A STEPPED BUNDLE APPROACH TO ECBC

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Ahmedabad

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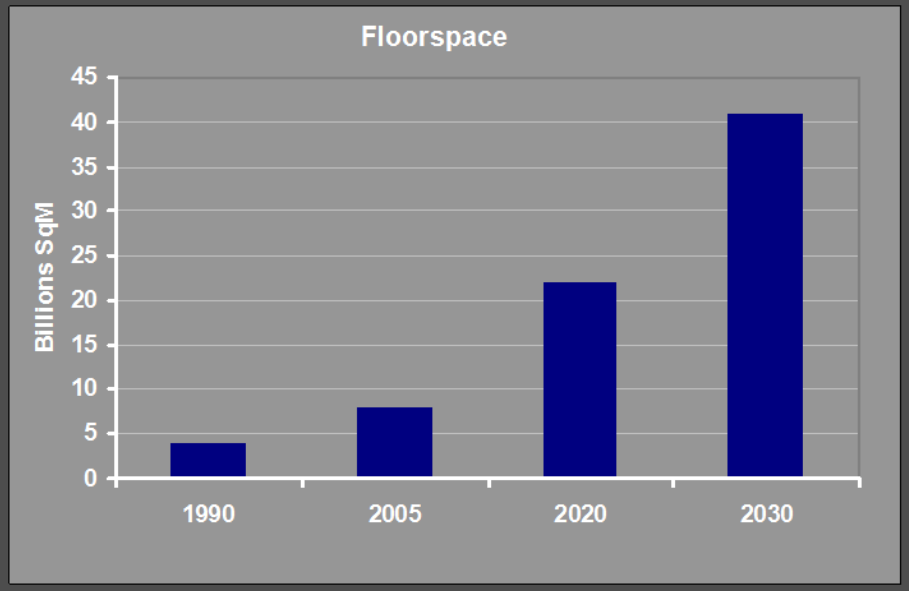
Study supported by

New Buildings Focus

70% of the floorspace for 2030 is yet to be built



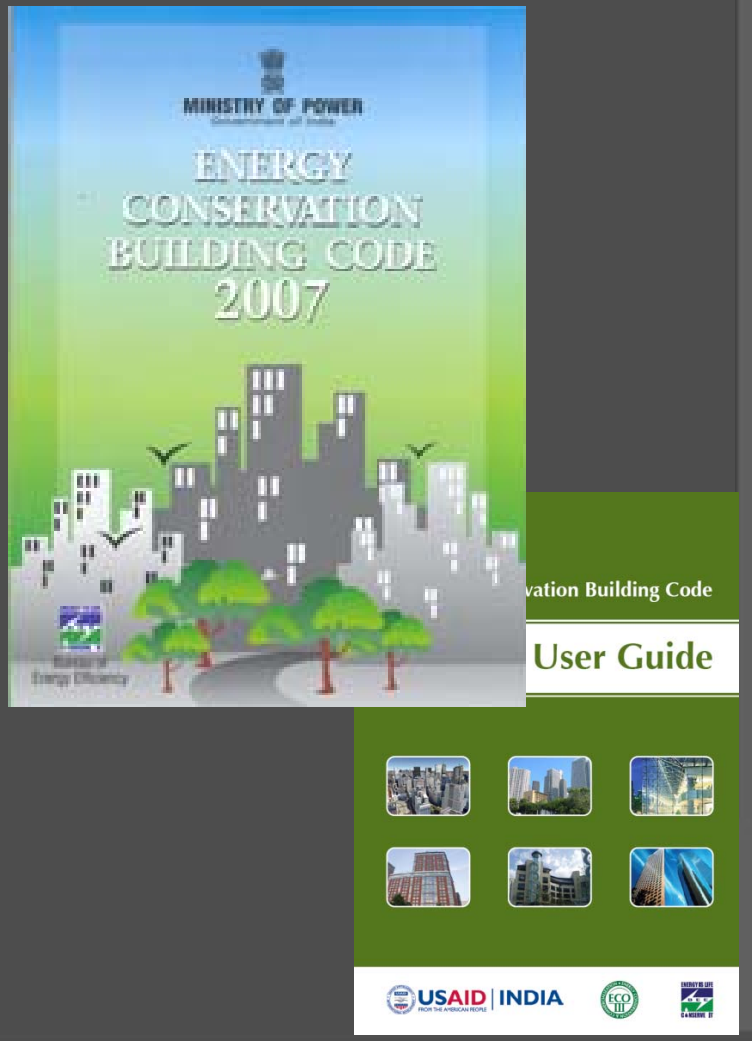
Source McKinsey 2009

LEED and GRIHA rating systems as drivers for energy efficiency?

- GRIHA and LEED rating systems while excellent tools for creating green buildings are cannot drive energy efficiency at a large scale because they are directed towards the leaders in the design and construction market.
  - Therefore, they will leave out the rest of the construction market
- These rating systems are intended to be voluntary mechanisms and cannot be used as mandatory building codes.
- Compliance with ECBC for energy efficiency is just a subset of all the requirements in the rating systems.

Energy Conservation Building Code (ECBC)

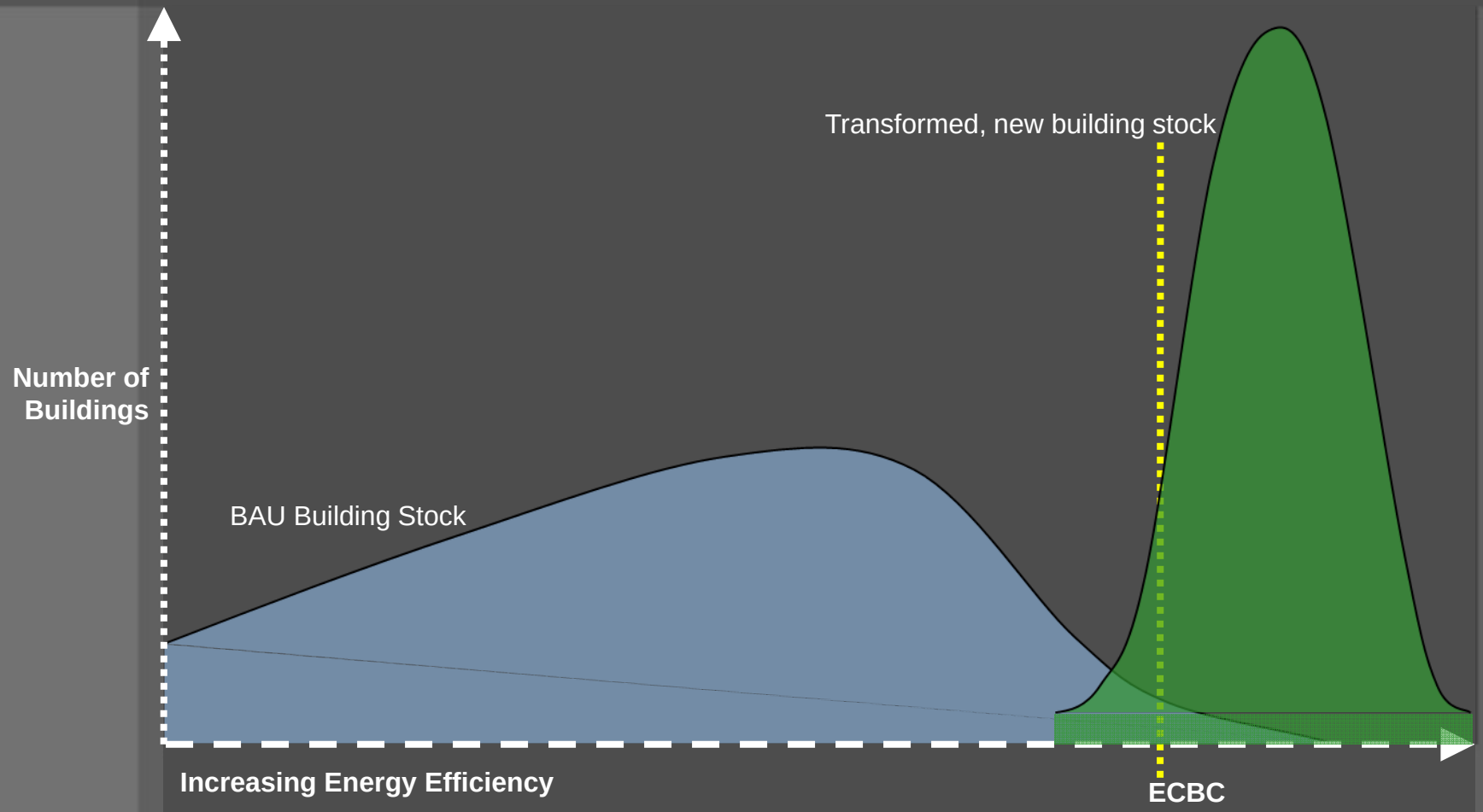
- Developed by Bureau of Energy Efficiency (BEE)
- Provides minimum requirements for energy-efficient design and construction of buildings
- Applicable to new buildings with a connected load of greater than 100 KW
- Prescriptive and Performance compliance paths



