Energy Efficiency Labels for Residential Buildings

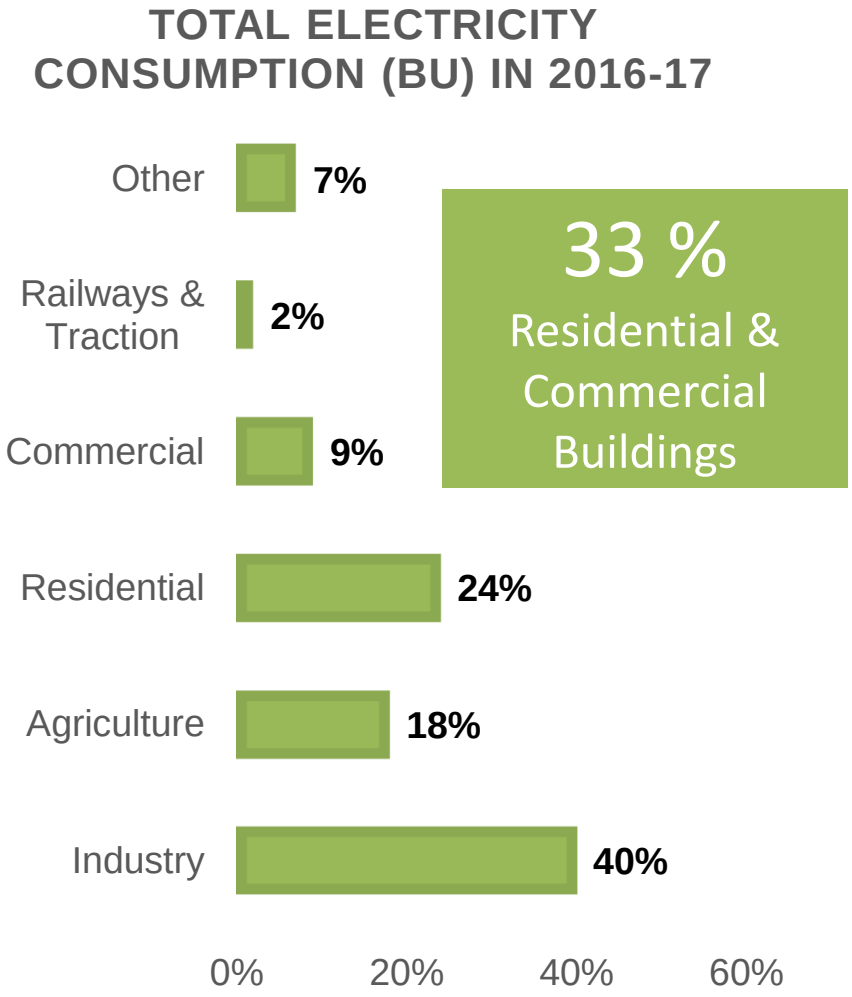
Technical Committee Meeting
20th September 2018

