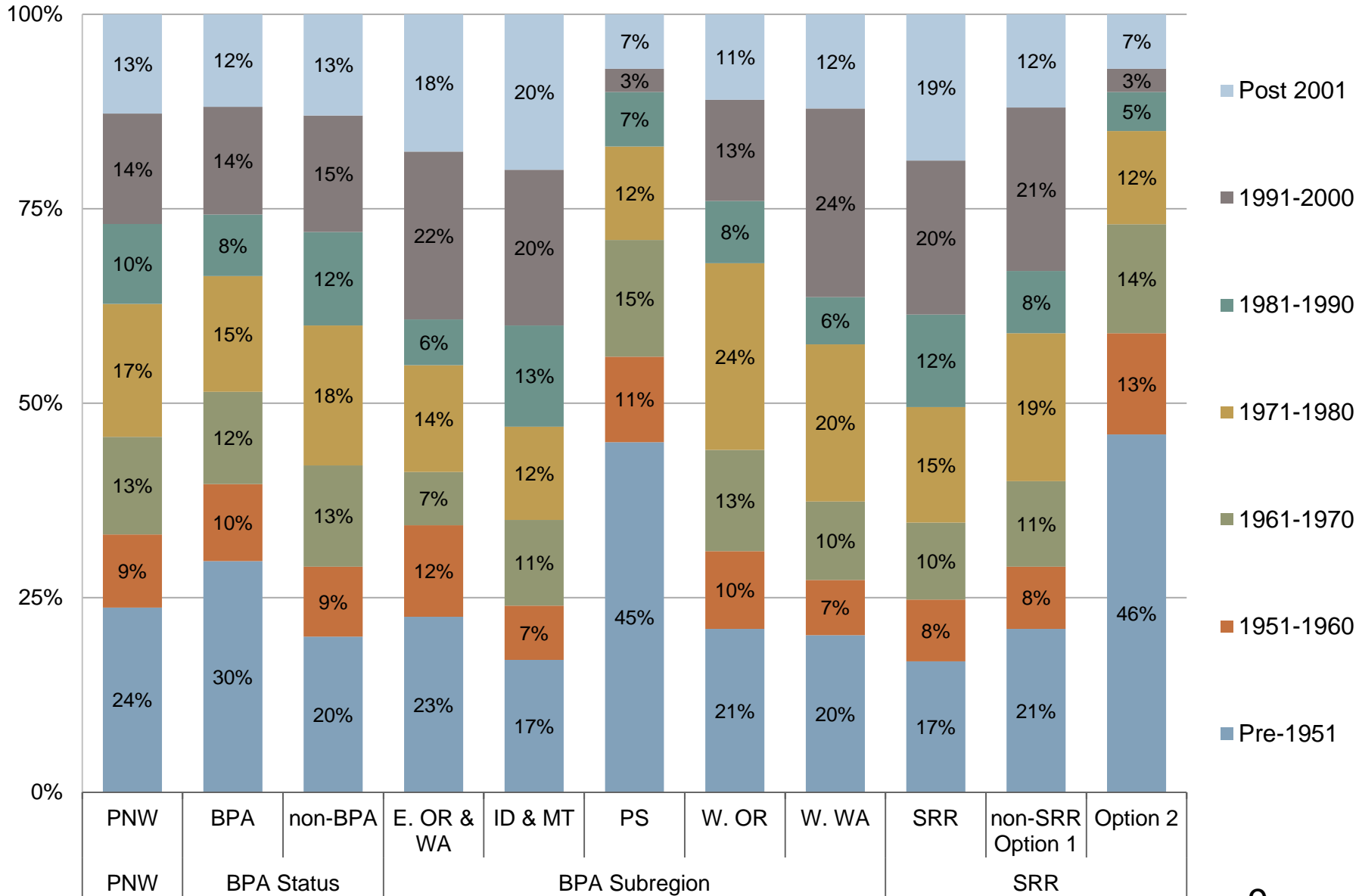
Note: Colored areas represent utility boundaries. Locations of sampled homes are approximated by zip code.

Distribution of building type



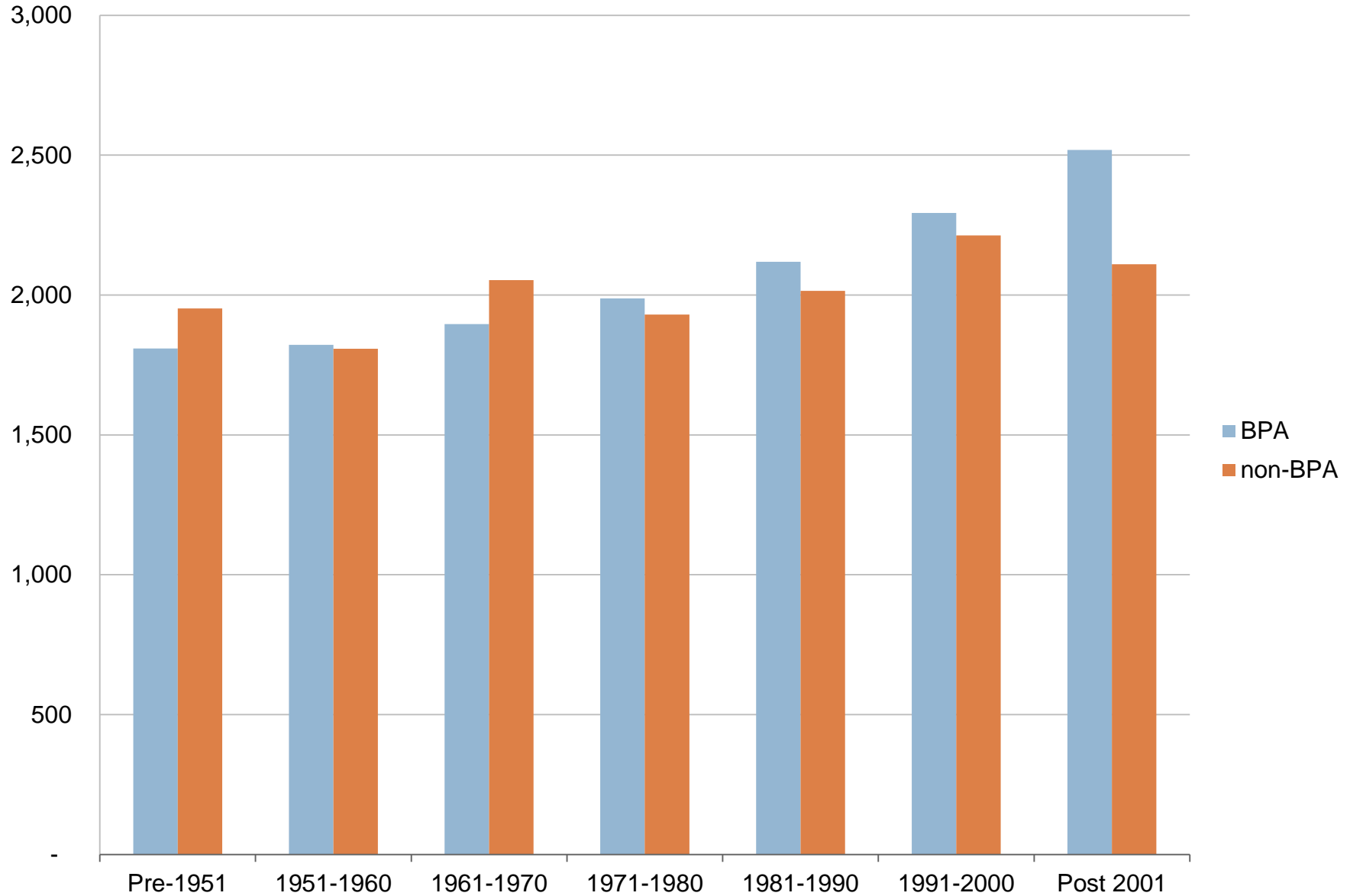
SF – Building Characteristics

Distribution of building vintage



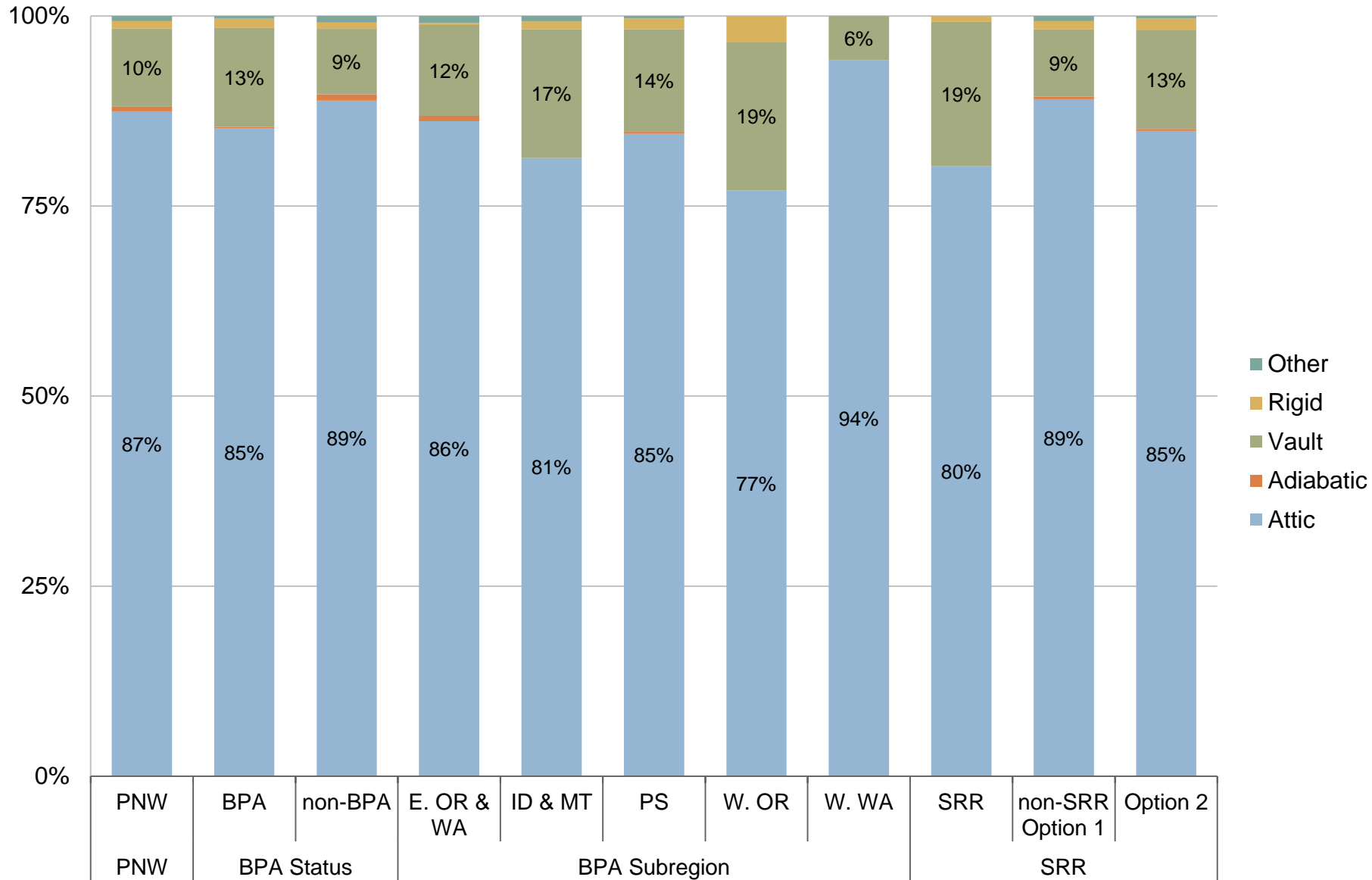
SF – Building Characteristics

Average square footage of conditioned space by building vintage



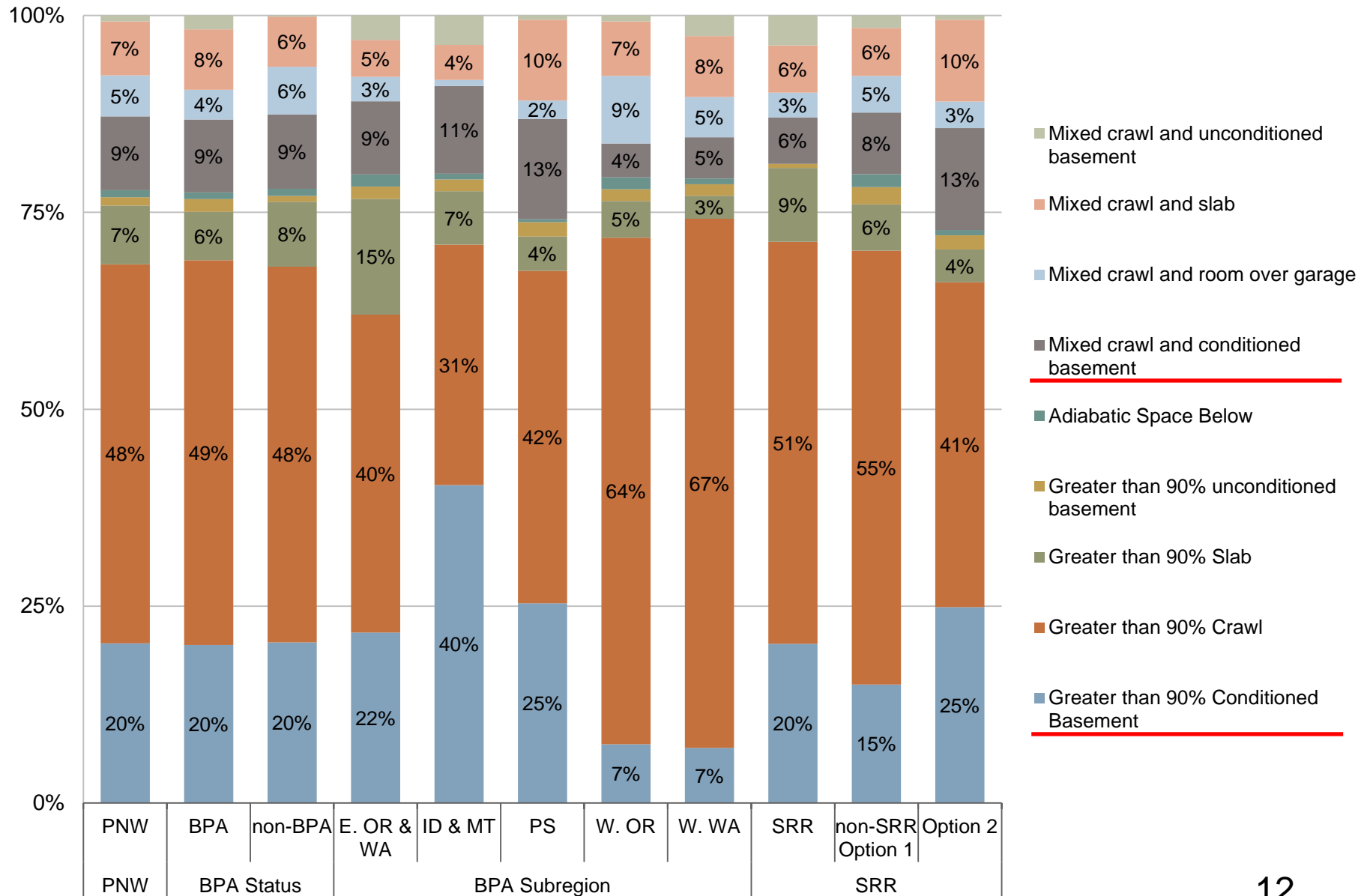
SF – Building Characteristics

Distribution of ceiling type (location of ceiling insulation)