Challenges to ECBC Compliance

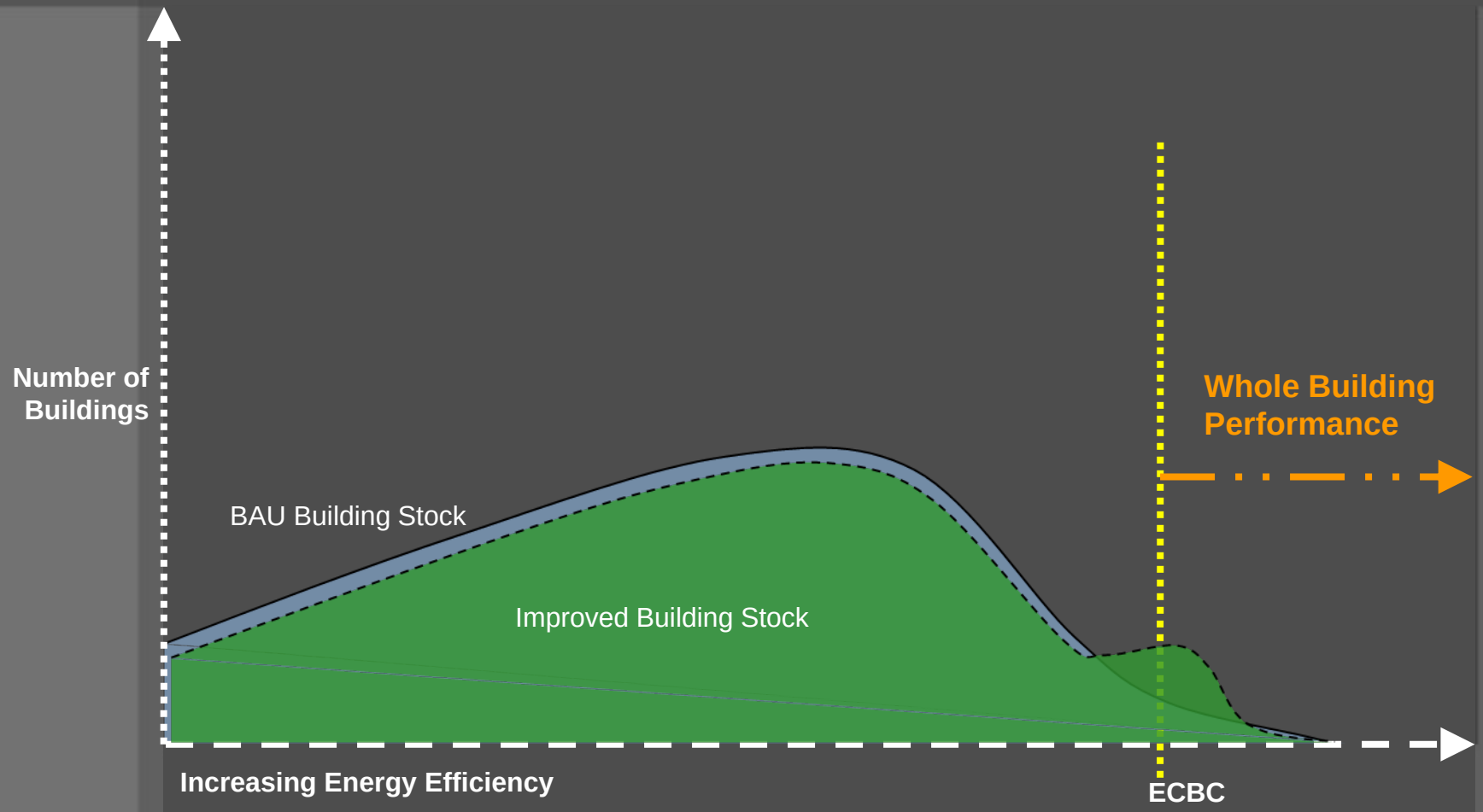
- Adoption
  - State by state adoption after mandatory requirement
- Implementation
  - Lack of expertise amongst architects, engineers and contractors
  - Lack of availability of equipment with prescribed efficiency levels
  - Lack of third party objective testing facilities that measure product efficiency with standard test procedures.
- Enforcement
  - Enforcement at urban local bodies
  - Lack of expertise and human resources
  - Occupancy approval does not include all building systems

Transform the market with ECBC
Ideal market penetration – very high compliance rates