Overview of Electricity Scenario and Building Sector in India

1

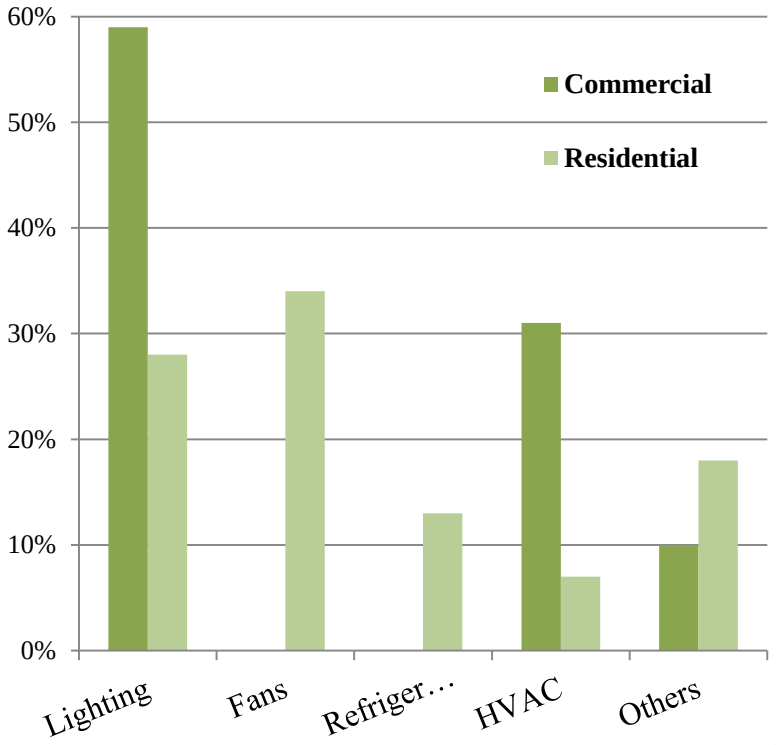
India's Electricity Scenario

Electricity Consumption in 2016-17=1066 BU



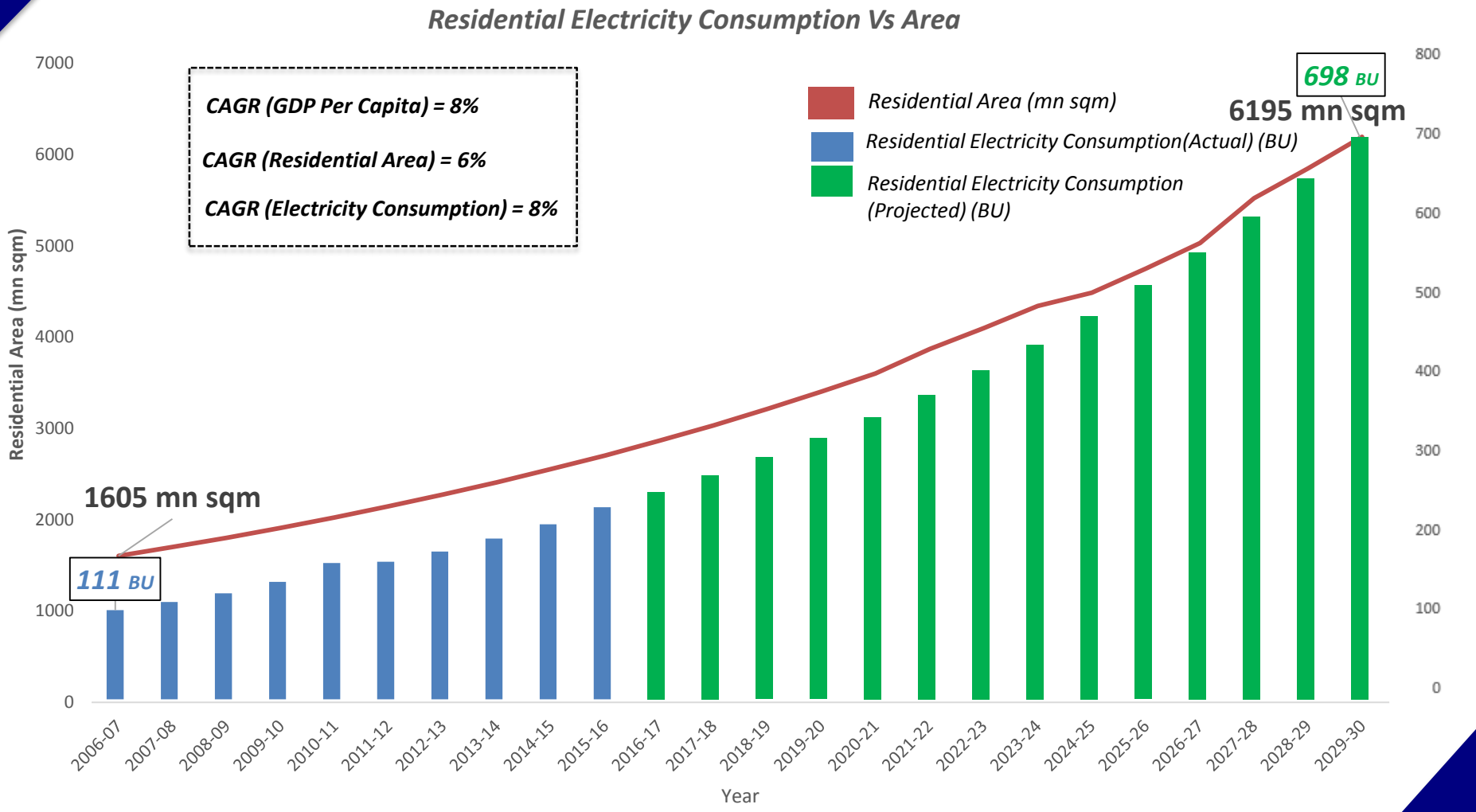
33 %
Residential & Commercial Buildings

Electricity Consumption Pattern



Source: Energy Statistics 2018

Building Sector- Built up area and electricity consumption projection

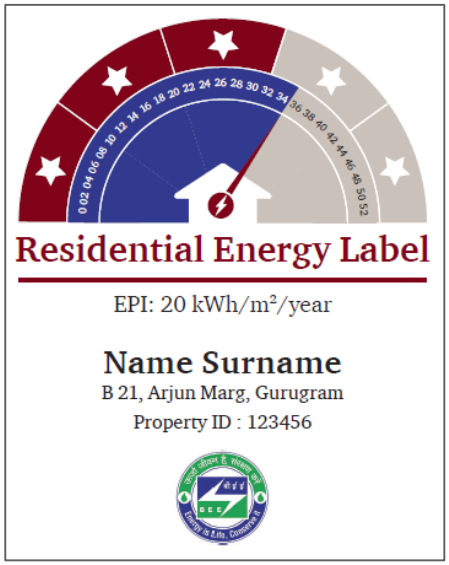


India will add
3 Billion m2 by 2030 of New residential building w.r.t Year 2018

Objective of Labelling Program

2

Objective of labelling Program-Passport



- To provide information to consumers for EE Homes
- Energy Sustainability for India
- To achieve Indian NDC Targets
- Market Transformation for Energy Efficiency in each Home

Features of labelling Program

- Choice for Consumers to select EE Homes
- Encourages consumers to improve EE
- Peer to Peer Comparison
- Provide information on the potential and actual energy use of buildings

Potential Savings from Labelling Program

3

Potential of Energy Savings in New residential buildings

Summary of energy savings considering 2018-19 as base year		
Year	**Savings (MU)**	**CO2 million tonnes**
2019-20	408.9	0.3
2020-21	1469.3	1.2
2021-22	3517.5	2.9
2022-23	6699.9	5.5
2023-24	11398.8	9.3
2024-25	20122.5	16.5
2025-26	30788.5	25.2
2026-27	37058.8	30.4
2027-28	44957.1	36.9
2028-29	55200.1	45.3
2029-30	66725.8	54.7
TOTAL	**278347**	**228**

The energy saving potential through proposed labelling program is around 278 BU per year