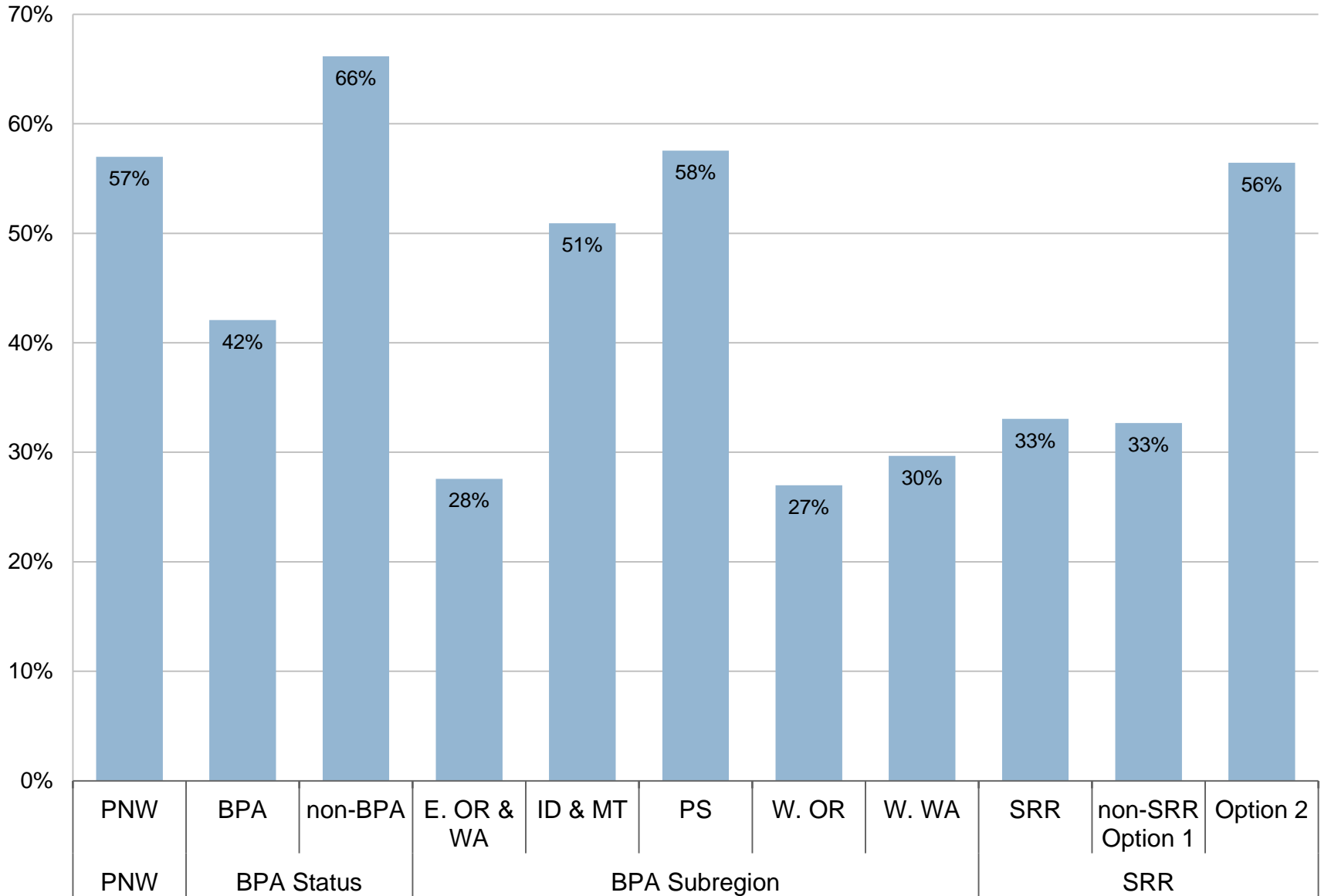


SF – Building Characteristics

Distribution of foundation type



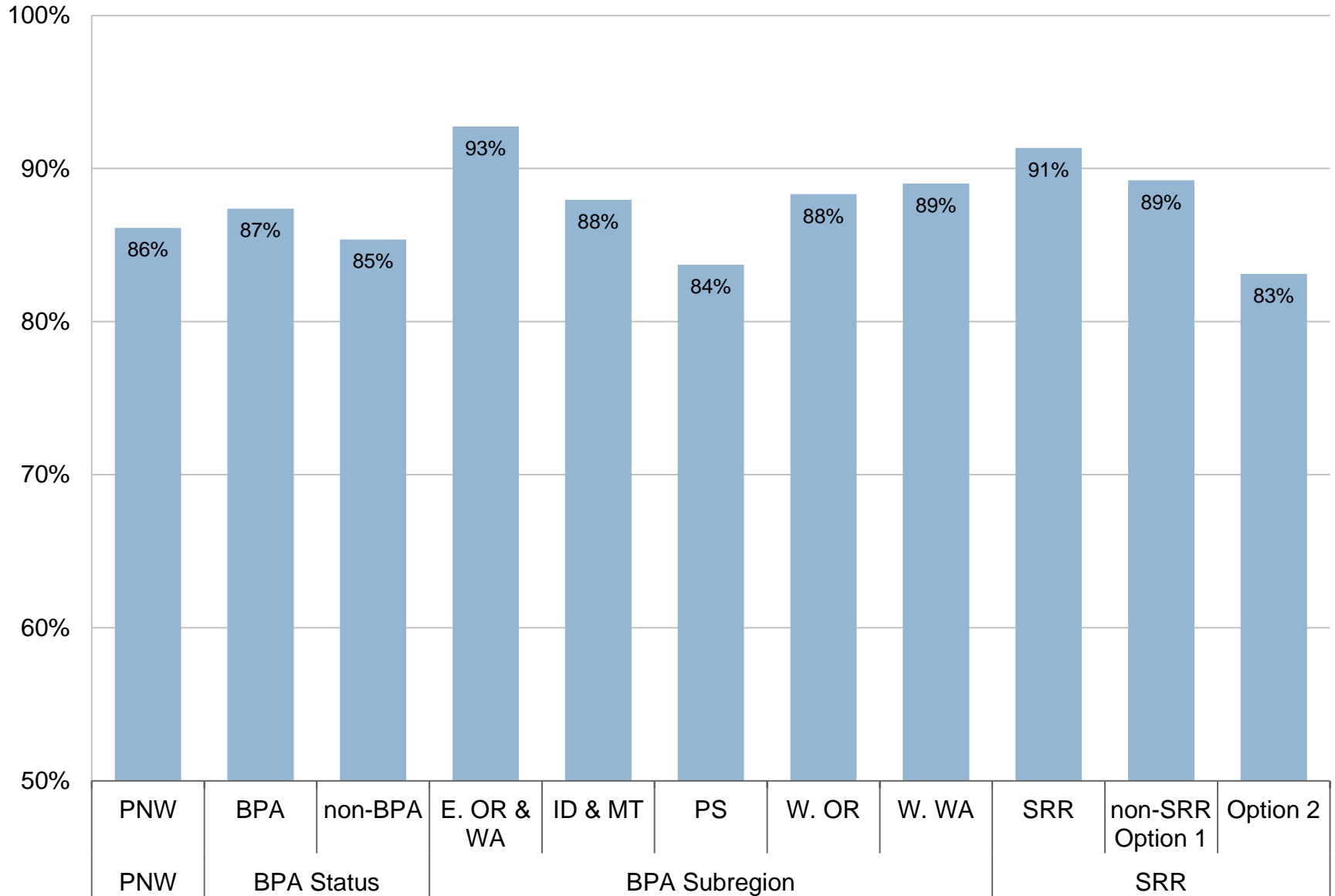
% of homes with verified use of natural gas