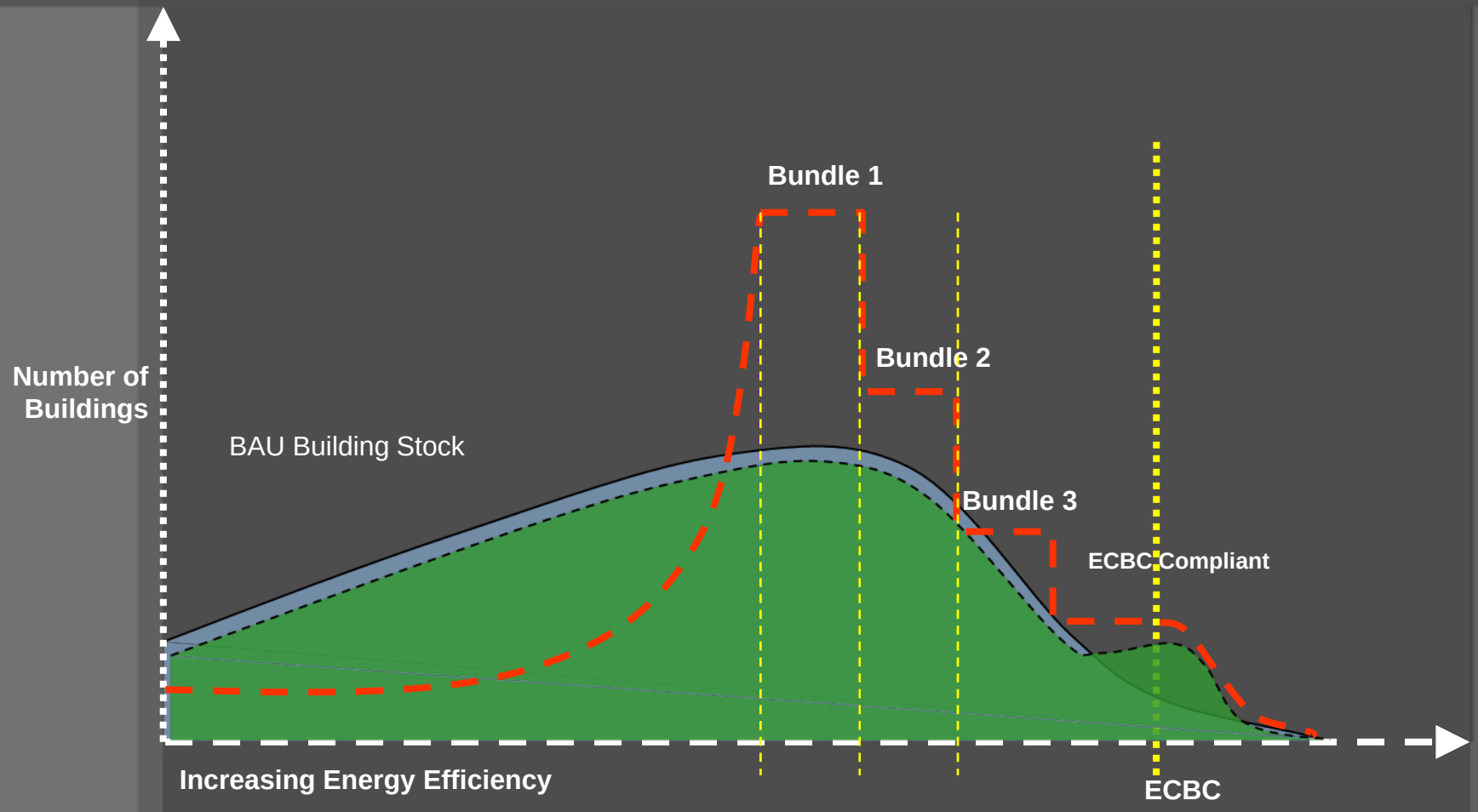
Transform the market with ECBC

Small market penetration – lower compliance rates



Transform the market – Bundled Approach

More market penetration – better compliance rates

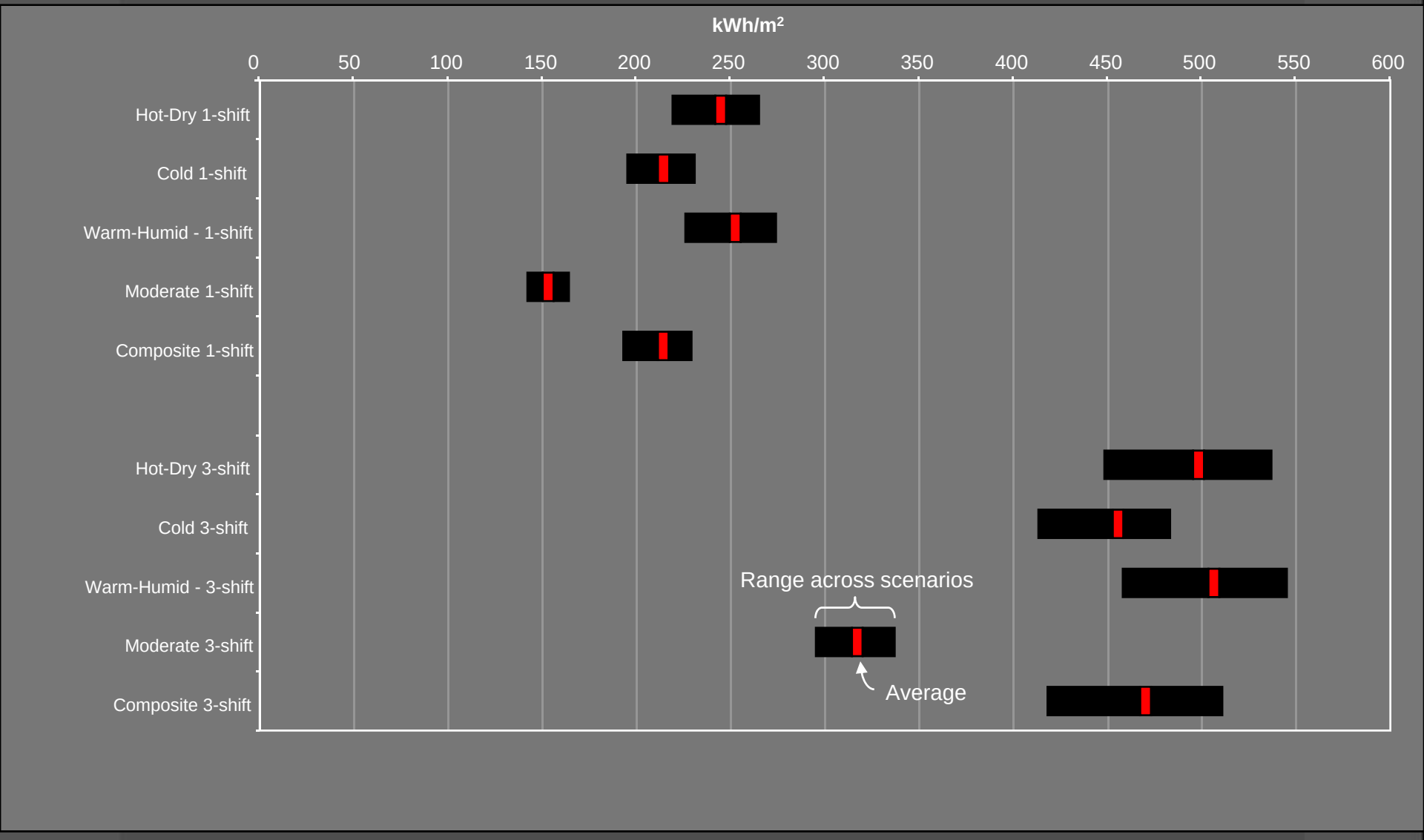


Bundles of ECBC Requirements

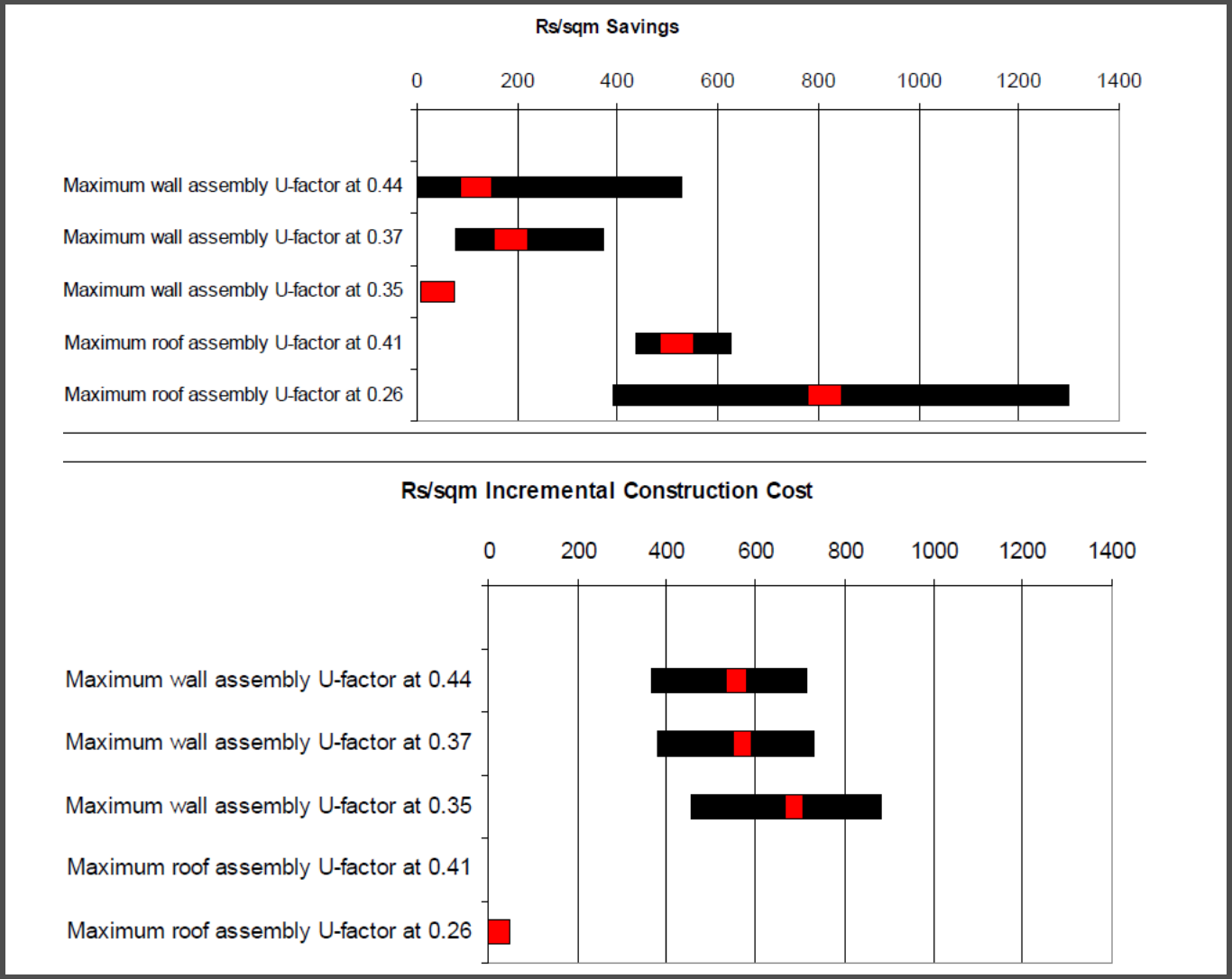
Bundles Based on Analysis of ECBC Measures

- Small Office Buildings
  - 500 m^2, 1000 m^2, 2500m^2
- 5 Climate zones
  - Hot-Dry, Cold, Warm-Humid, Moderate, Composite