Key Activities

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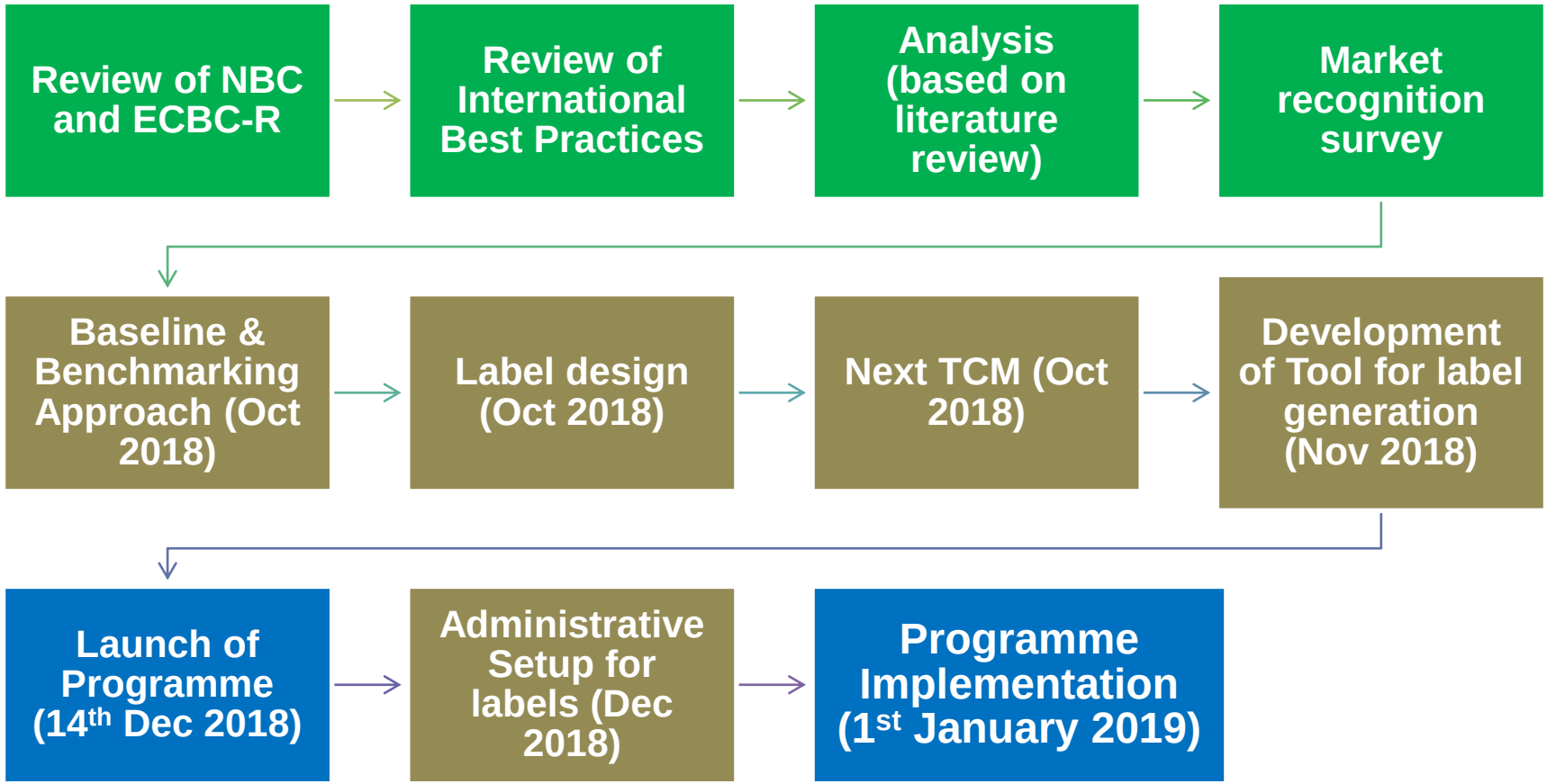
Key Activities



Project Activities Completed

Work in Progress

Components of Label

01

Scope

- Types of home
- Area of home
- Phases to be covered (Design, construction, post construction)
- Climate zones

02

Various aspects of Label

- Agency responsible for compliance
- Tool for Calculation
- Validity
- Renewal
- Labeling fee
- Inclusion of Common services in label for a home
- Impact developer faces if there is any deviation
- Compliance and enforcement

International analysis w.r.t framework of labelling program

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Countries Selected for the analysis

S.No.	Country	Climate Zone as per Indian Classification
1	Germany (Berlin)	Cold
2	Australia (Melbourne)	Cold
3	Singapore	Warm and Humid
4	Hong Kong	Warm and Humid
5	Japan	Cold
6	China (Beijing)	Moderate
	China (Shanghai)	Warm and Humid
7	UK	Cold
8	France	Cold
9	Brazil	Warm and Humid
10	Canada	Cold
11	USA (NY)	Cold
	USA (Miami)	Moderate
	USA (Arizona)	Hot and Dry
	USA (Salt Lake)	Composite
12	Mexico (La Paz)	Warm and Humid
	Mexico (Mexico City)	Cold
13	Dubai	Warm and Humid

Countries selected for the study of International Best Practices

Detailed International Analysis

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Scope of Label	• Initially launched for new homes but within a span a of 2-3 year covered existing homes
Single dwelling/multiple dwelling unit	• Imagine a residential building of 10 floors with 3 apartments of identical size per floor, then it might require as few as 3 floor (Ground, Intermediate and Top) typologies x 3 units per floor = just 9 EPCs to represent the 30 apartments.
Stakeholder responsible for seeking the Label	• New Homes: Developer shall be responsible for getting the label for house • New Homes: For a new single independent house, the person owning the house shall be responsible • Existing Home: Developer or owner

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Energy Systems assessed	• Major focus given on Design, Envelope, HVAC system, & Lighting system

Agency responsible for providing Label	• For large geographical countries, ***regional state authority*** provides the label due to differing:
	  • energy performance
	  • Ease of label compliance and enforcement

Tool for label calculation	• All the European countries have developed their own simplified tool (no simulation is required) for calculation of label. • Standard inputs related to house characteristics needs to be entered to get an estimated rating of the house.