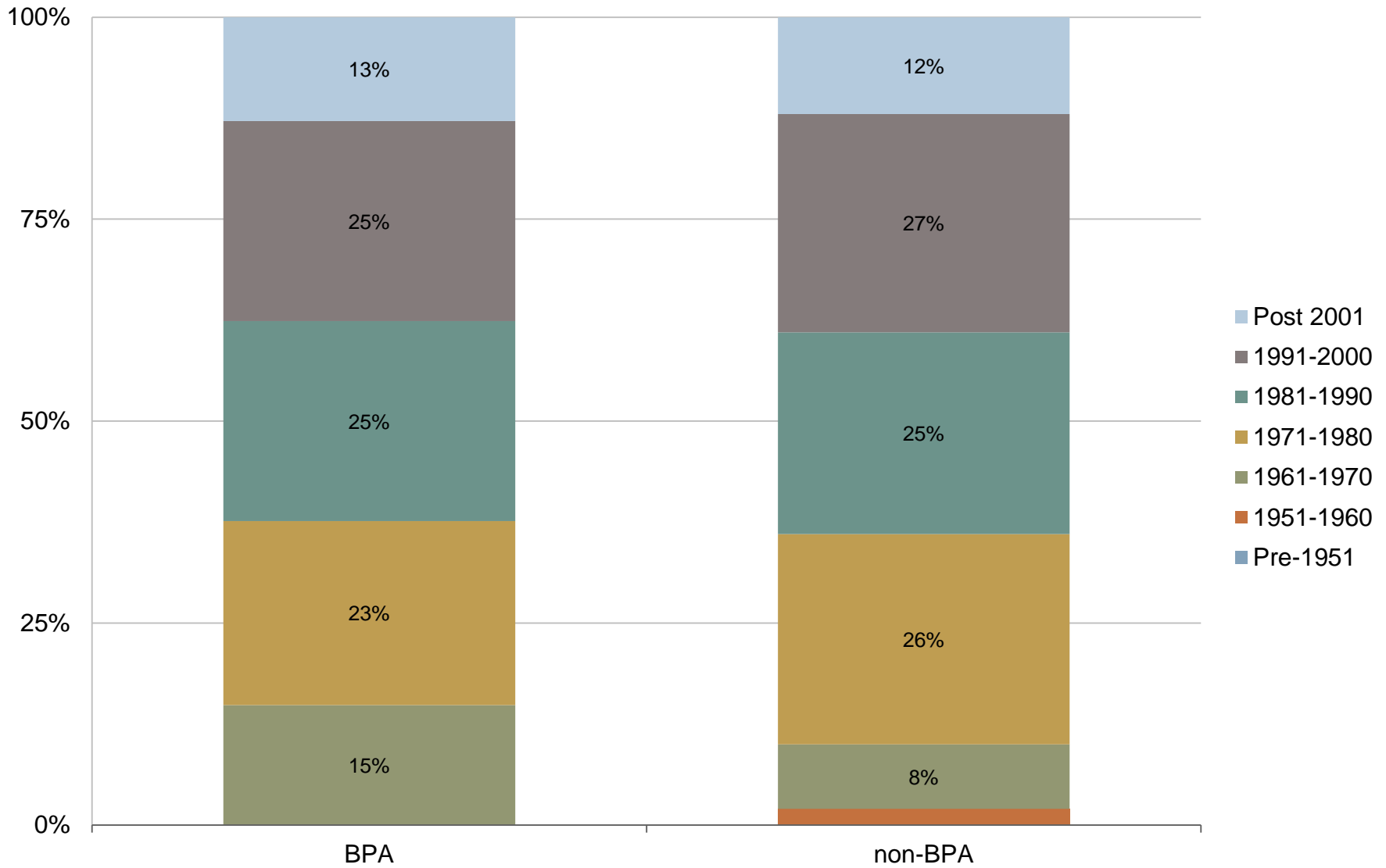
SF – Building Characteristics

% of owner-occupied homes

SF – Building Characteristics

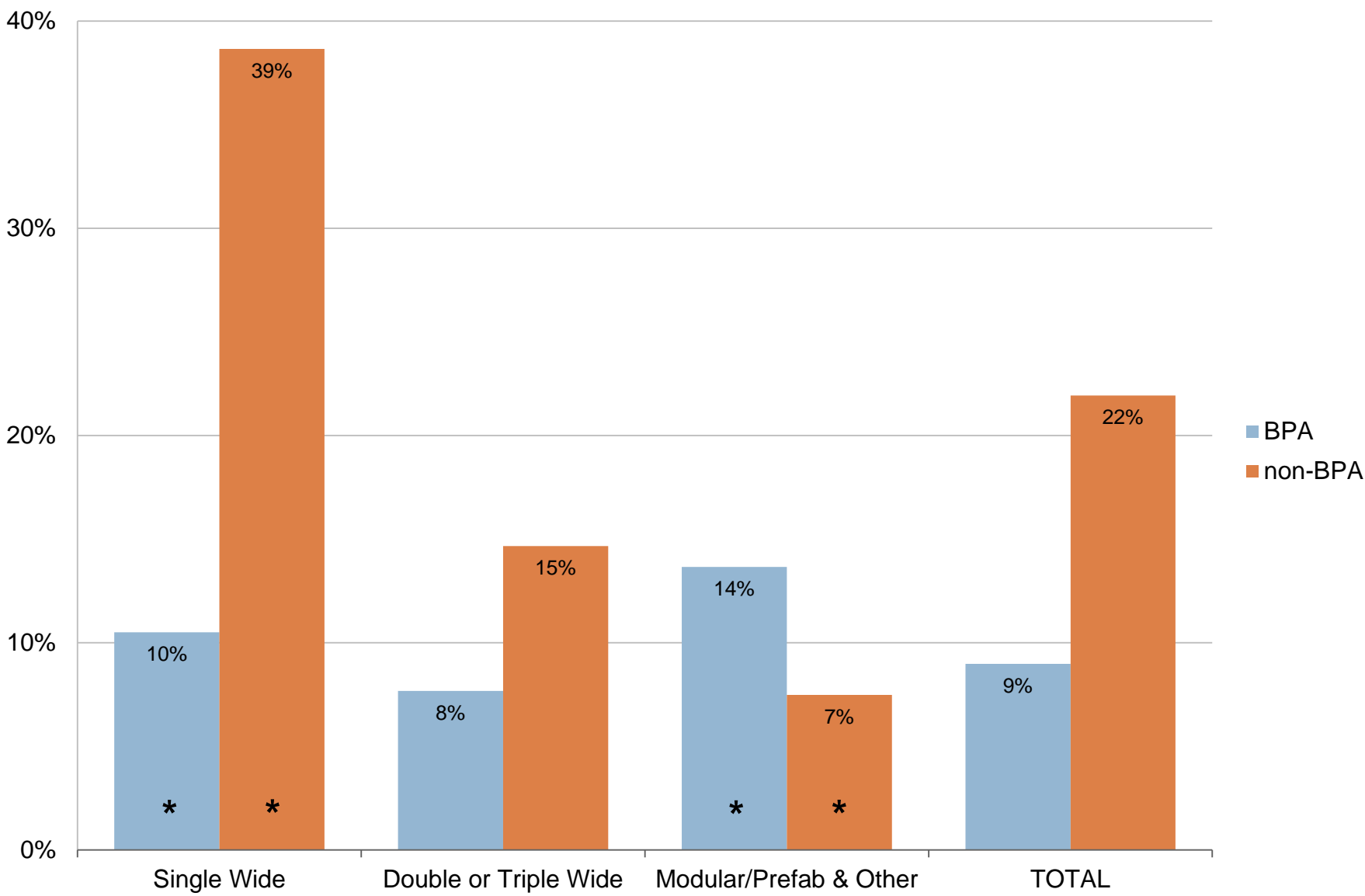


Distribution of building vintage



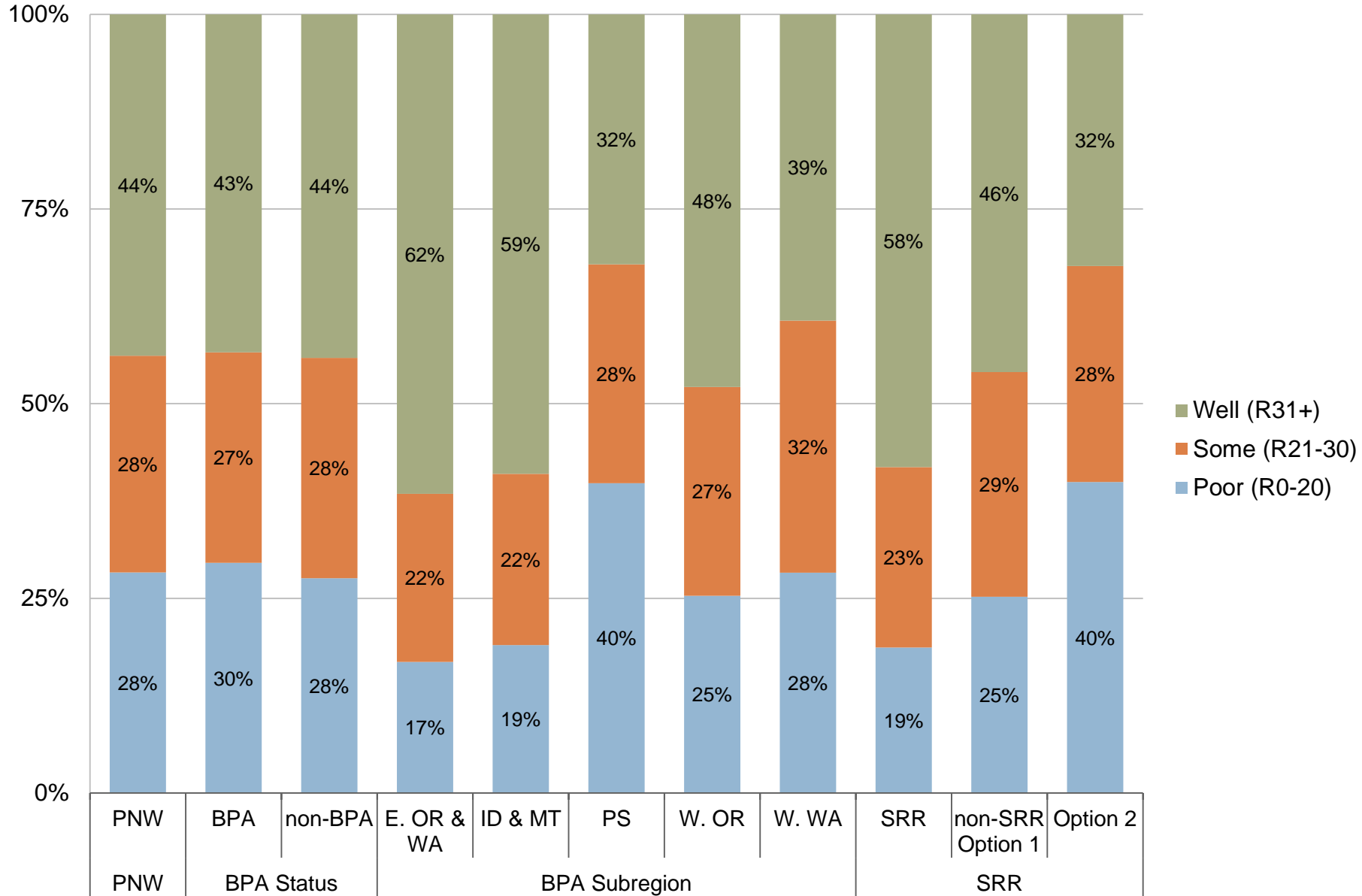
MH – Building Characteristics

% of homes with verified use of natural gas by building type

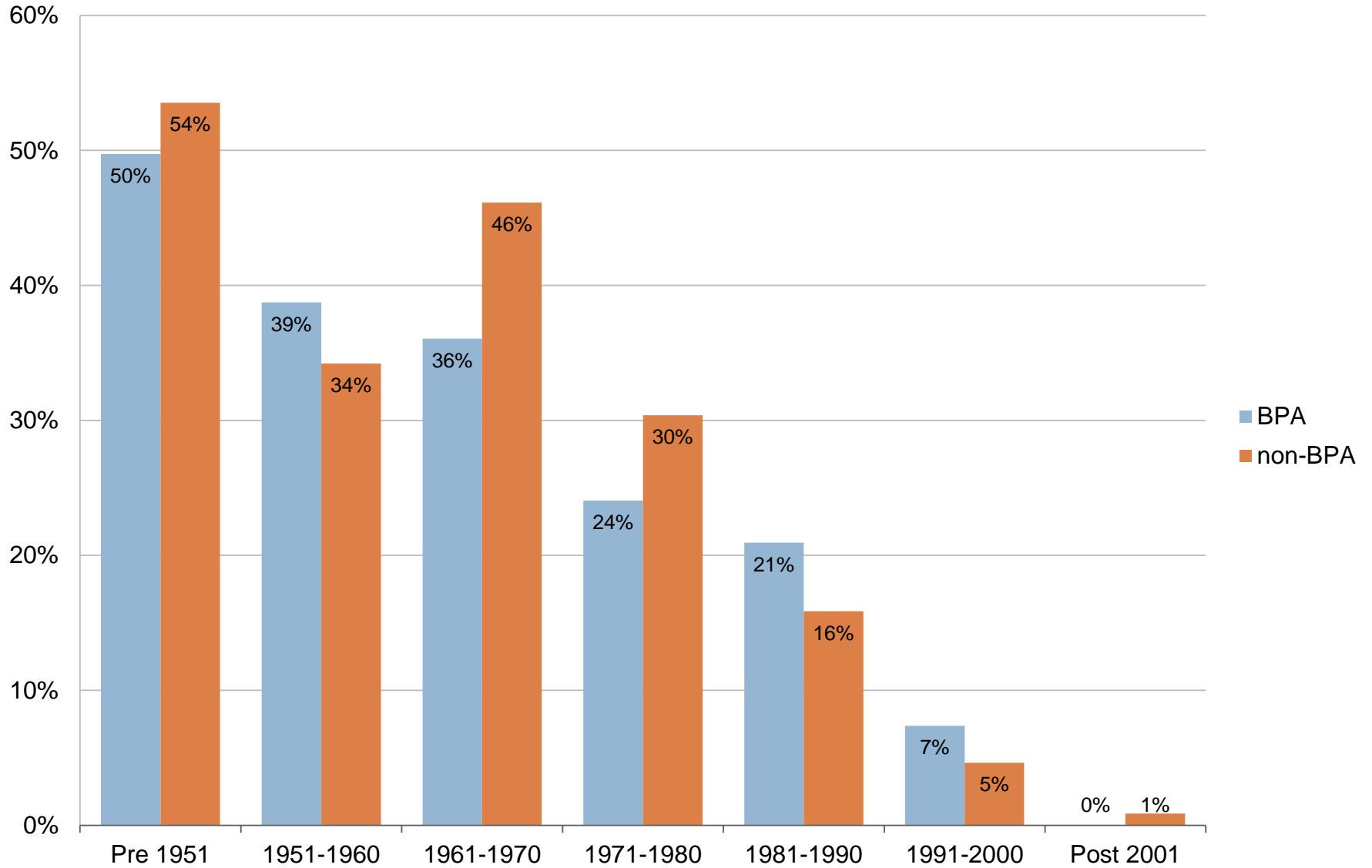


Note: Bars with asterisk (*) indicate small sample (< 68).

Distribution of attic insulation level

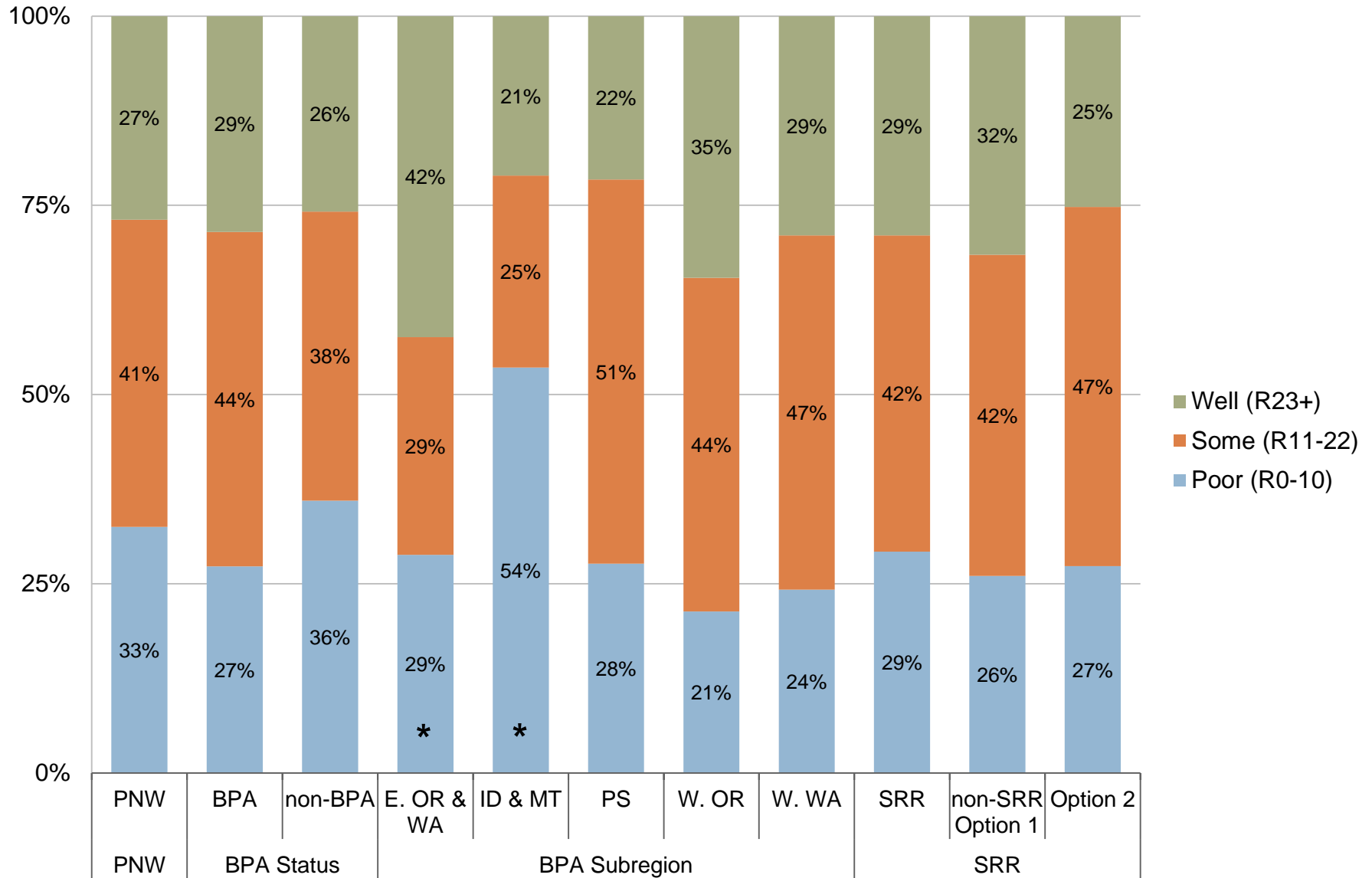


Average % of homes with "poor" attic insulation (R0-R20) by vintage



SF – Attic Insulation

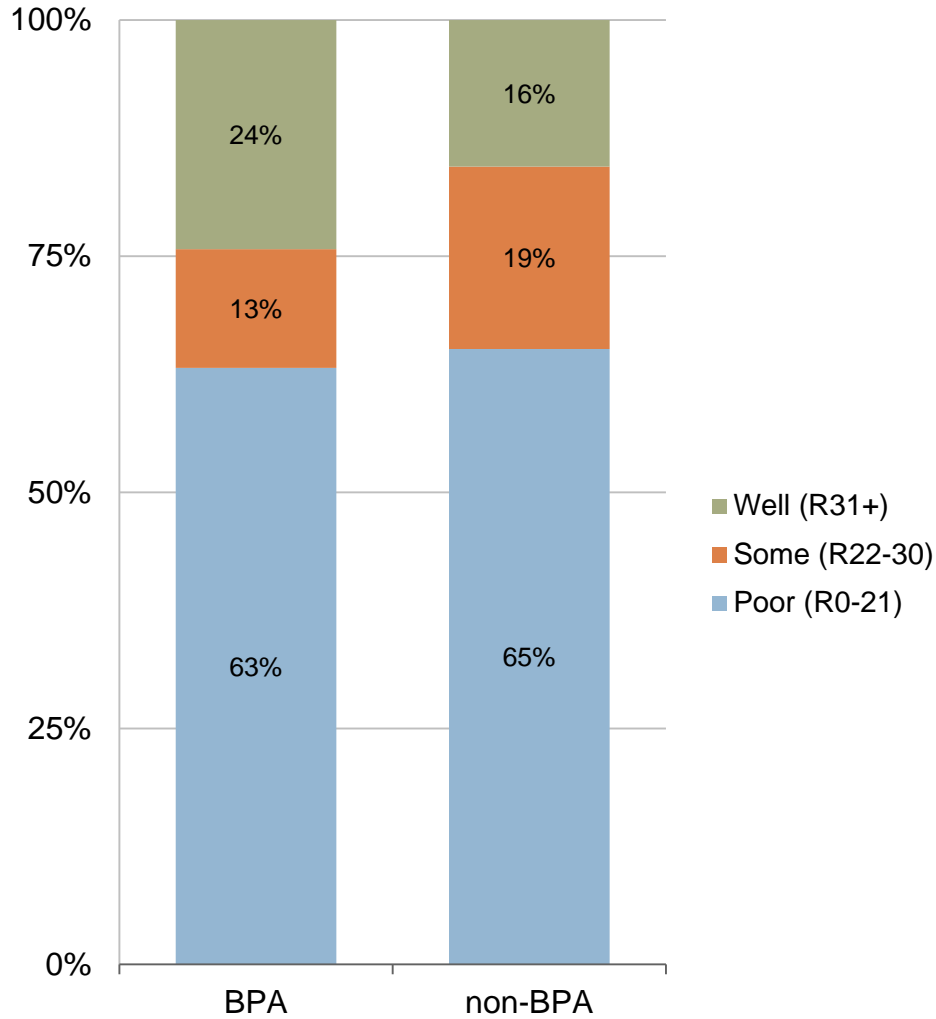
Distribution of insulation level of floors above crawlspaces