- 2 operational scenarios
  - 1-shift, 3-shift
- 3 building shapes
  - Square, Rectangle 2:1, Rectangle 1:2
- Total of 90 building scenarios
  - BAU case modeled
  - ECBC measures modeled
- 5,264 Simulation runs
- Incremental Cost Estimates
  - For each ECBC measure
  - Payback analysis for each ECBC measure
- Implementability and Enforceability Analysis
  - For each ECBC measure

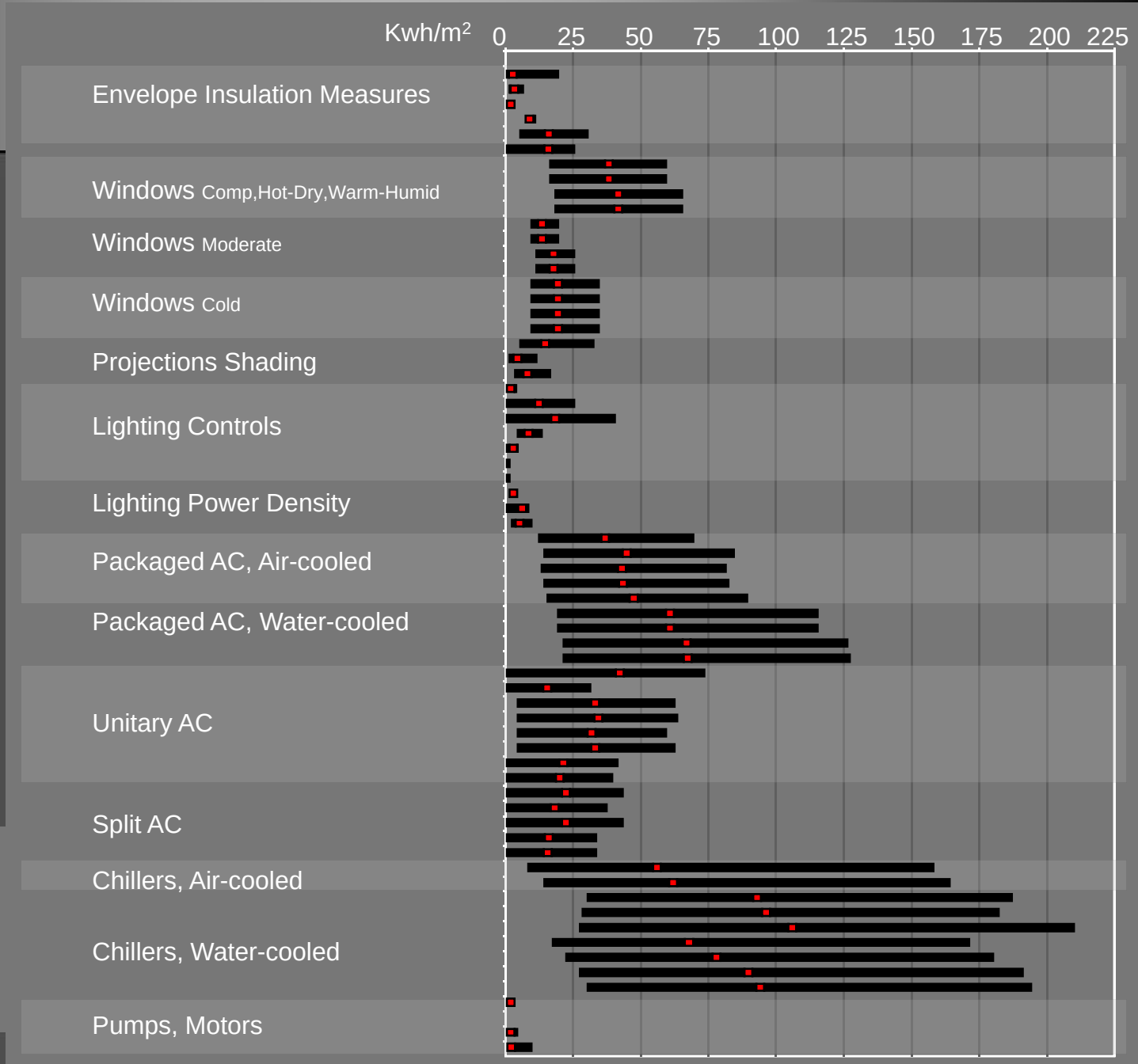
Summary of EPI Results by Climate
1-shift use (8 hrs) and 3-shift use (24 hrs)