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Label parameter	• Generally kWh/sqm/yr is used as the parameter • In Australia, China and Mexico Connected load density (W/m2) has been used as the parameters
Label validity	• Generally 10 years • It can be less than 10 years if the house is extended or significant energy characteristics are altered and the house is placed on the market again before label expiration

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Label renewal if the property ownership changes/ is rented	No
Label renewal after expiry	• **Register with database of EPC homes** is maintained at state level in Europe and this database helps in identifying homes where label is about to expire • If "**major renovation**" has happened during label tenure, than it may be necessary for a new label to be pursued by the person responsible • Legally under the EU EPBD, it only needs to be renewed if and when the property is to be placed on the market again

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Label Cost	• Cost of a typical home – Euro 300,000 • Transaction cost (legal fees, property registration search fees, stamp duty) – Euro 5000 • Label cost (to certified professional) – Euro 200 ***(0.07% of home cost including VAT)*** • Label cost to designated agency – Nil
Inclusion of Common services	• For EPBD, common services are not included in the code. • In **some countries** with apartments buildings, the energy use in **corridors and stairwells and other common services** can be included and apportioned between the apartment units. There is not any consistent approach across Europe • Impact of chilled water from district cooling on the label

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Impact developer faces if there is any deviation in rating from design to actually constructed building.	• **No legal implication** • It would require detailed analysis to account for differences between the design/ calculated/ asset rating and the performance in use as reflected in a operational/ measured rating. • There are researchers and other experts in Europe who advocate that responsibility for performance should extend to the first 2-3 years of occupation of the building (year 1 is often unreliable) but this has not been codified to date. Sweden does allow performance in use as an option within its building energy code, but seems to be the only such example in Europe

International Best Practices: A Brief Snapshot

Parameter	• Highlights of International Best Practices
Compliance process	• **Design stage** The design done with the help of certified professional is checked by building control authority • **Construction stage** Compliance check (for the energy code as well as EPCs) at construction stage is a big challenge in Europe. But assignment of a clear chain of legal responsibilities to different parties can provide a robust compliance environment • **Post construction stage** The bill of relevant materials for the building would be thoroughly checked and analyzed to ensure compliance with the labelling requirement

International Best Practices: A Brief Snapshot

Label of European Union

Energy Performance Certificate

SAP

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type: Detached house
Date of assessment: 02 February 2007
Date of certificate: [dd mmmm yyyy]
Reference number: 0000-0000-0000-0000-0000
Total floor area: 166 m²

This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92-100) A		
(81-91) B		
(69-80) C		73
(55-68) D		
(39-54) E	37	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating

	Current	Potential
Very environmentally friendly - lower CO_2 emissions		
(92-100) A		
(81-91) B		
(69-80) C		69
(55-68) D		
(39-54) E	31	
(21-38) F		
(1-20) G		
Not environmentally friendly - higher CO_2 emissions		
England & Wales	EU Directive 2002/91/EC	

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

energy saving recommended

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call **0800 512 012** or visit **www.energysavingtrust.org.uk/myhome**

Label of USA

Home Energy Score

Score | Home Facts | Recommendations

Address: 12345 Honeysuckle Lane
Smithville AR 72466

Home size: 2,800 square feet
Year built: 1970
Air conditioned: Yes

Your home's current score 5

Score with improvements 7

Estimated 10 year savings $3,900

Uses more energy 1 2 3 4 5 6 7 8 9 10 Uses less energy

Top 20% of similarly sized homes score here or better

U.S. DEPARTMENT OF ENERGY

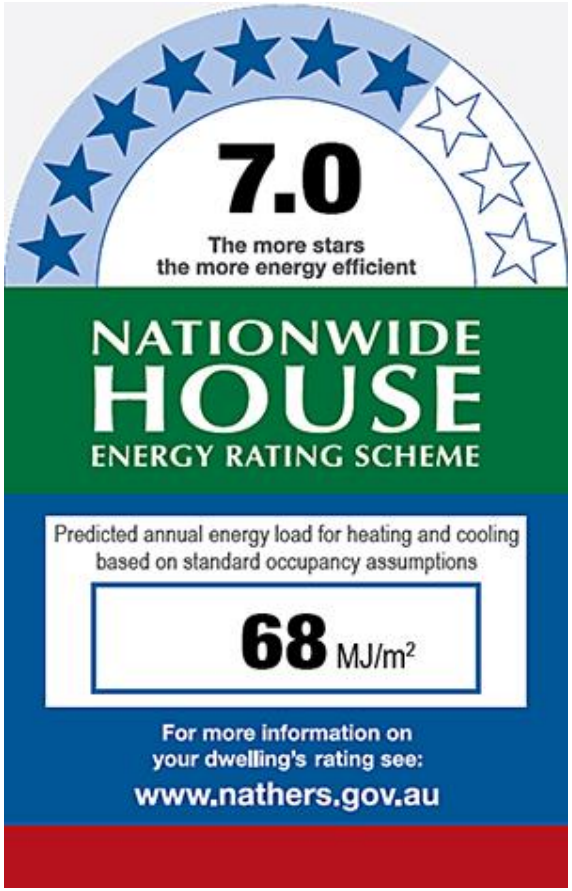
homeenergyscore.gov

The Home Energy Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a home based on the home's structure and heating, cooling, and hot water systems. The Home Facts provide details about the current structure and systems. Recommendations show how to improve the energy efficiency of the home to achieve a higher score and save money.