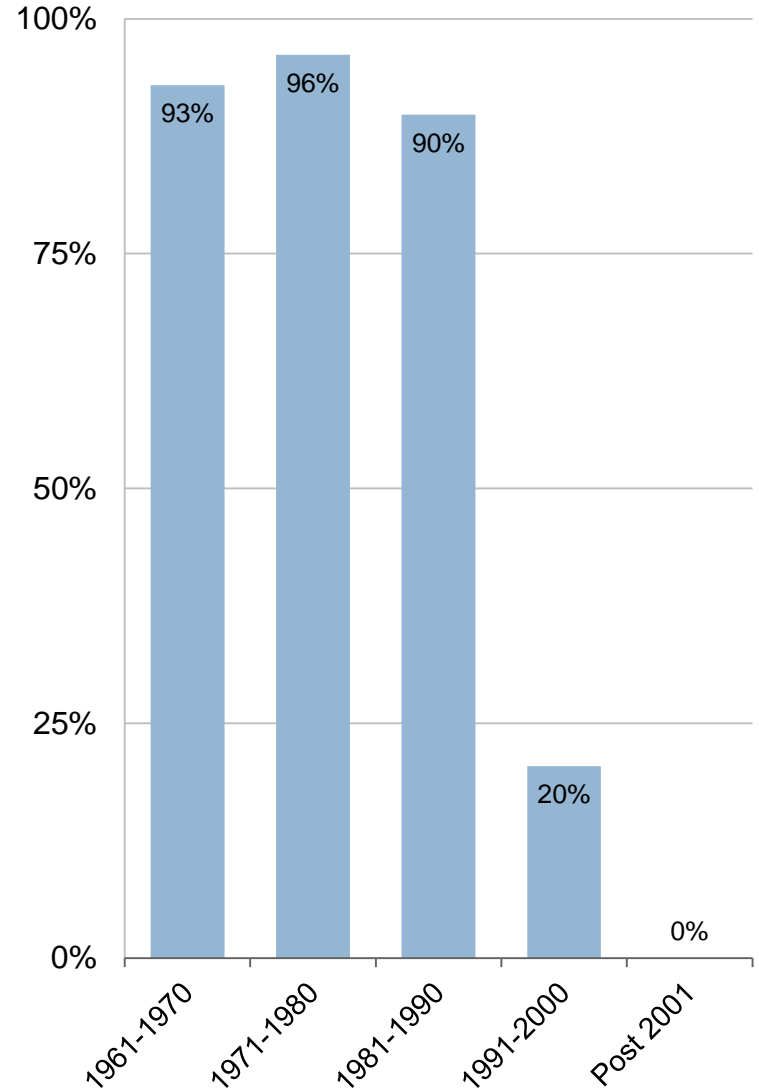
Note: Bars with asterisk (*) indicate small sample (< 68). This analysis is only among the sites without crawl space wall insulation.

MH – Envelope

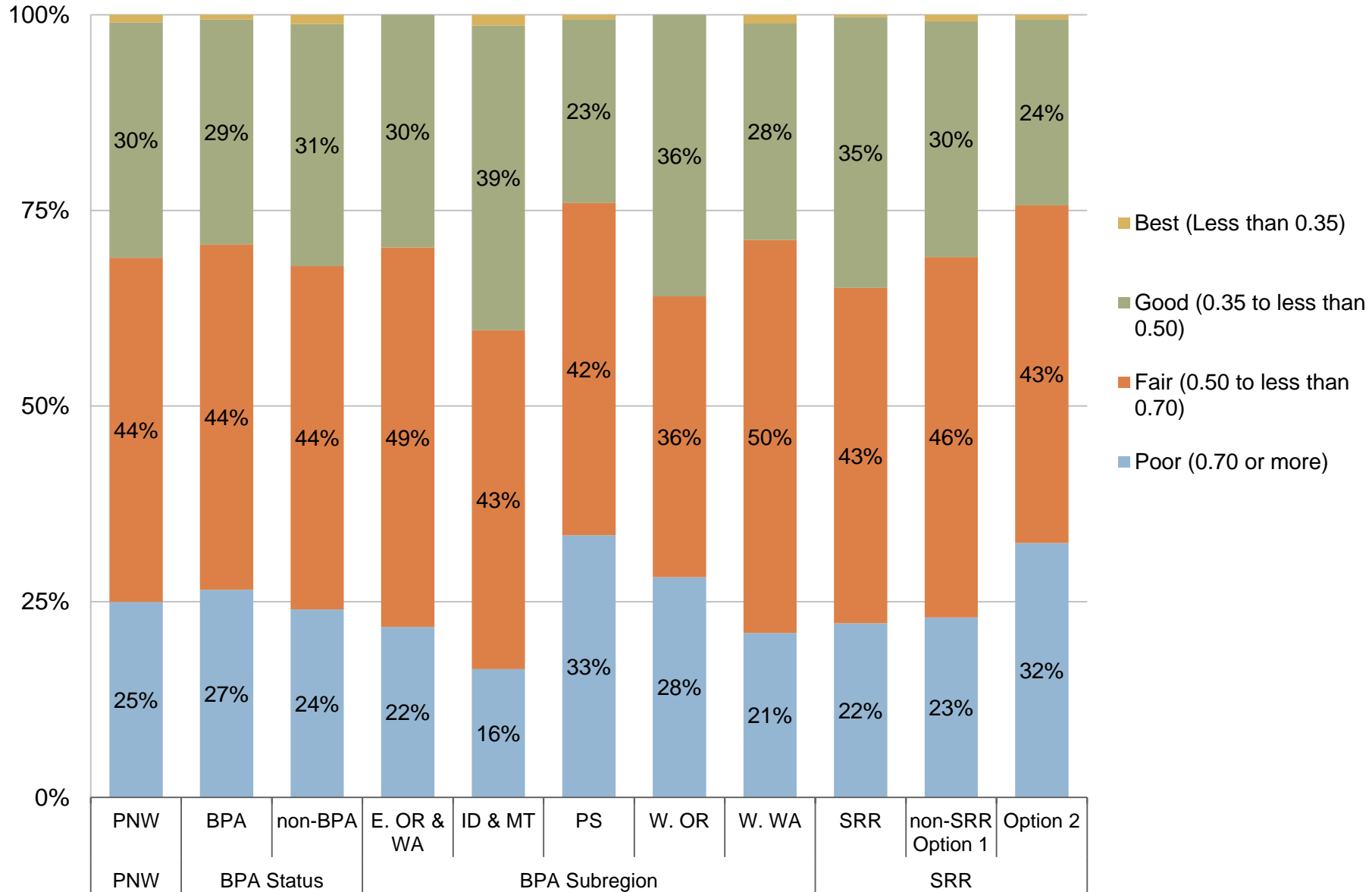
Distribution of attic insulation level by BPA status



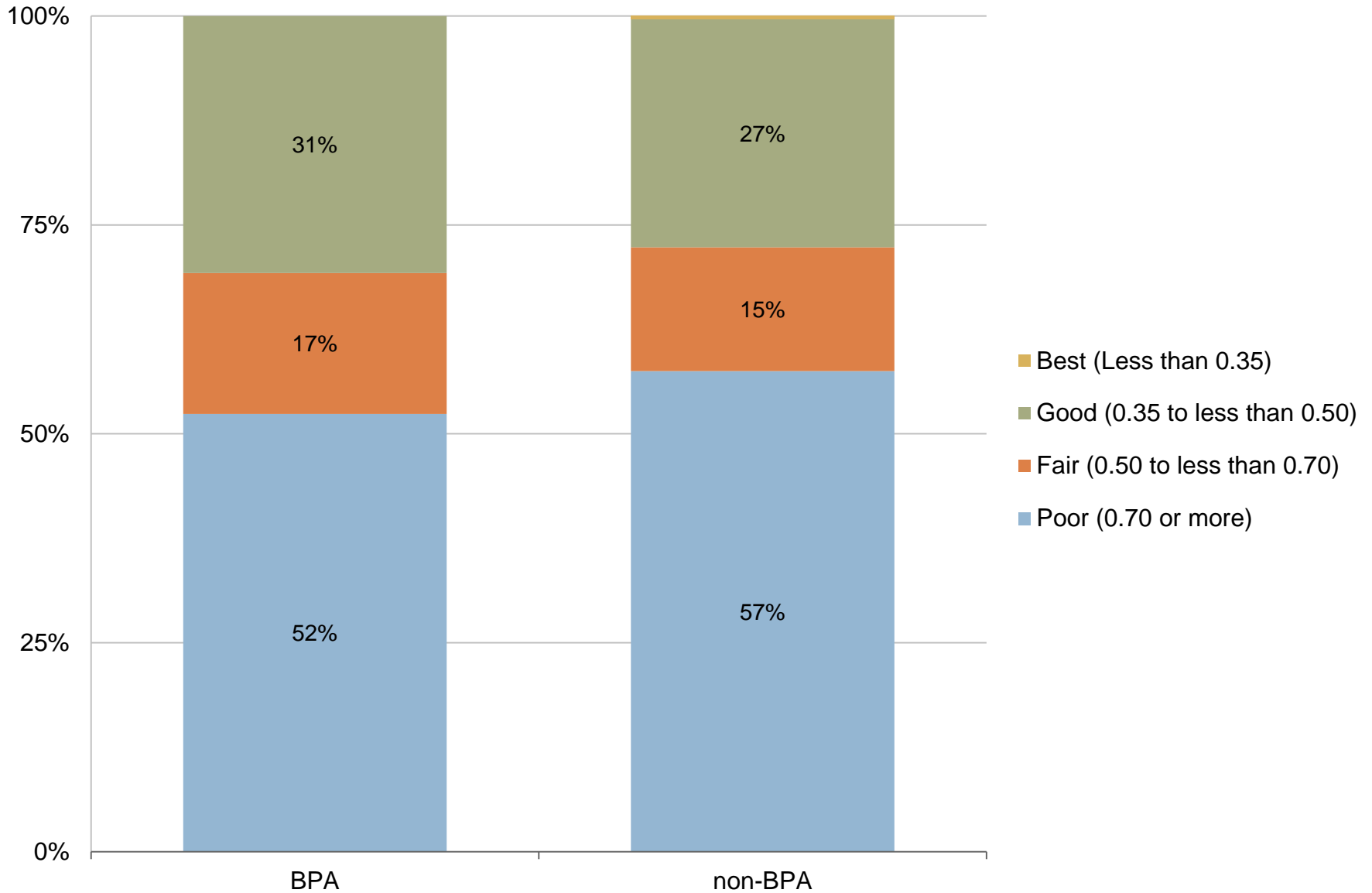
Average % of homes with "poor" attic insulation by vintage in BPA region