Cost Benefit Analysis

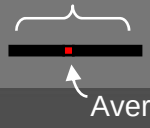


Savings Summary

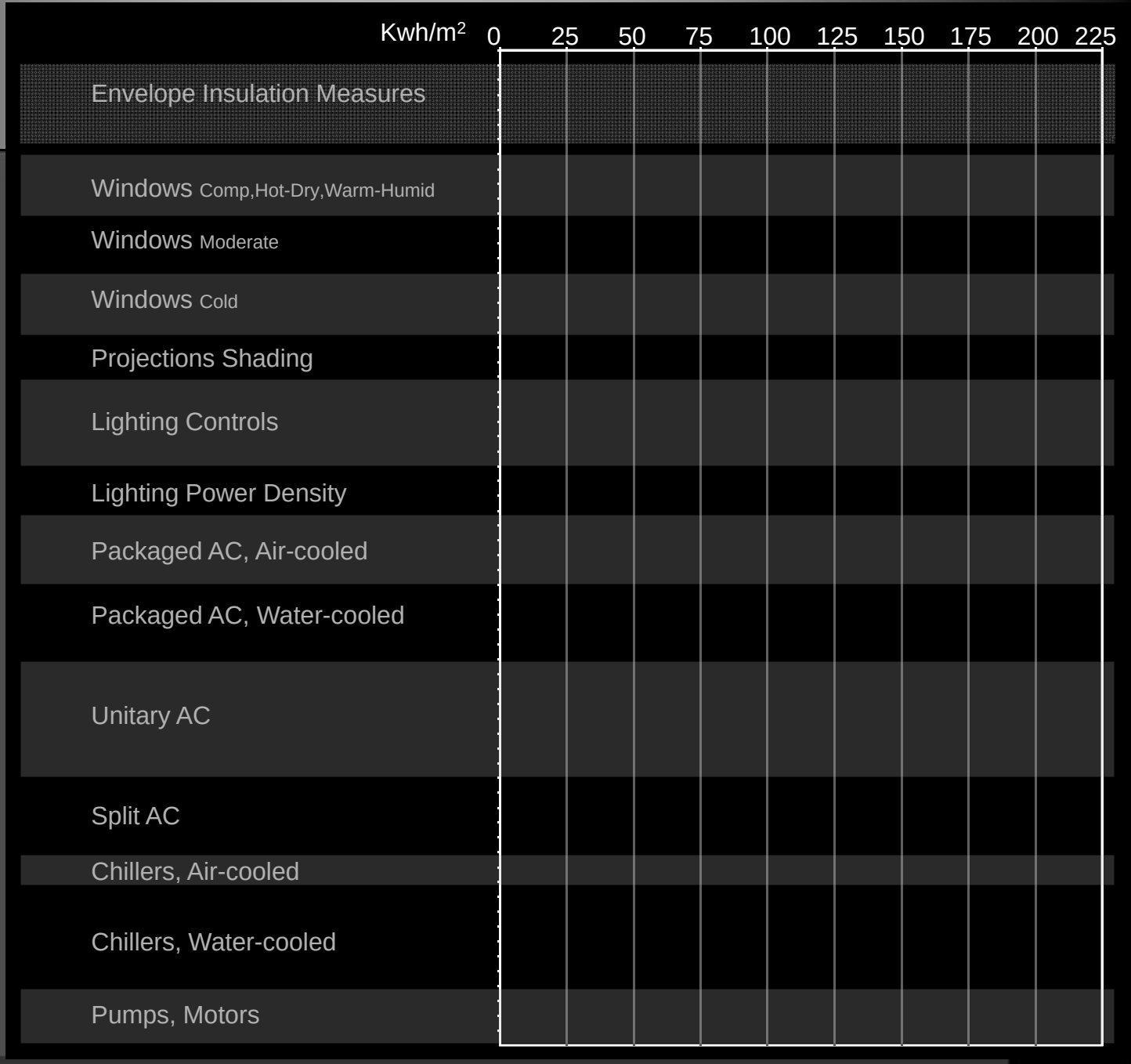


Savings compared to BAU

Range across scenarios



Savings Patterns



Hot-Dry

Cold

Warm-Humid

Temperate

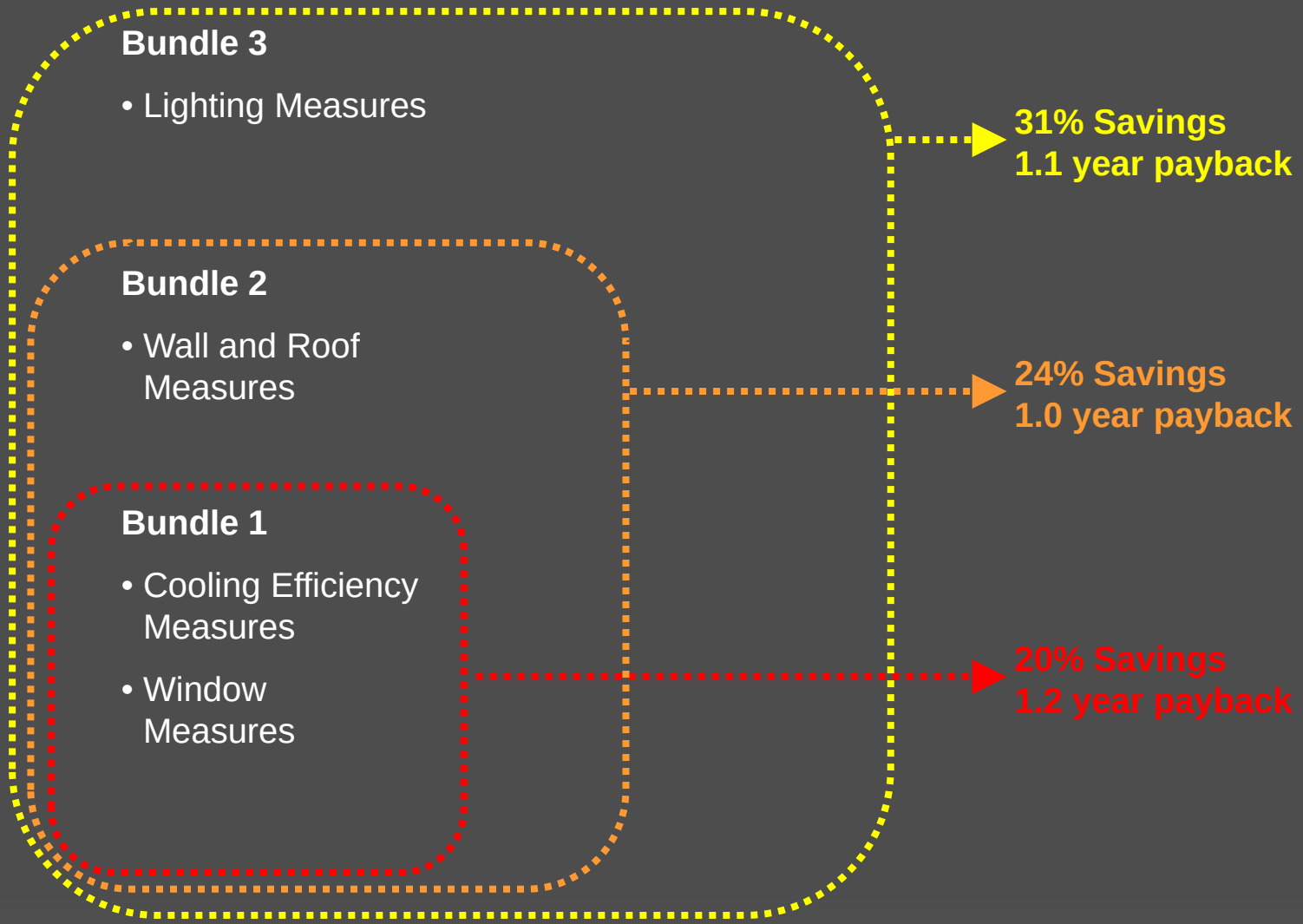
Composite

Stepped Bundles with 2 approaches

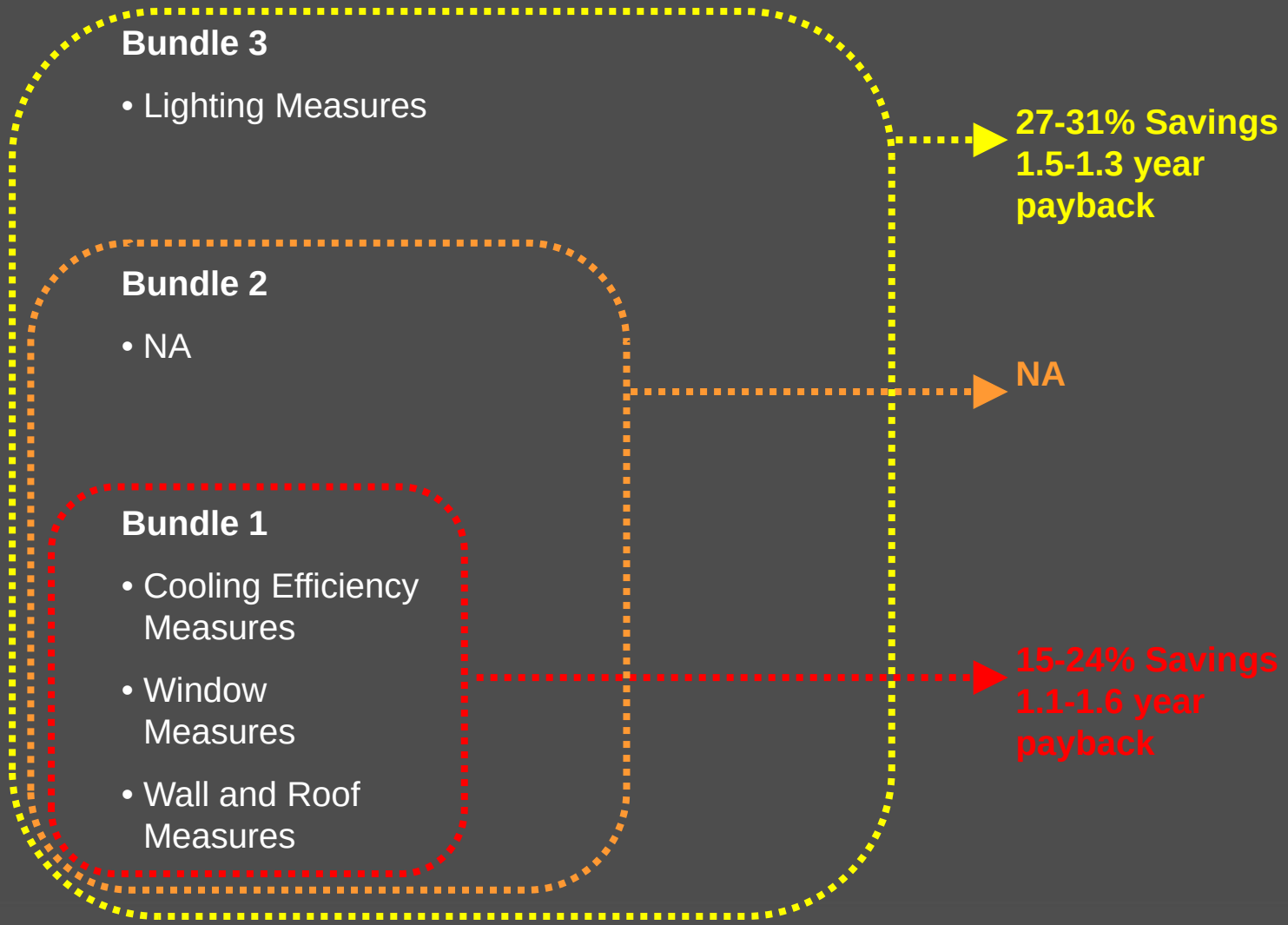
- Approach 1
  - The most promising measures for each climate zone in terms of energy savings are included in the first Bundle.
  - Thus, ECMs with high energy savings are in Bundle 1, followed by moderate energy savings in Bundle 2 and those with lower energy savings in Bundle 3.
  - This rational ensures that high energy savings are realized even when the first step- Stepped Bundle 1 is implemented.