Assessment date: 01/12/2012
Scored in: 2012
Score ID: 1913375
Qualified assessor #: 101019

International Best Practices: A Brief Snapshot

Label of Australia



International Best Practices: A Brief Snapshot

Label of Hong Kong

RESIDENTIAL BUILDING ENERGY LABEL FOR HONG KONG

Household owner : xxx
Address : xxx

Calculation Grading

<90 kWH/year **A**
90 - 160 kWH/year **B** — 137
>160 kWH/year **C**

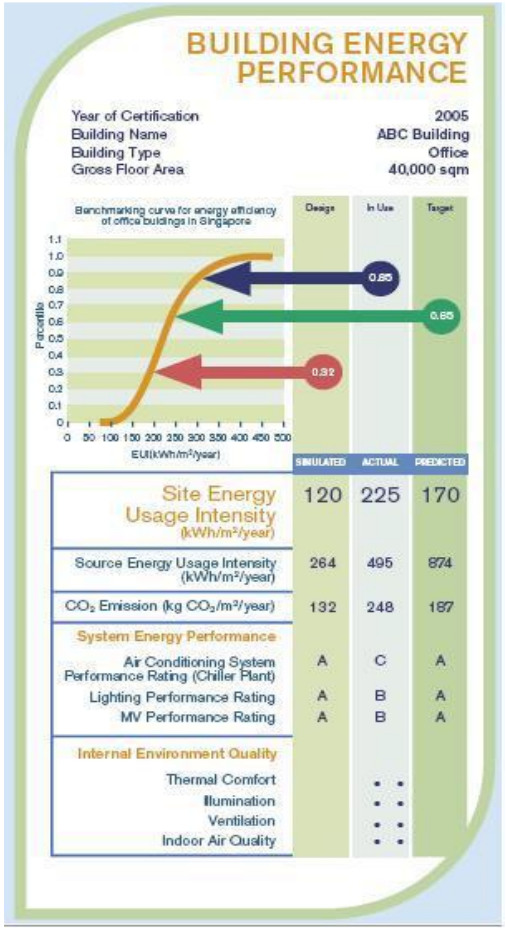
Remarks : Cooking energy exclude

Sub-Grade

1. Window-to-Wall ratio	A	**B**	C
2. External wall thermal conductivity (U-value)	**A**	B	C
3. Window shading coefficient	**A**	B	C
4. HVAC efficiency (Coefficient of performance)	A	**B**	C
5. Lighting load	A	B	**C**
6. Hotwater load	A	B	**C**
7. Miscellaneous equipment load	A	B	**C**
8. Ventilation design	A	**B**	C

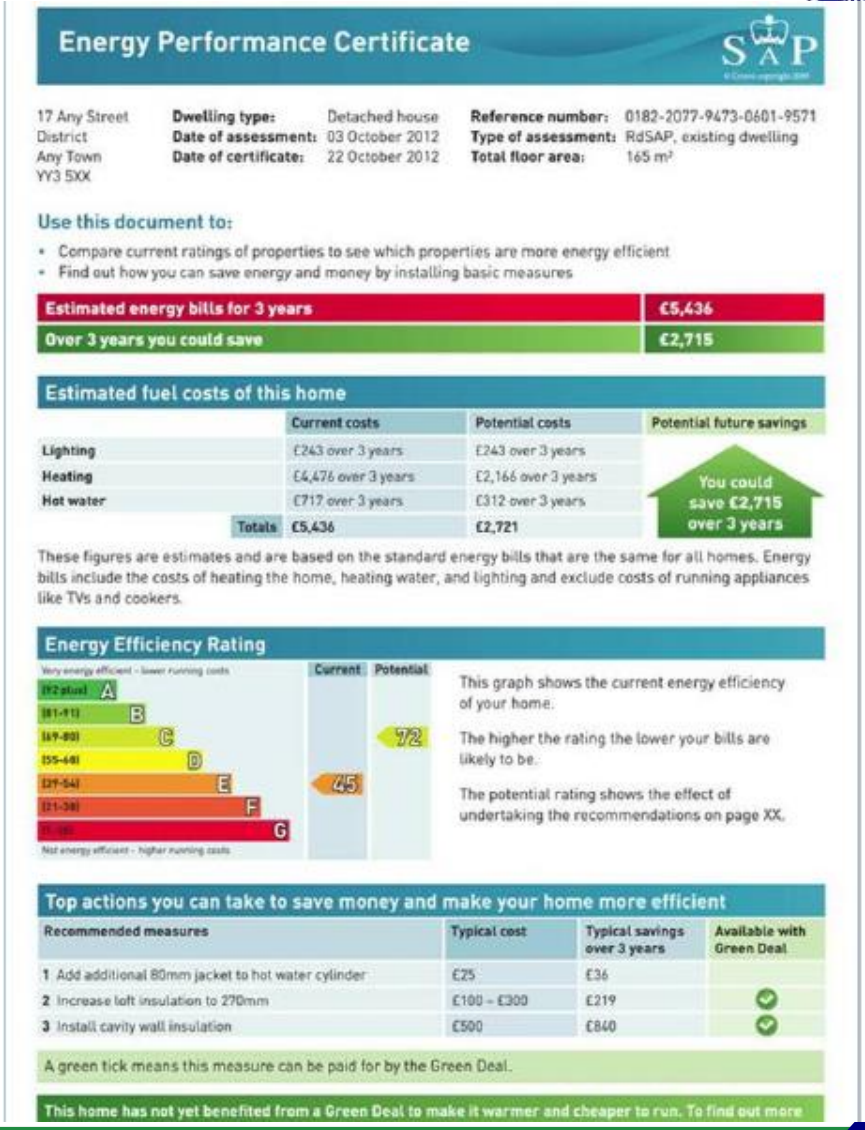
SAMPLE

Label of Singapore



International Best Practices: A Brief Snapshot

Energy Performance Certificate of Ireland



Energy Performance Certificate

SAP

17 Any Street
District
Any Town
YY3 5XX

Dwelling type: Detached house
Date of assessment: 03 October 2012
Date of certificate: 22 October 2012
Reference number: 0182-2077-9473-0601-9571
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing basic measures