Distribution of U-value of primary window type

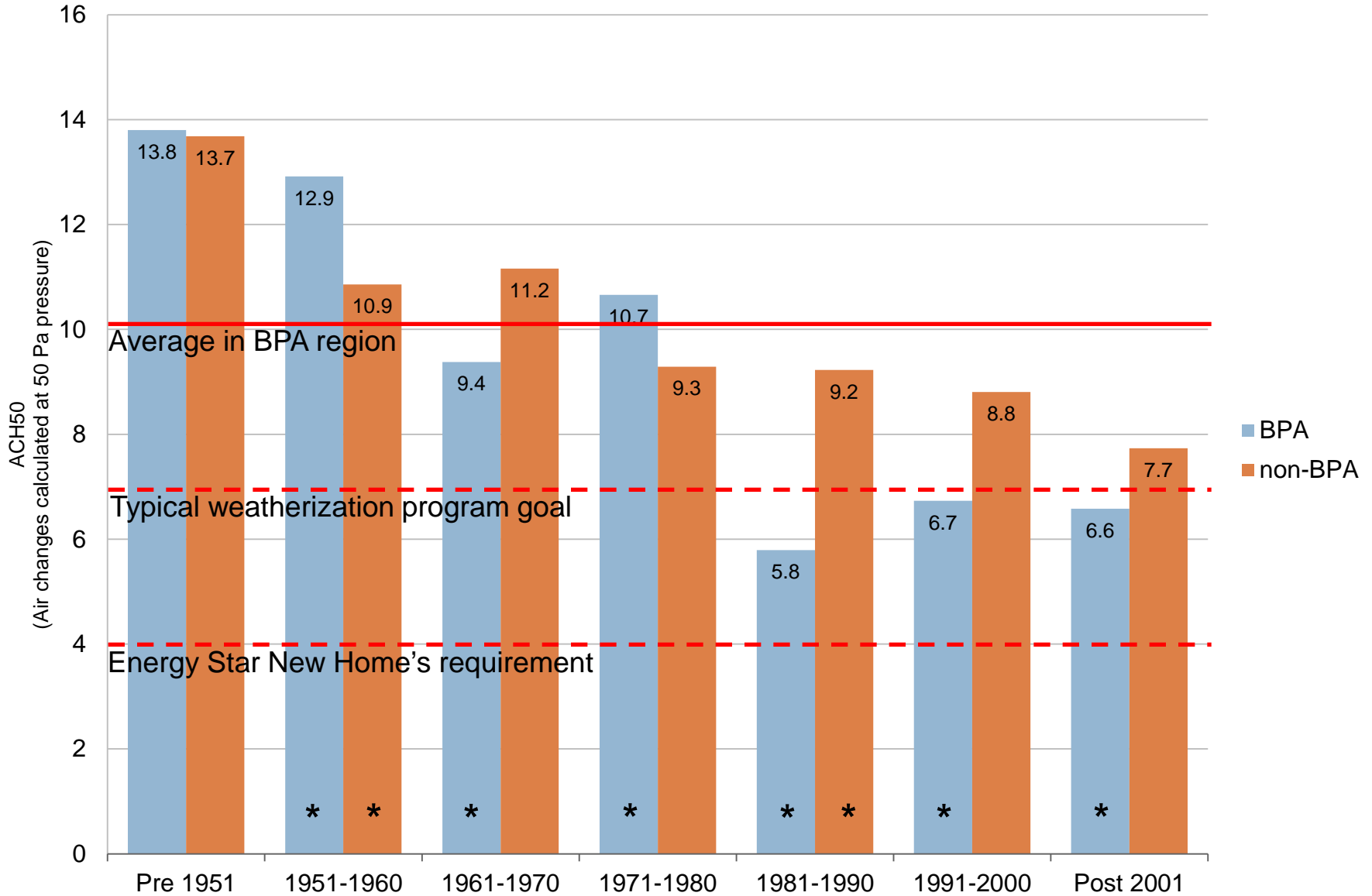


Distribution of aggregated U-value of all windows



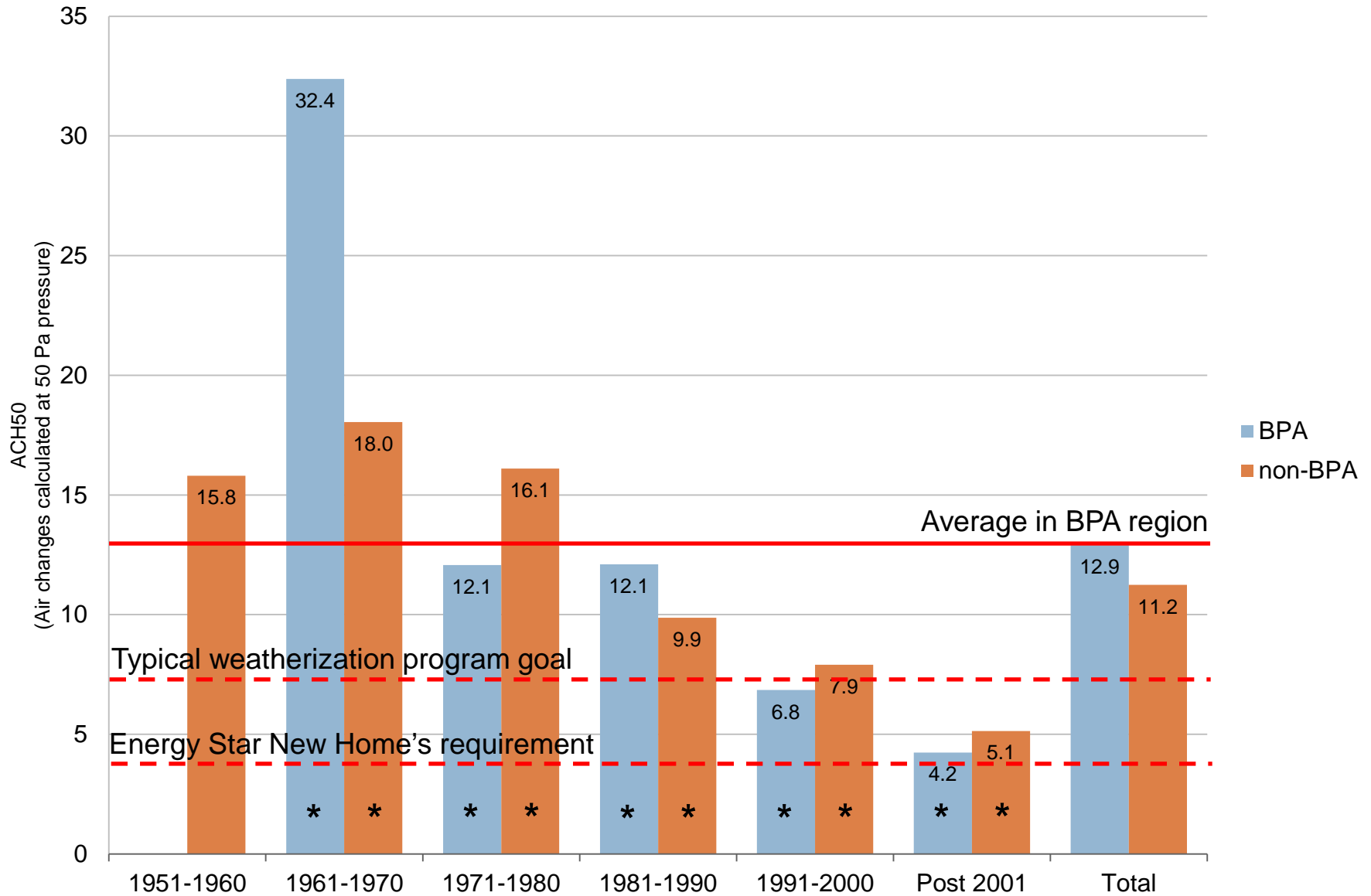
SF – Envelope

Average ACH50 by vintage



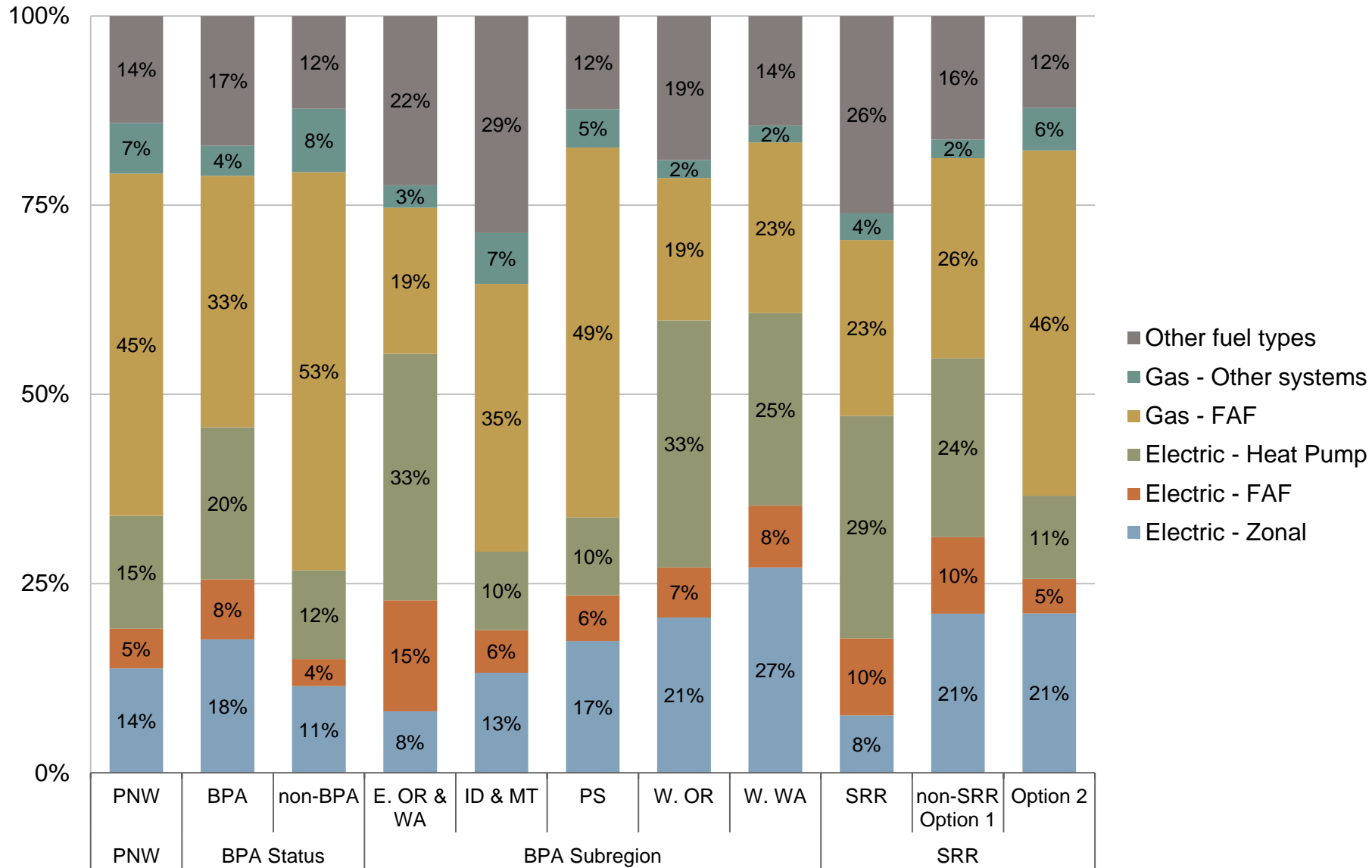
Note: Bars with asterisk (*) indicate small sample (< 30).

Average ACH50 by vintage



Note: Bars with asterisk (*) indicate small sample (< 30).

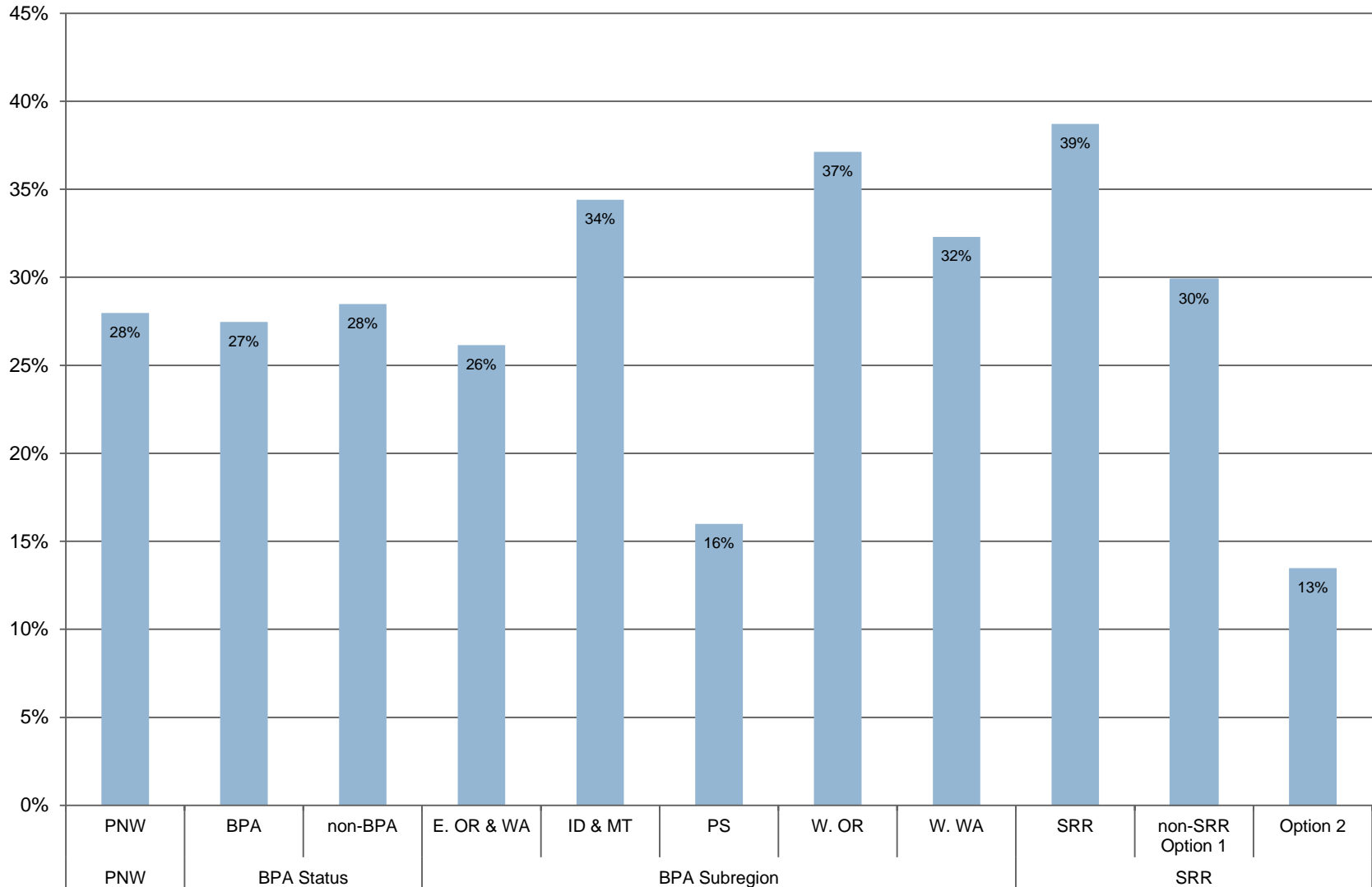
Distribution of primary heating system and fuel type



Note: "Electric Zonal" includes baseboard, boiler, and plug-in heater. "Heat Pump" includes DHP. "Gas - Other systems" includes boiler and stove heater. "Other fuel types" includes oil-, propane-, pellets-, or wood-based systems.

% of homes reporting wood consumption

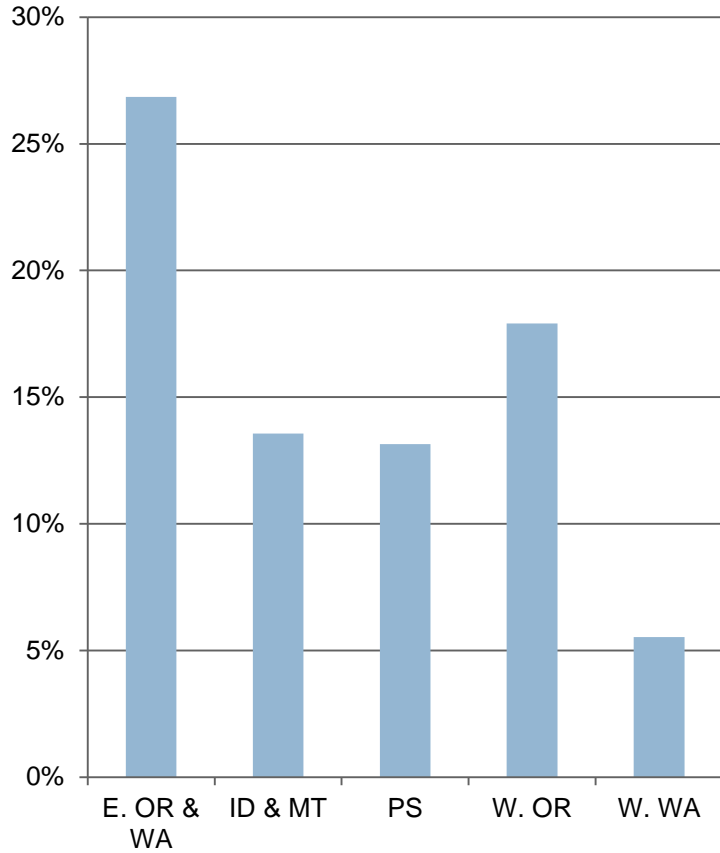
SF – Wood Consumption



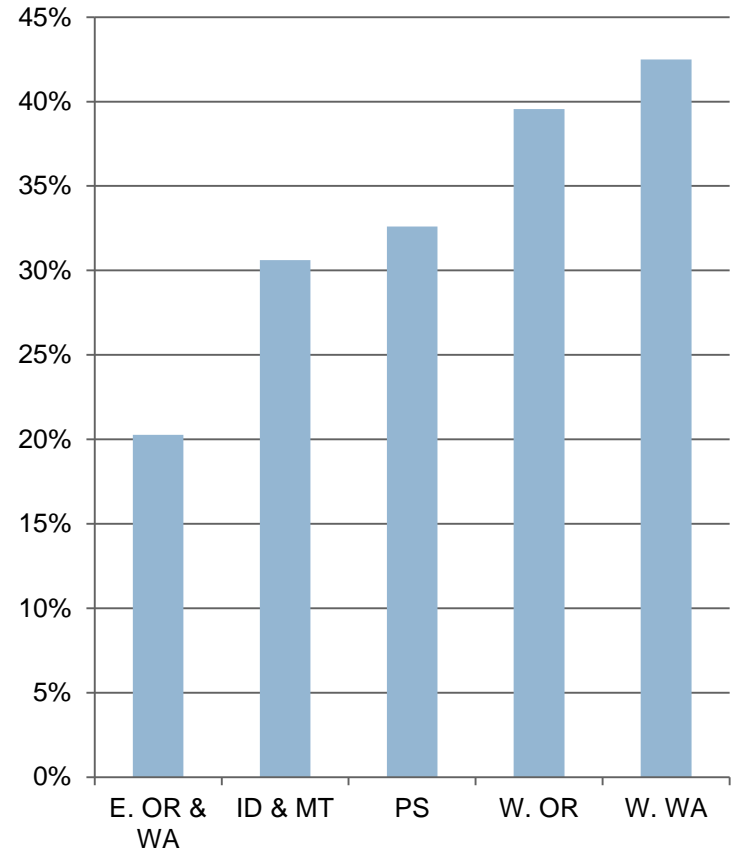
Note: Wood use is self-report data. The analysis is among homes that use electricity as primary heating fuel or wood as primary and electric as secondary.