ECBC Bundles – Best Energy Performance Approach

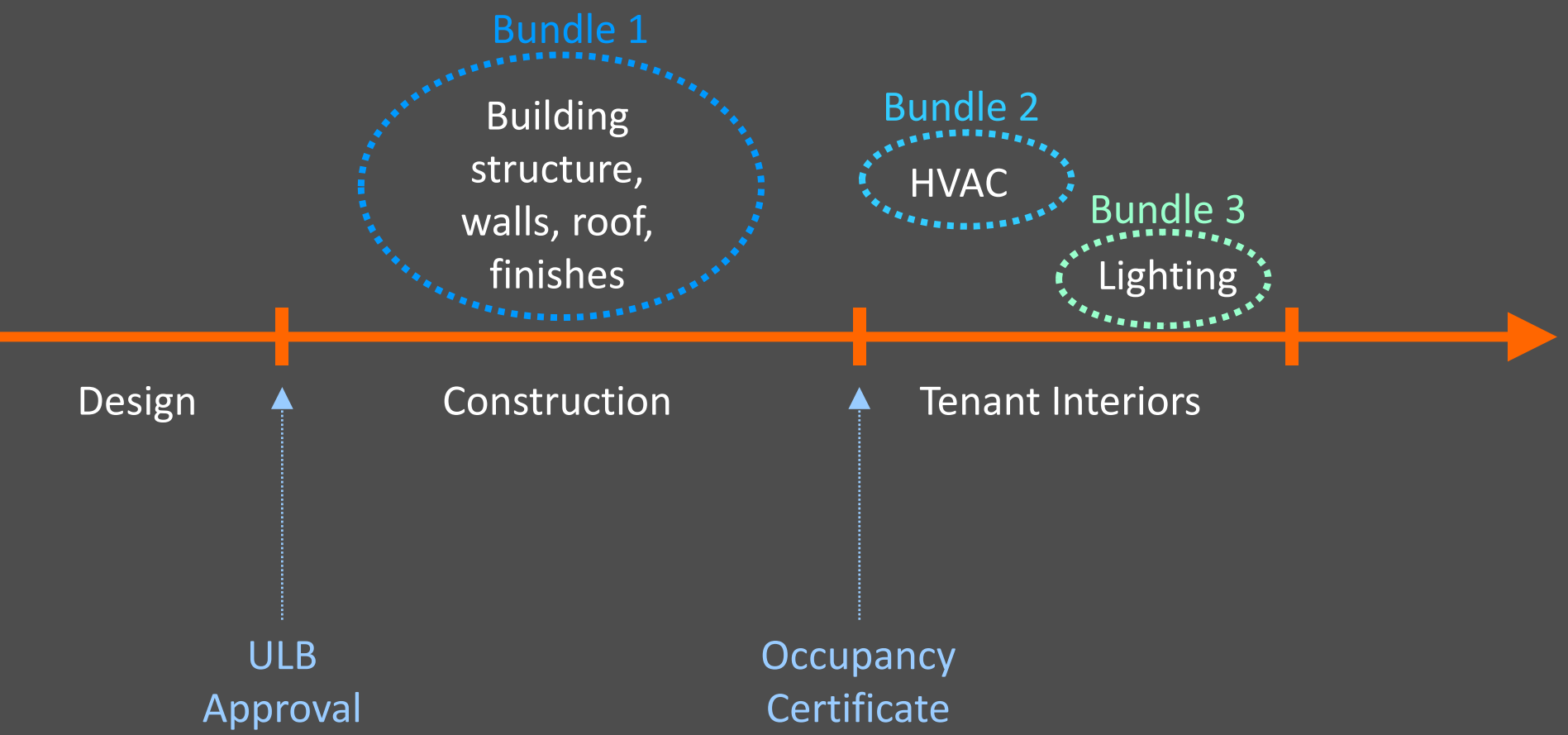
Hot-Dry and Warm-Humid Climates



ECBC Bundles – Best Energy Performance Approach
Cold, Moderate and Composite Climates



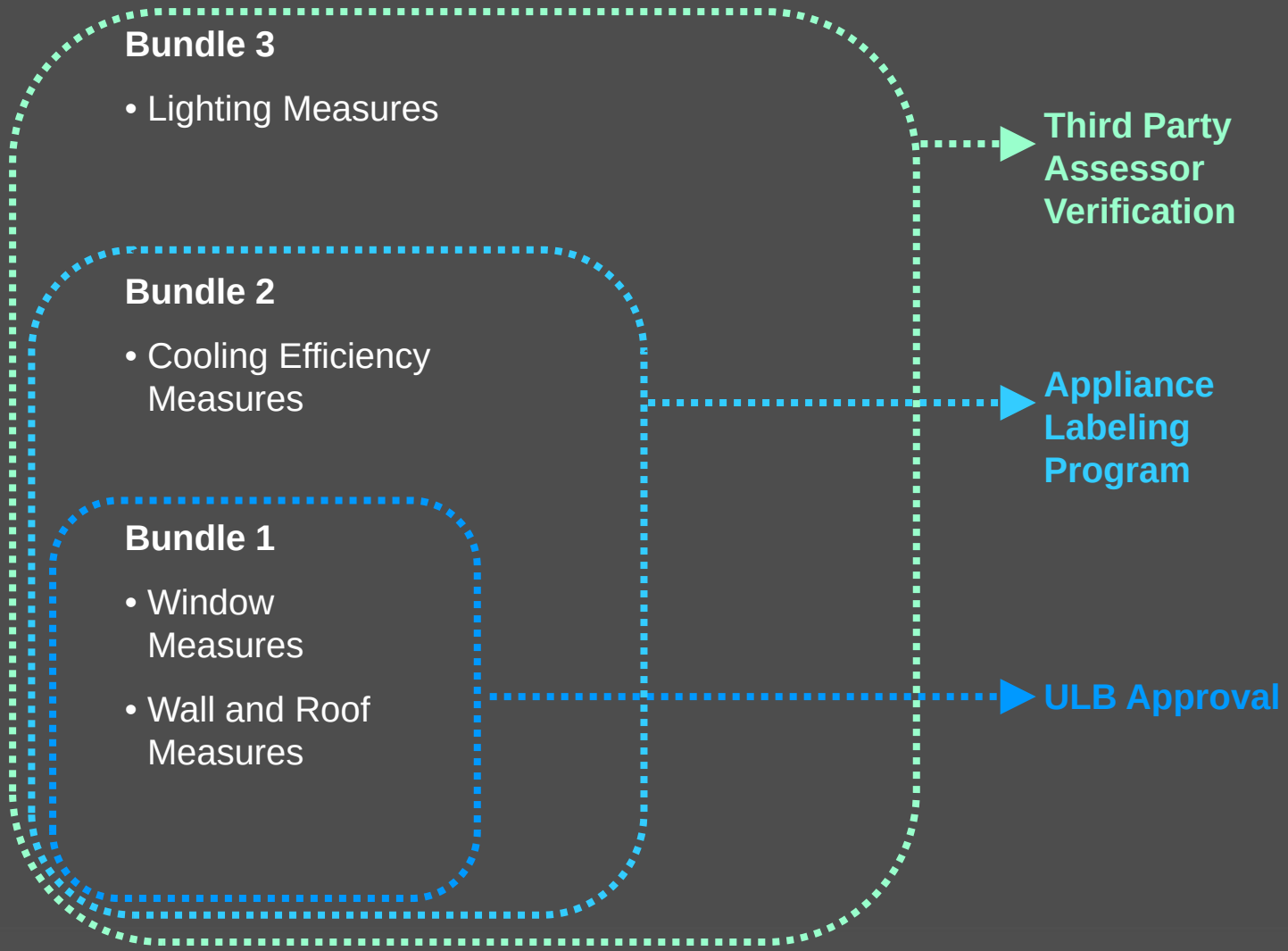
Building Construction and Permitting Process
For majority developer projects



Stepped Bundles with 2 approaches

- Approach 2
  - Bundles area arranged with ECBC requirements that align with the current building permitting process
  - Bundle 1 contains measures that can be checked when the building shell is completed and ready for approval given the current construction approval process of most ULBs.
  - Bundle 2 contains measures that could be implemented by the developer/owner with labeling programs as the mode of enforcement.
  - Bundle 3 contains measures that are difficult to enforce with labeling programs or with the current ULB approval process, and may require an independent Third Party Agency to do the compliance check, or may require a change in the way ULBs currently provide building completion approvals.
  - This approach ensures smoother implementation and enforcement.