Estimated energy bills for 3 years	€5,436
Over 3 years you could save	€2,715

Estimated fuel costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£243 over 3 years	£243 over 3 years	
Heating	£4,476 over 3 years	£2,166 over 3 years	
Hot water	£717 over 3 years	£312 over 3 years	
Totals	£5,436	£2,721	

You could save £2,715 over 3 years

These figures are estimates and are based on the standard energy bills that are the same for all homes. Energy bills include the costs of heating the home, heating water, and lighting and exclude costs of running appliances like TVs and cookers.

Energy Efficiency Rating

Current | Potential

A
B
C
D
E
F
G

Current: 45
Potential: 72

This graph shows the current energy efficiency of your home.

The higher the rating the lower your bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page XX.

Top actions you can take to save money and make your home more efficient

Recommended measures	Typical cost	Typical savings over 3 years	Available with Green Deal
1 Add additional 80mm jacket to hot water cylinder	£25	£36	
2 Increase loft insulation to 270mm	£100 - £300	£219	✓
3 Install cavity wall insulation	£500	£840	✓

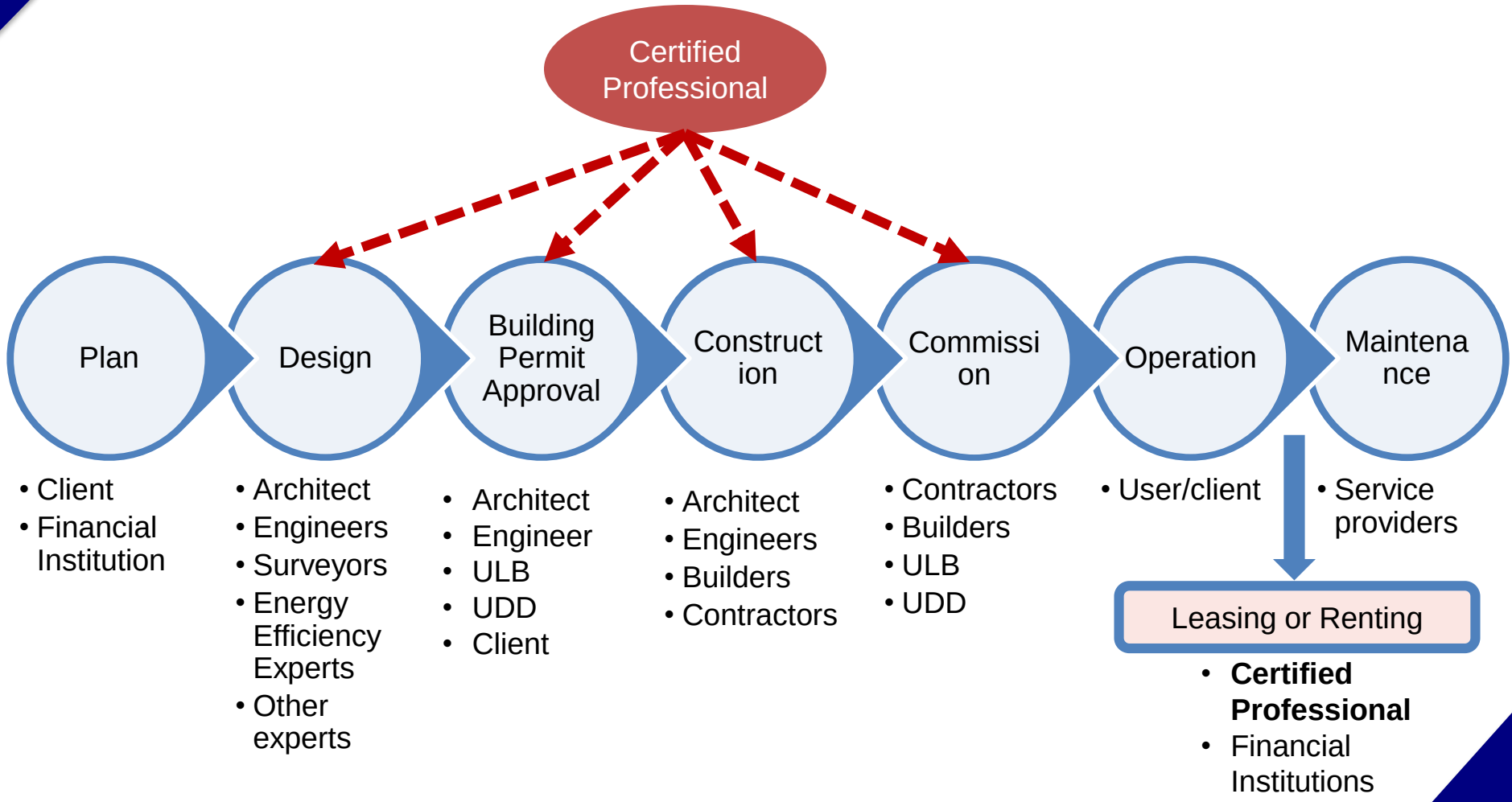
A green tick means this measure can be paid for by the Green Deal.