SF – Resistance Heat

% of sites with plug-in heater

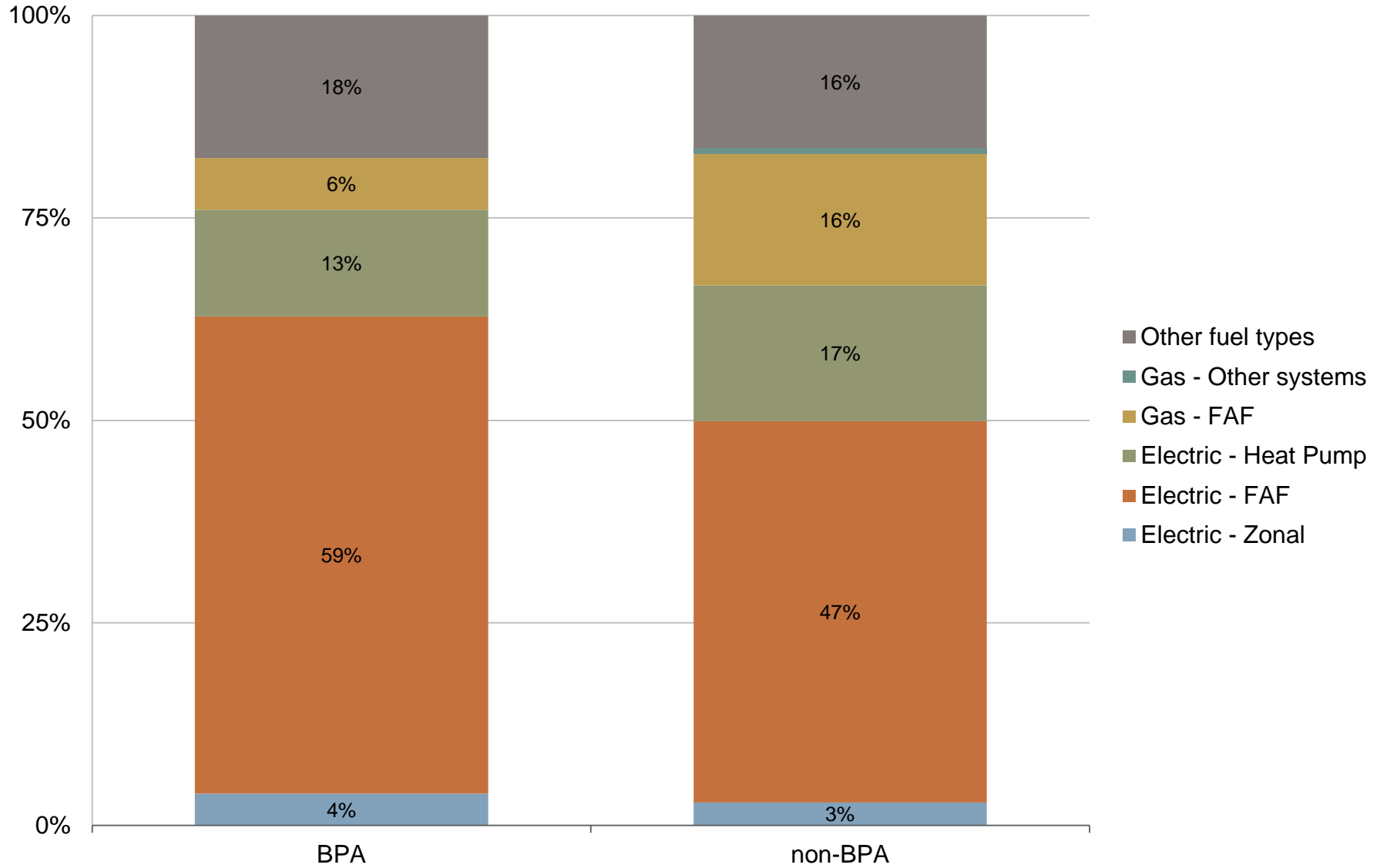


% of sites with baseboard

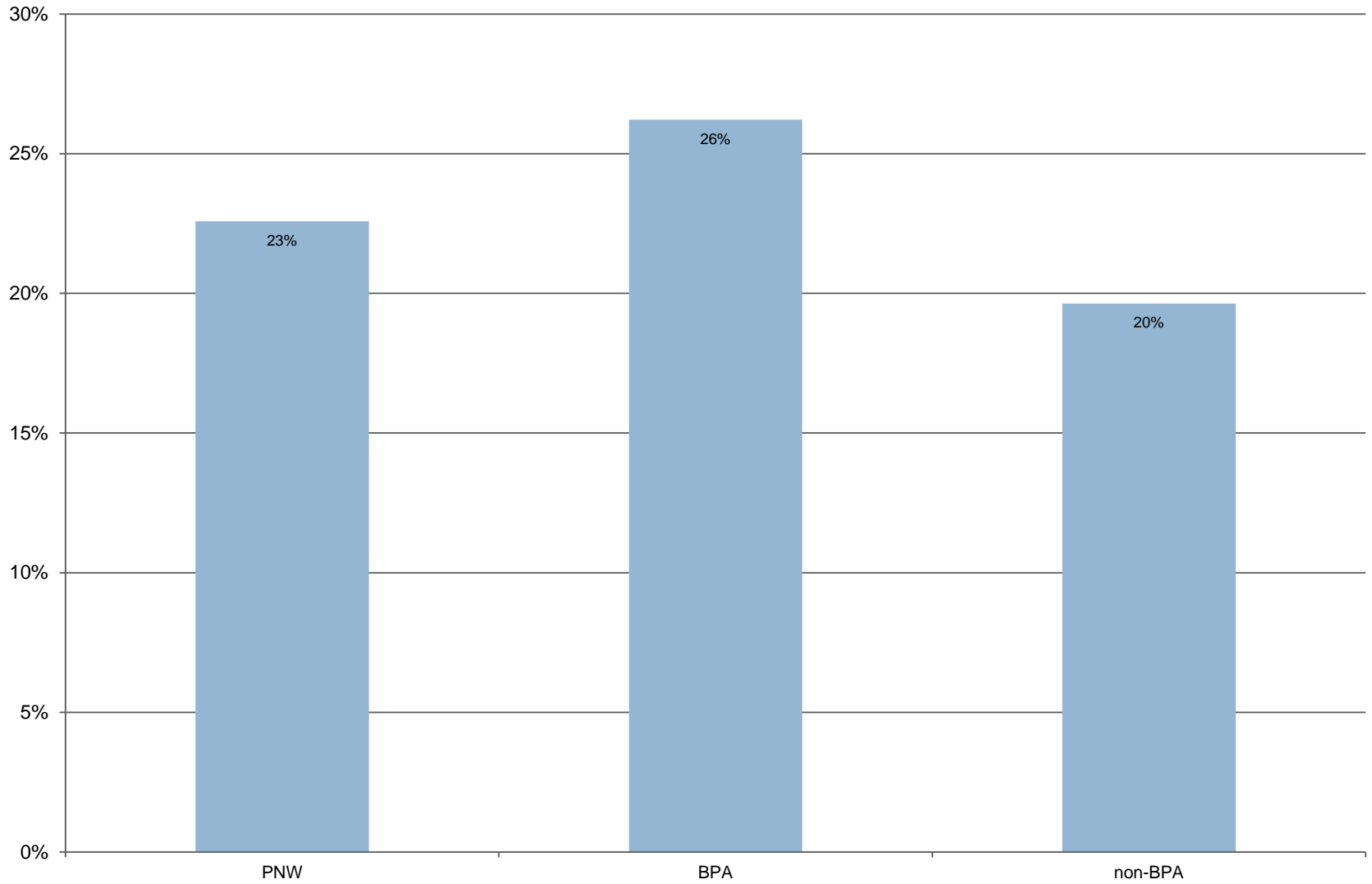


MH – HVAC

Distribution of primary heating system and fuel type



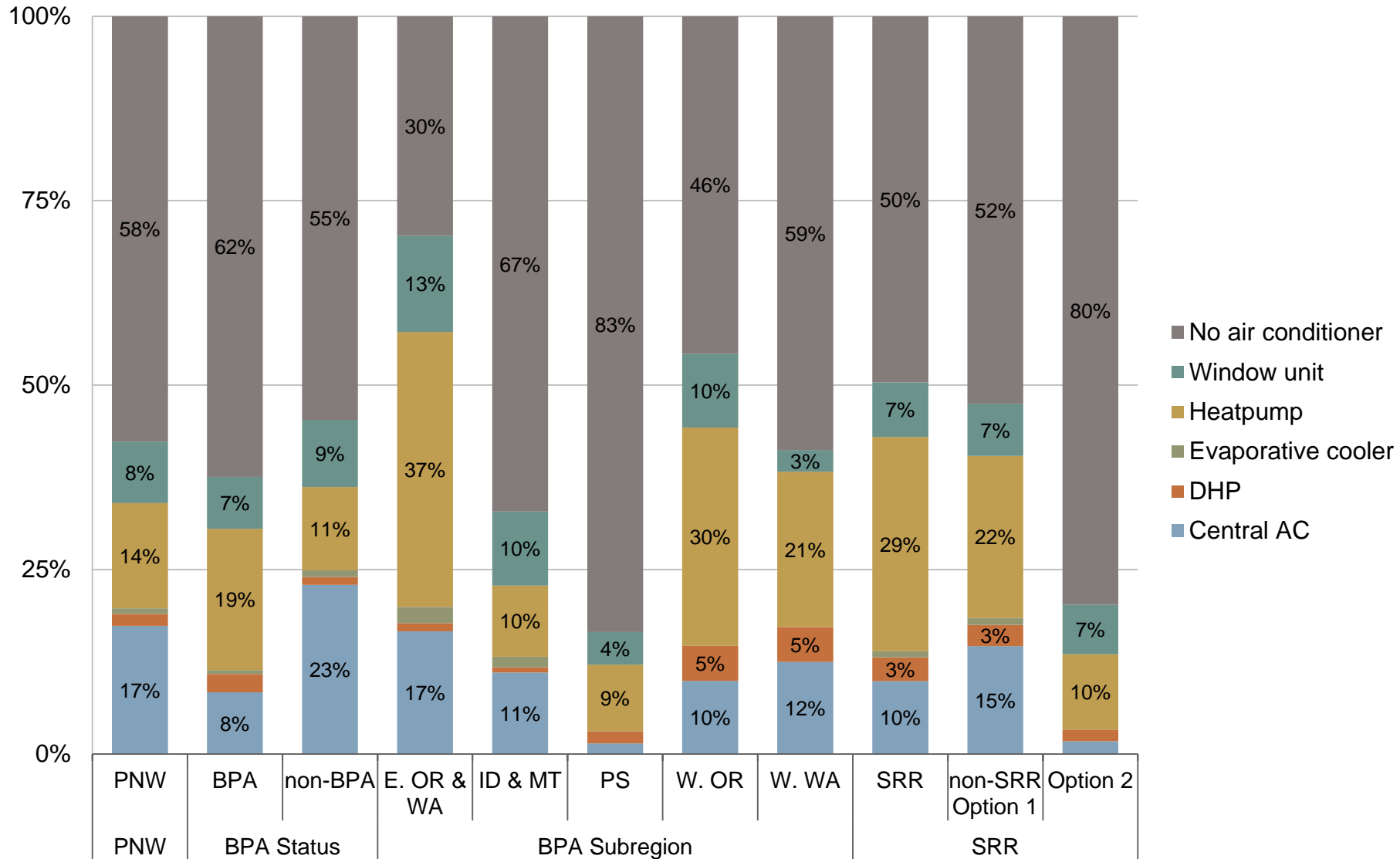
% of MH homes reporting wood consumption