ECBC Bundles – Easy Enforcement Approach



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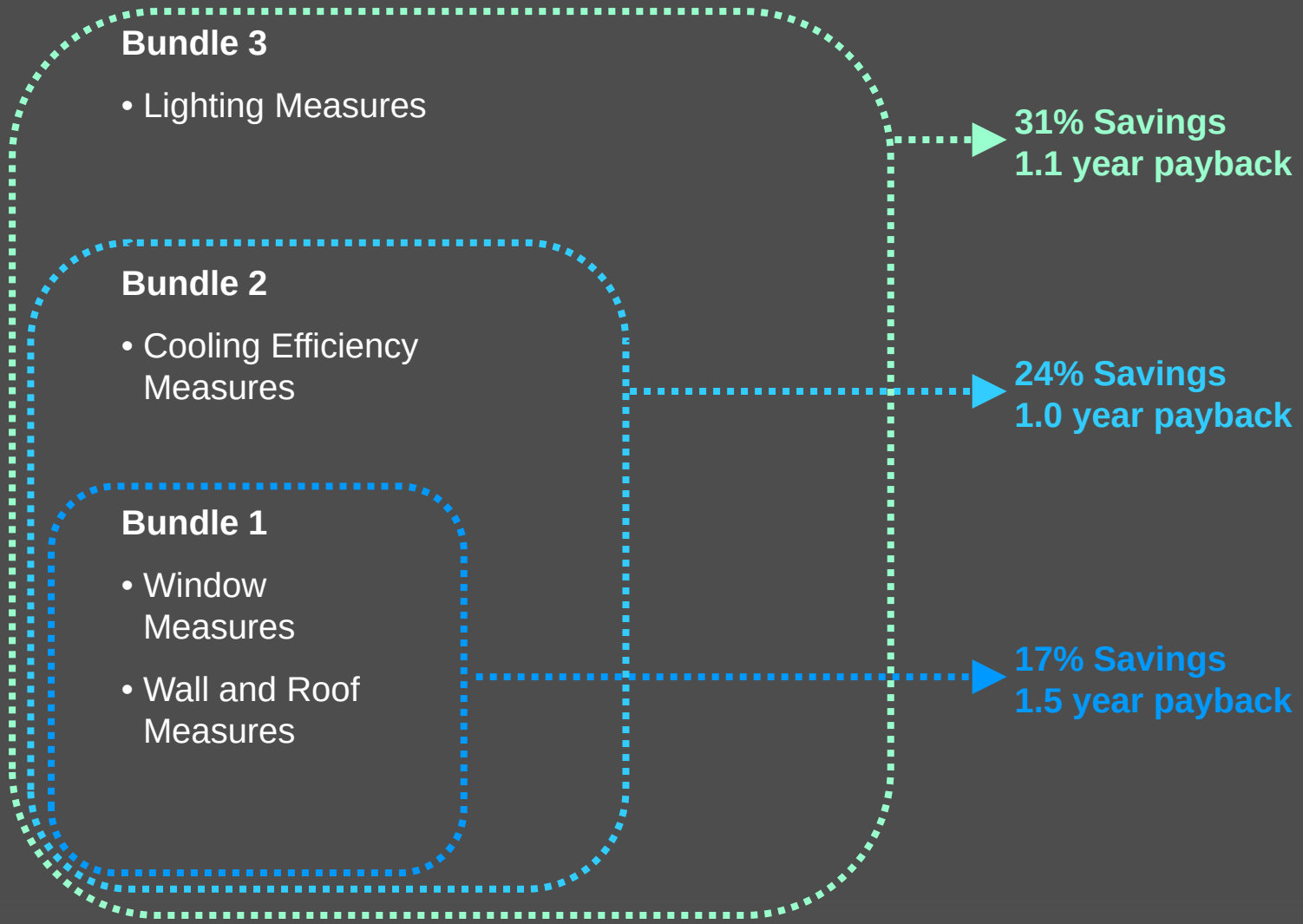

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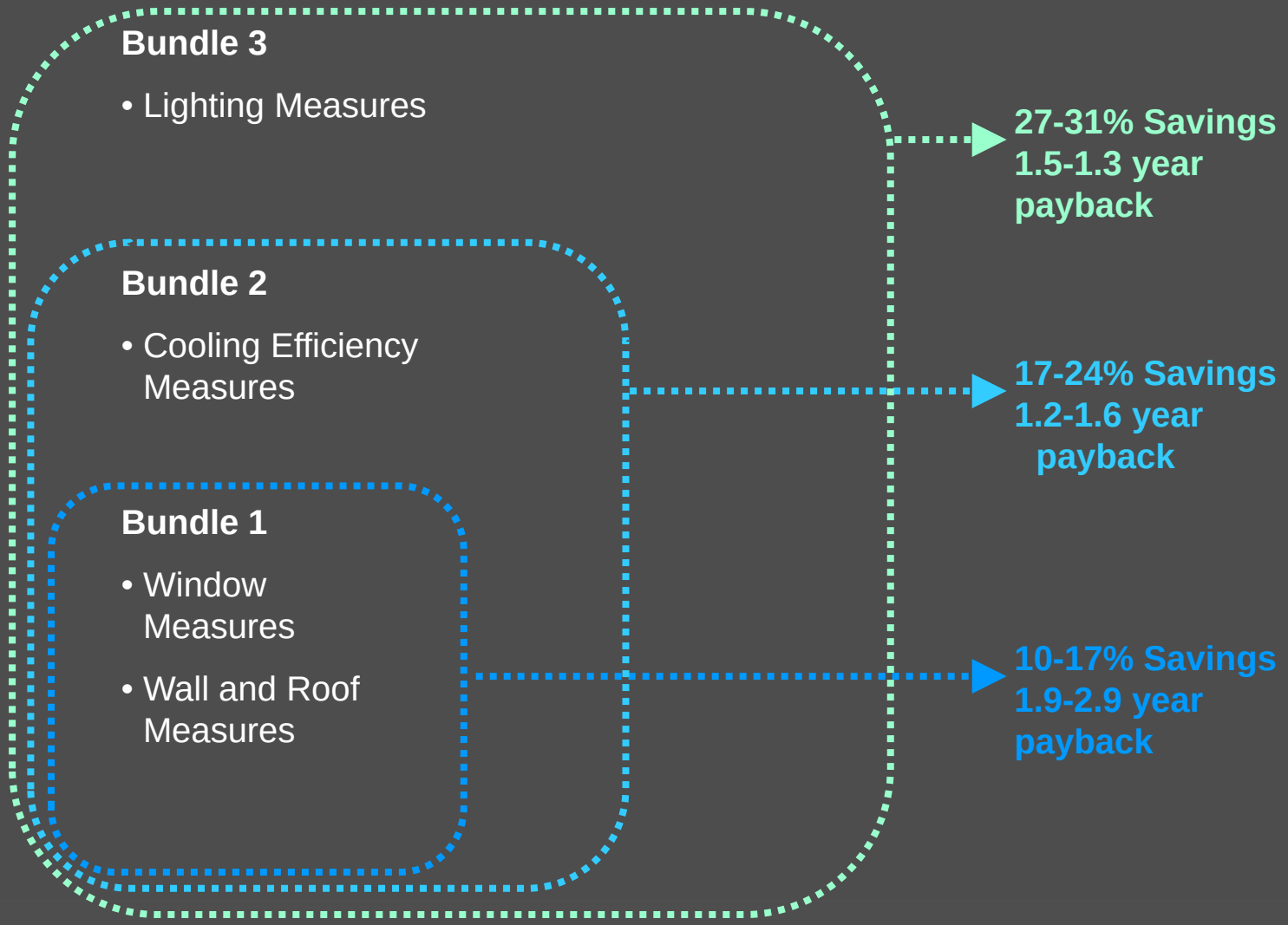

ECBC Bundles – Easy Enforcement Approach

- Bundle 1
  - 10-17% energy savings
  - Installed for the life of a building
  - More than 2,400 kWh saved per sqm over 50 years
  - More than Rs. 1,38,728 saved per sqm over 50 years
- Bundle 2
  - Adds HVAC equipment requirements to Bundle 1, this equipment has a 10-15 year life
- Bundle 3
  - Adds Lighting equipment requirements to Bundle 2, this equipment has a 5-10 year life.

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