This home has not yet benefited from a Green Deal to make it warmer and cheaper to run. To find out more

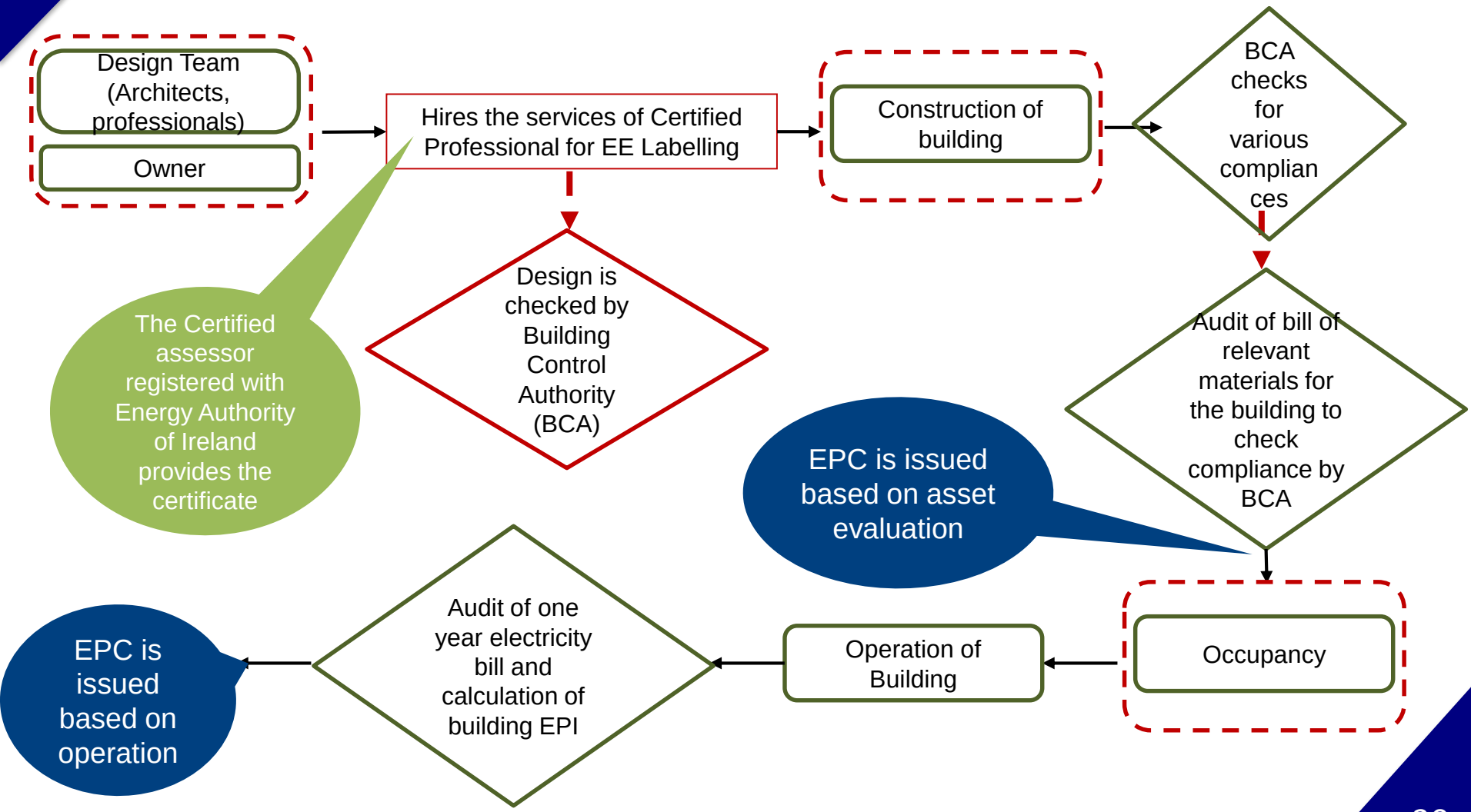
International analysis w.r.t Labelling Compliance in building lifecycle

6

Building lifecycle and stakeholders involved



Lifecycle of labelling in Ireland



Market Recognition Survey (Findings)