MH – HVAC

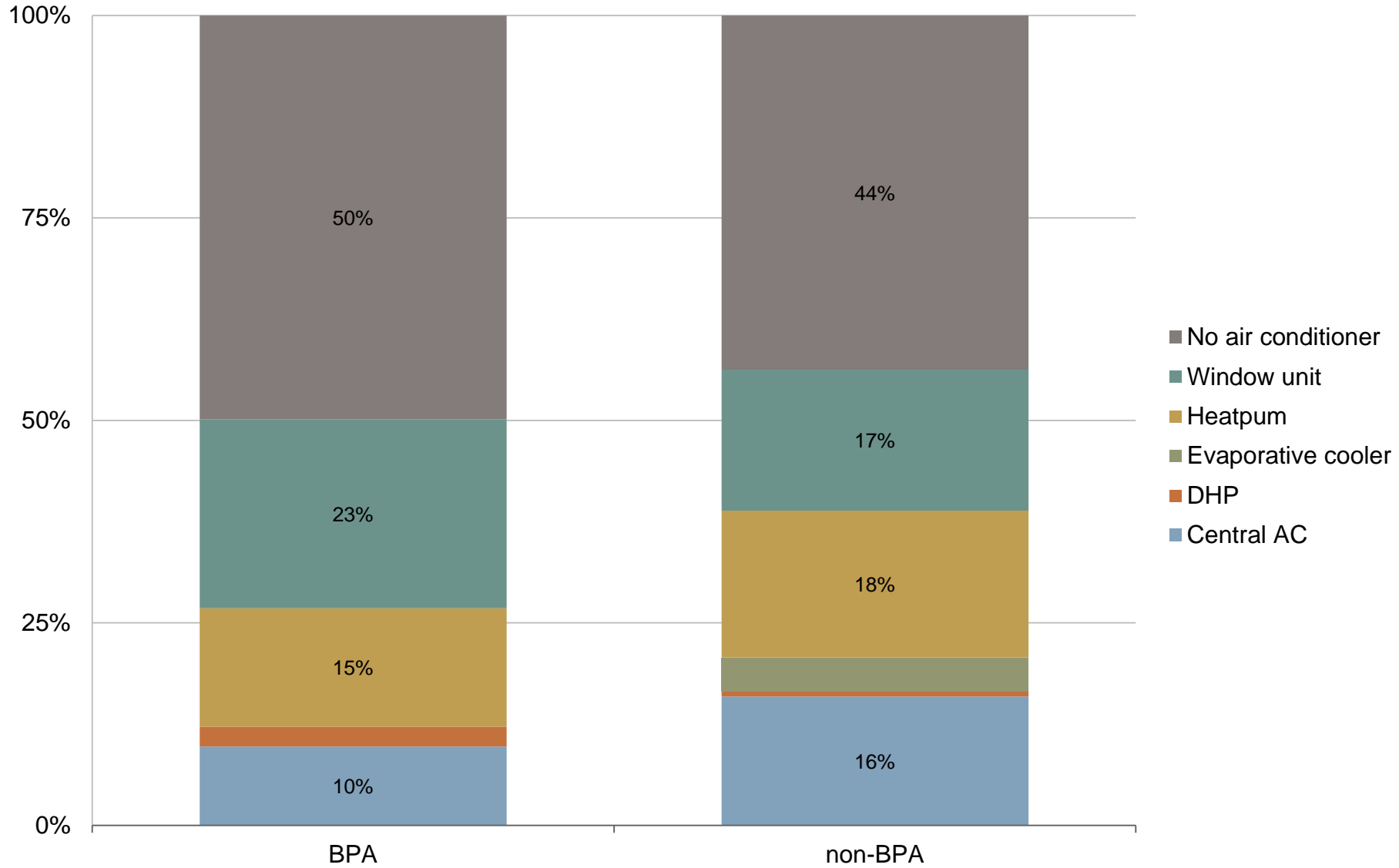
Distribution of primary cooling system

SF – Cooling System



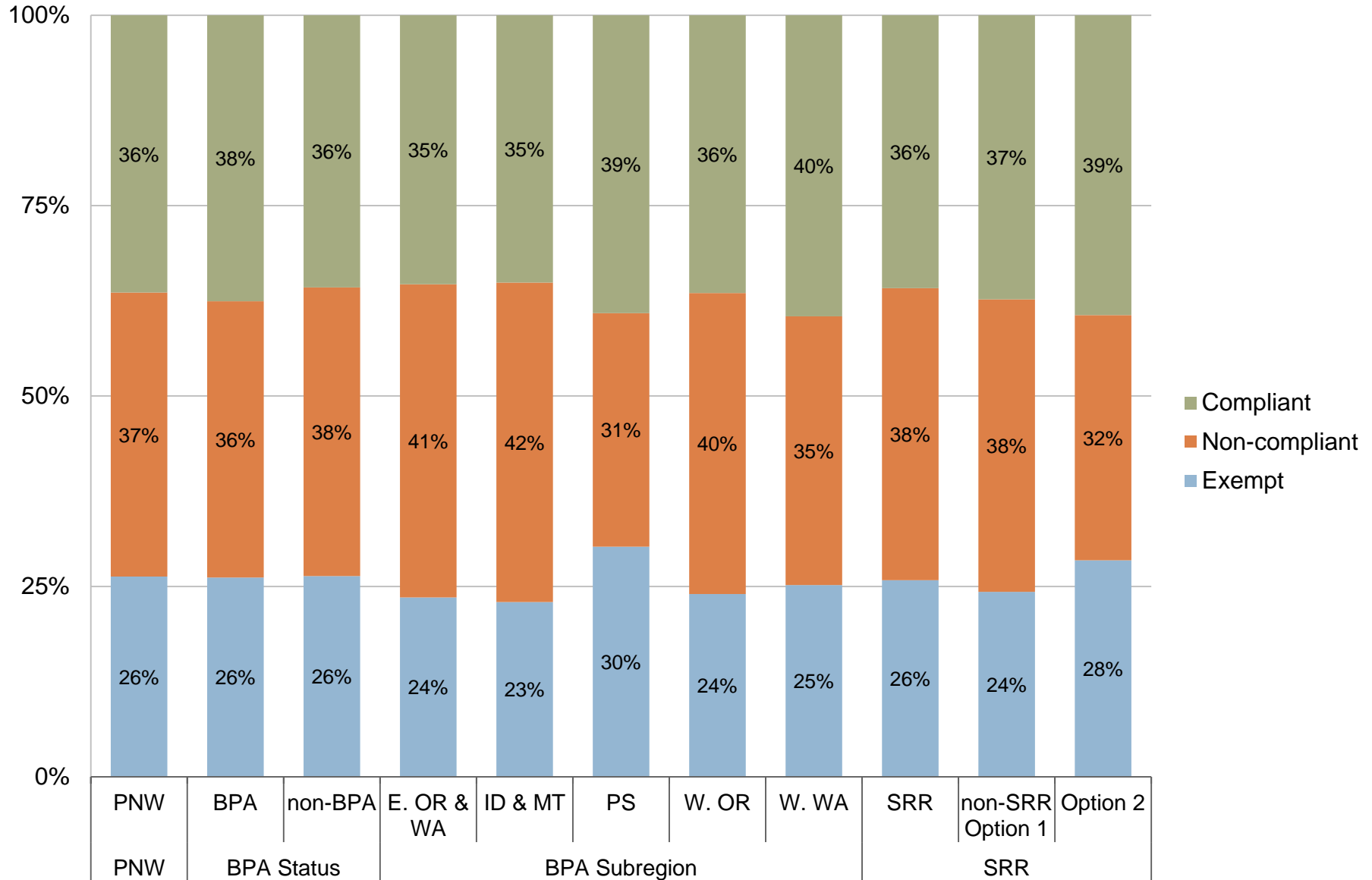
Note: "Window unit" includes PTAC and windowshaker.

Distribution of primary cooling system



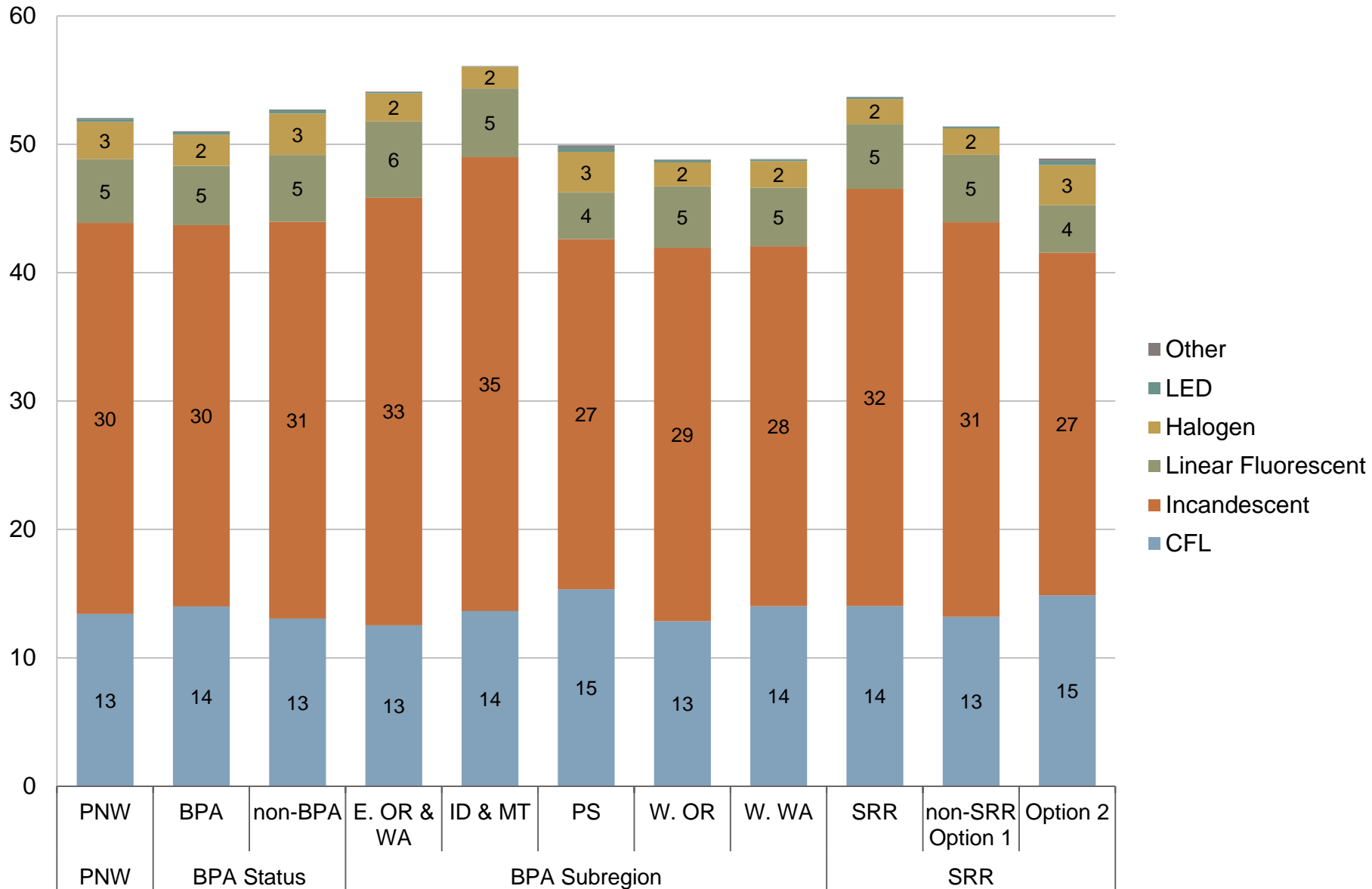
MH – HVAC

Distribution of interior lamps EISA compliance



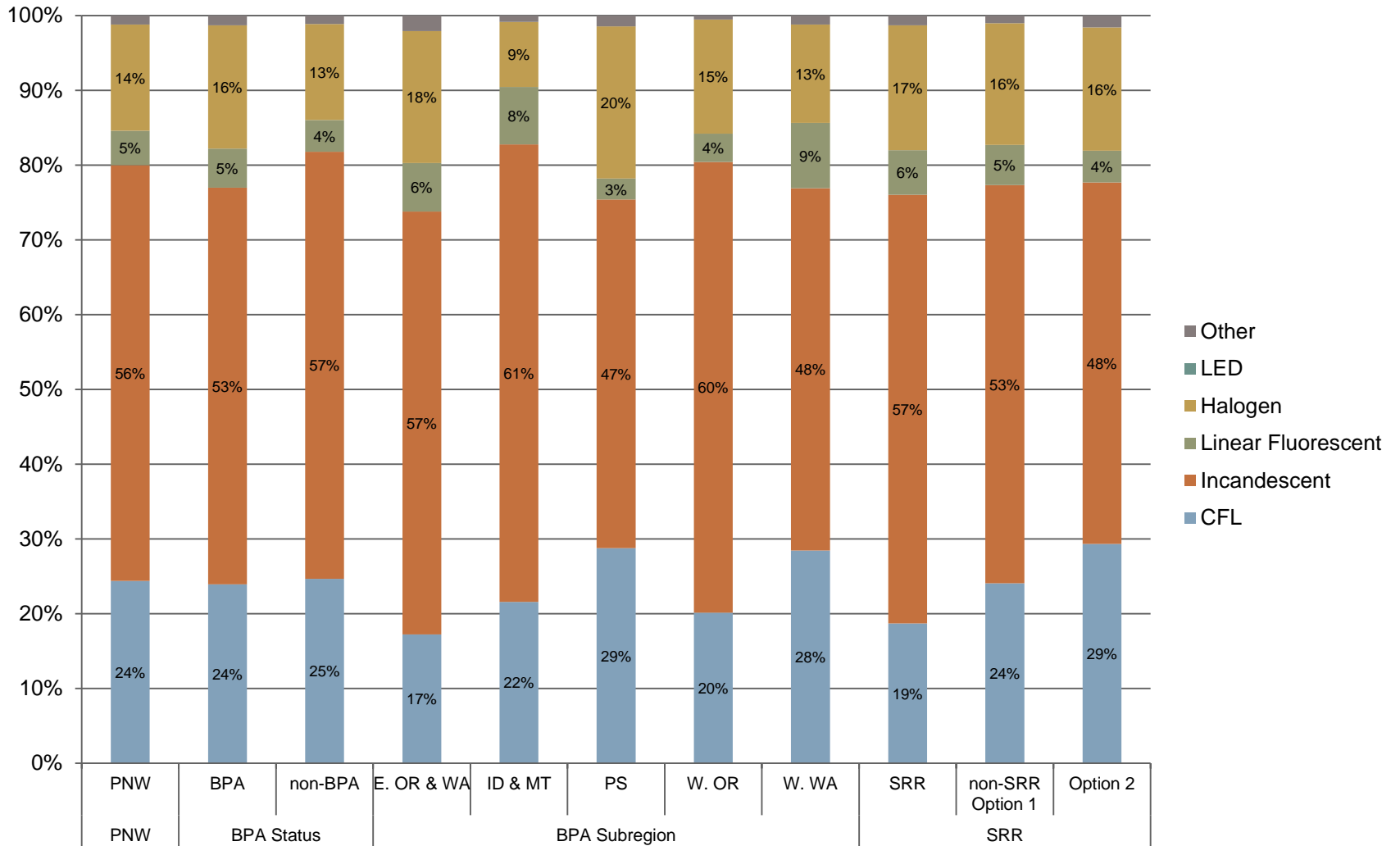
SF & MH – Lighting

Average lamp count by lamp type

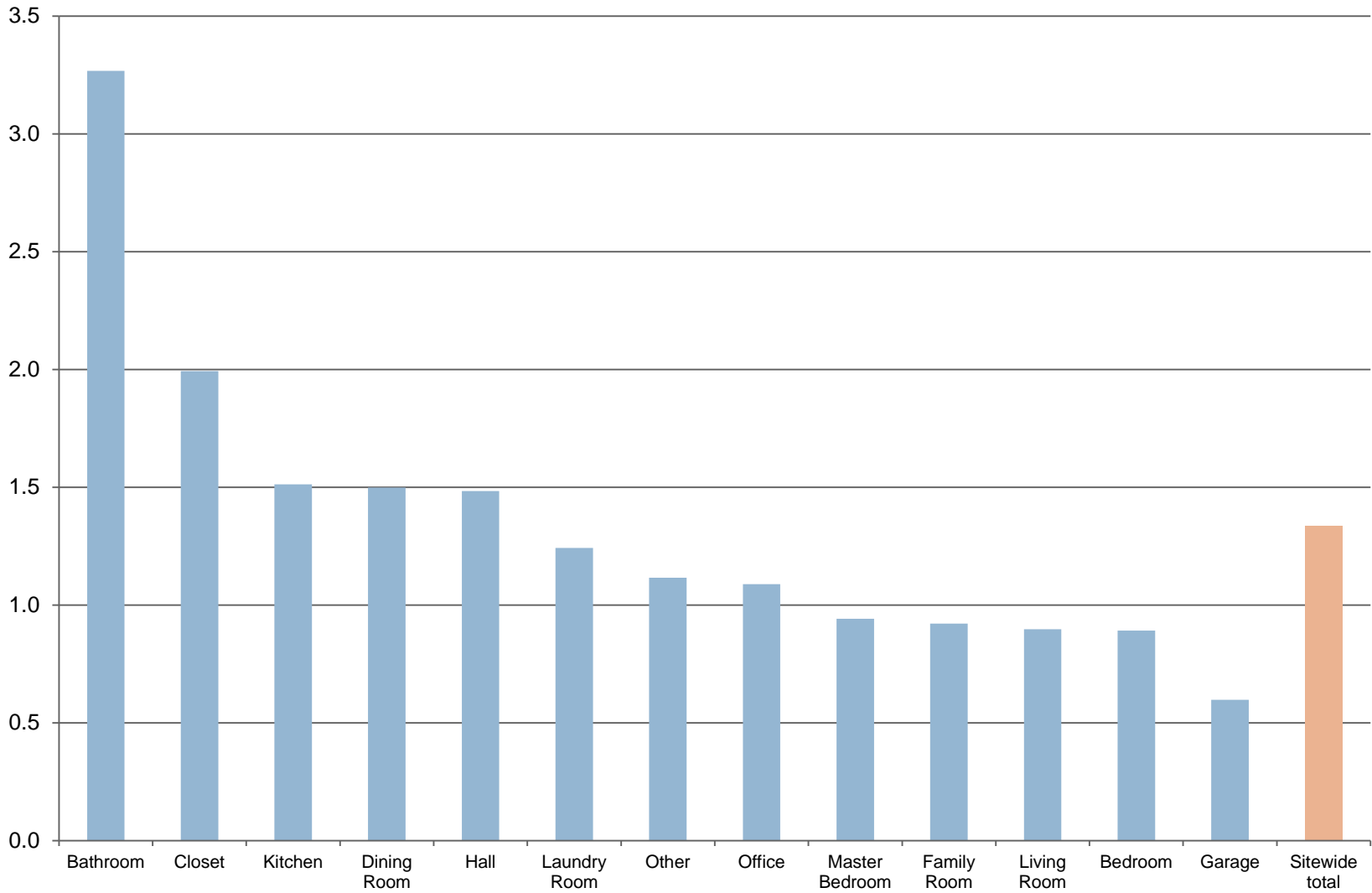


SF & MH – Lighting

Distribution of exterior lamp type



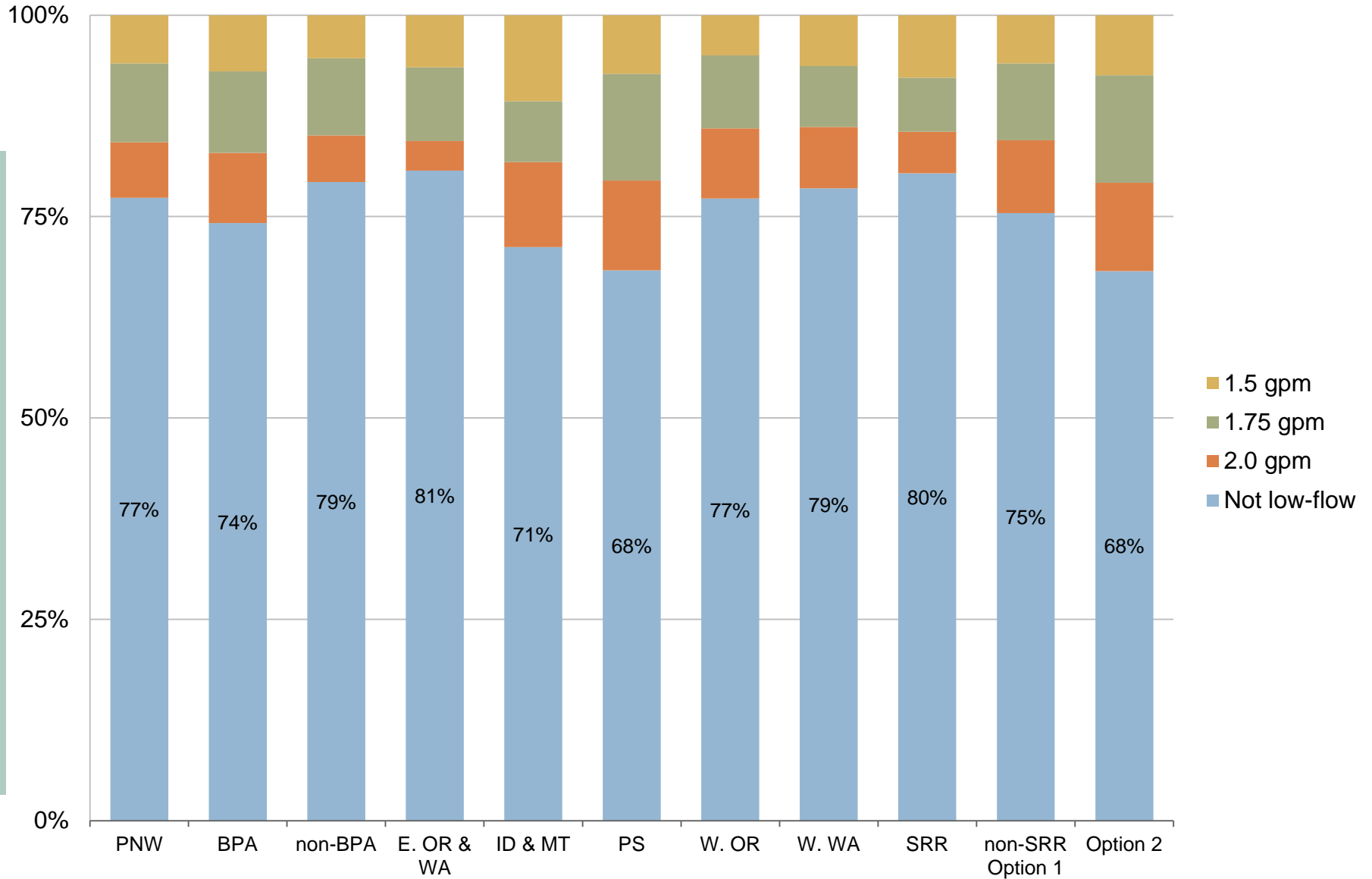
Average interior LPD by room in BPA territory



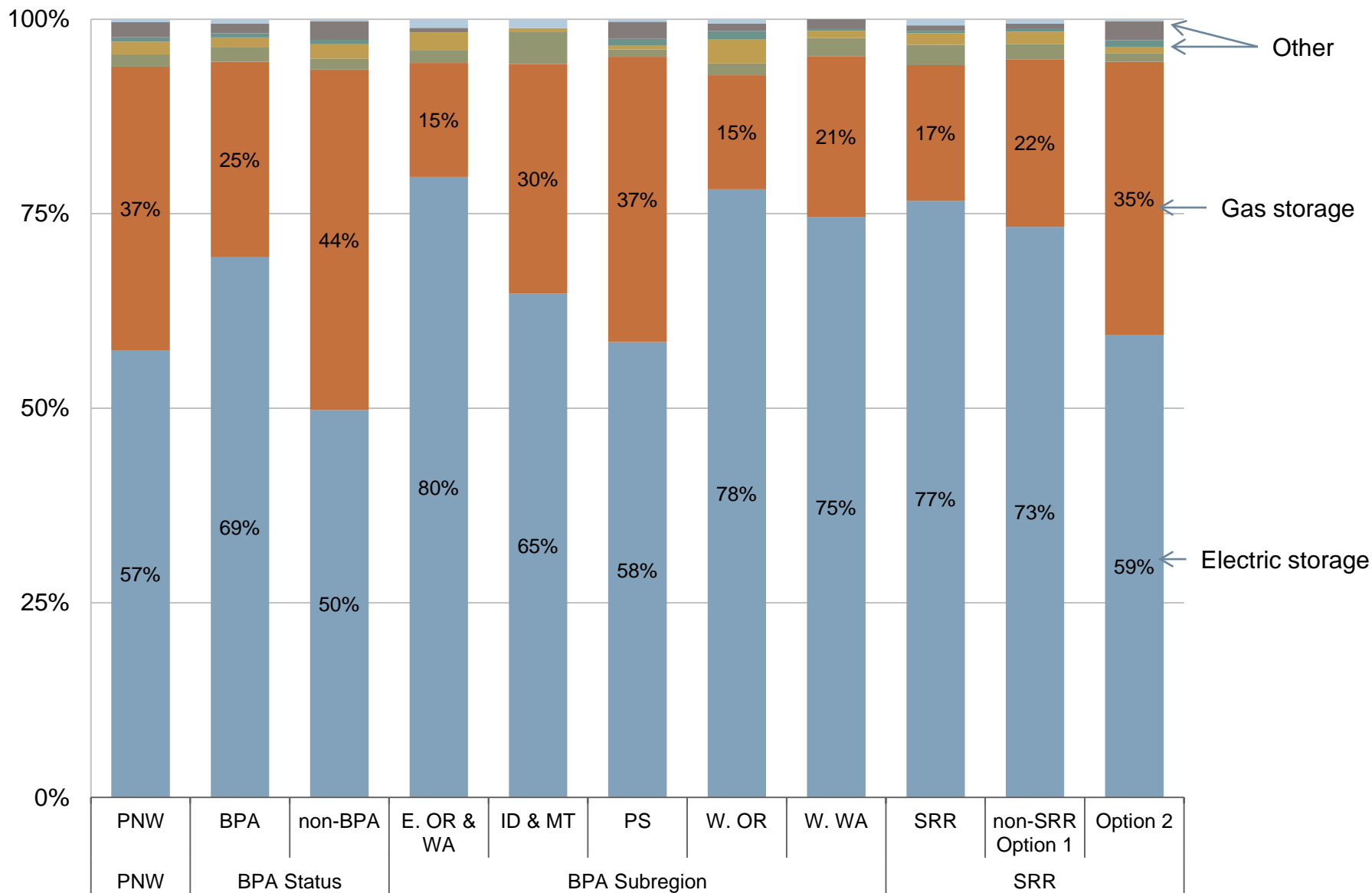
LPD (Lighting Power Density) – ratio of light output in an area and the electric power used to produce that light.

Flow rate of showerheads, %

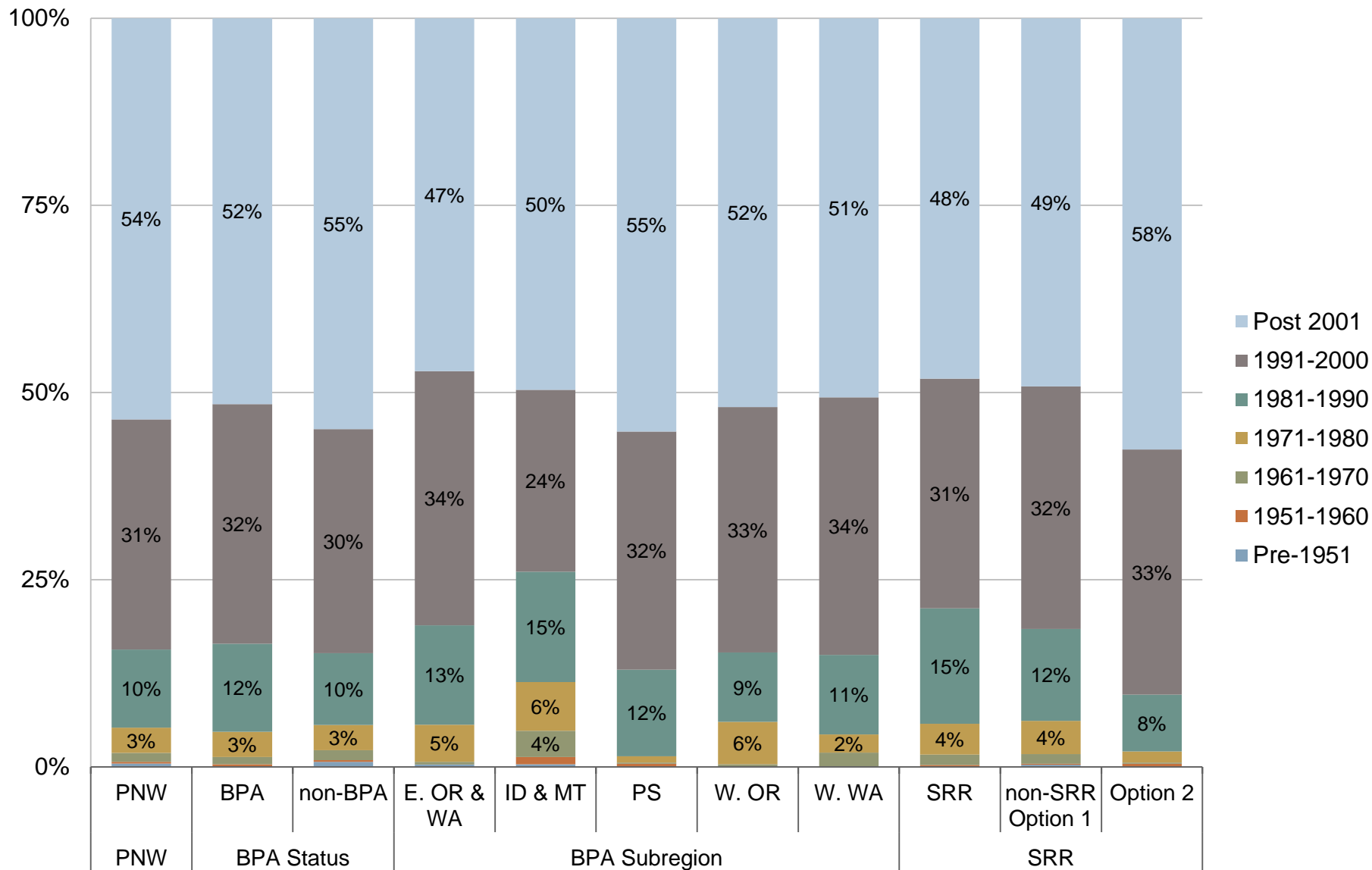
SF & MH – Showerhead



Distribution of water heater and fuel type



Distribution of refrigerator and freezer manufacture age



Program Opportunities – summary of all measures

Envelope measures

- Attic and floor insulation measures in older vintage homes and in urban regions.
- Air-tightening measures for older vintage homes.

HVAC measures

- Central heat pump and DHP conversion opportunities in E. Oregon and Washington, W. Oregon and Washington and Puget Sound.
- DHP conversion opportunities among manufactured homes.

Lighting

- 26% of region's lamps are EISA exempt, a majority of which are incandescent or halogen lamps.

Primary Program Opportunities

Water technologies

- Low-flow showerheads opportunities in W. Oregon and W. Washington.

Appliances

- Earlier retirement of aged refrigerators with priorities in rural and suburban regions.

Thank you!

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