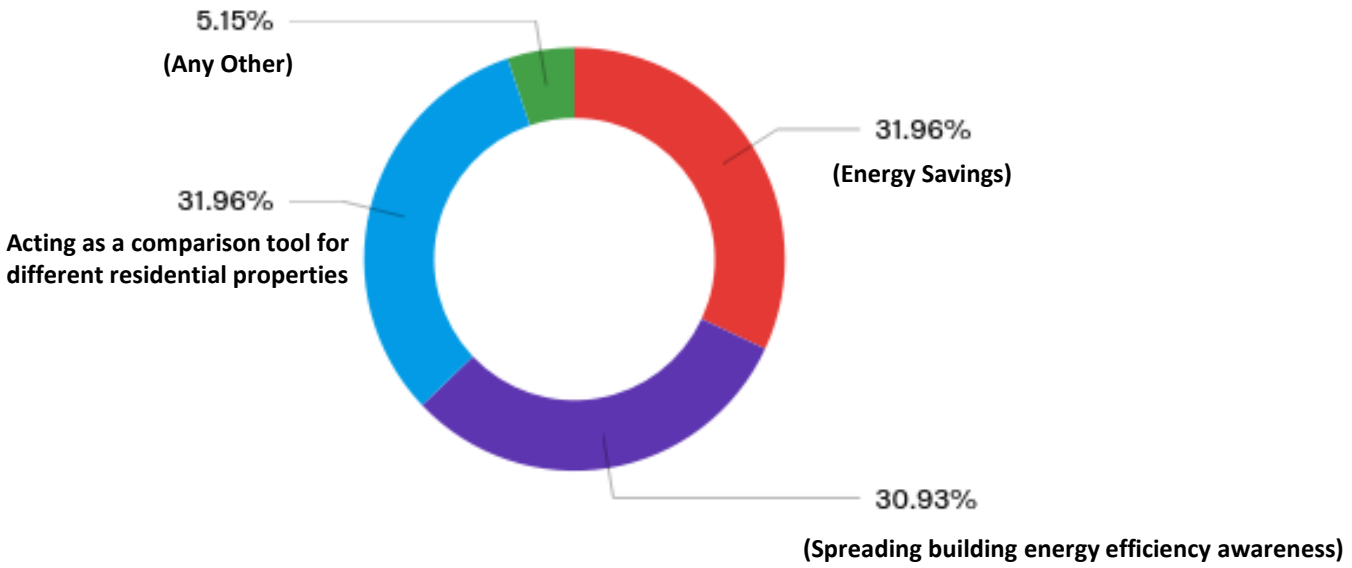
7

Survey Approach for Market Recognition Survey

Survey Type 1	• ECBC Master Trainers and other consultants
Survey Type 2	• Government officials and State Designated Agencies (SDA)
Survey Type 3	• Developers
Survey Type 4	• Financial Institutions

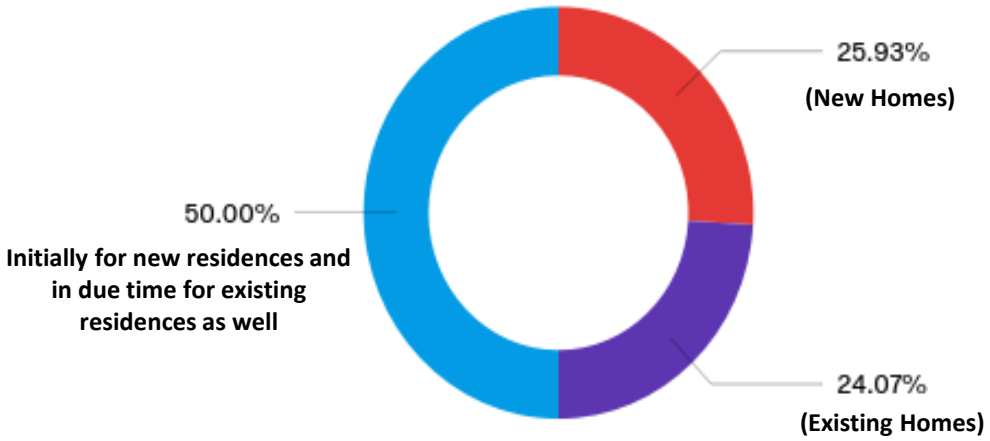
Market Survey: A brief glimpse of responses

What should be the goals of Energy efficiency label



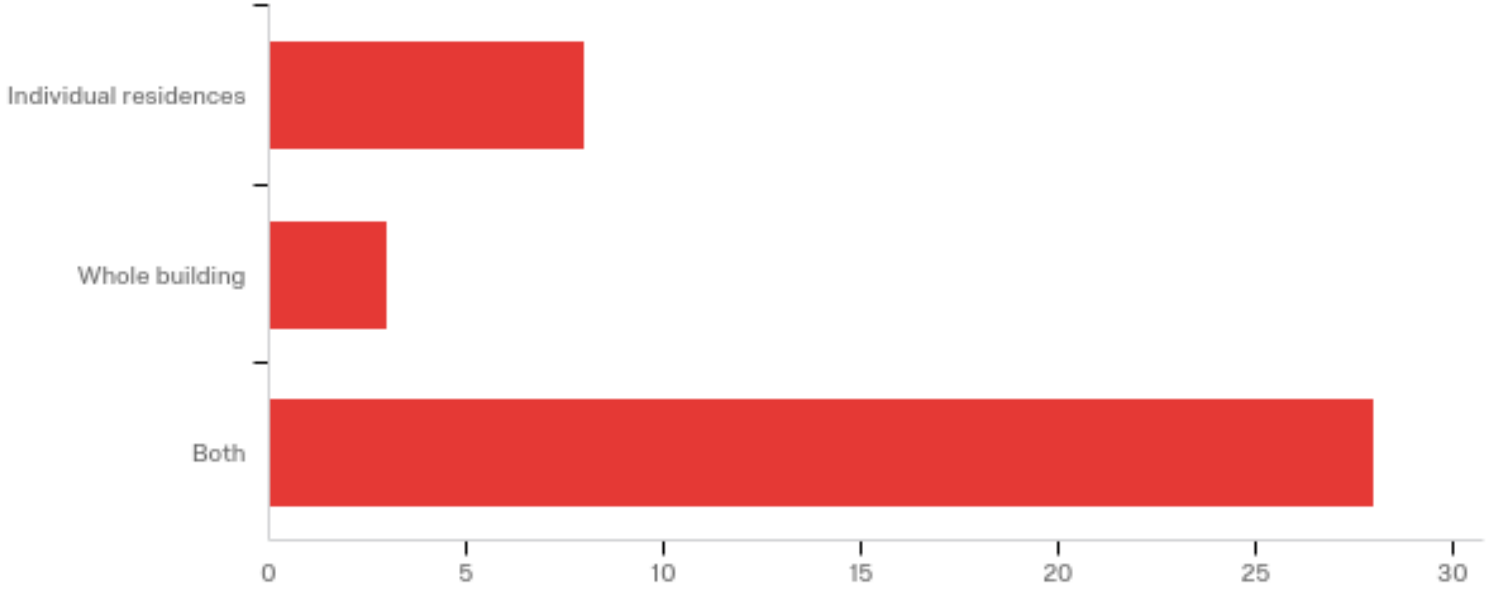
Market Survey: A brief glimpse of responses

Energy Efficiency Label should focus on new/existing building



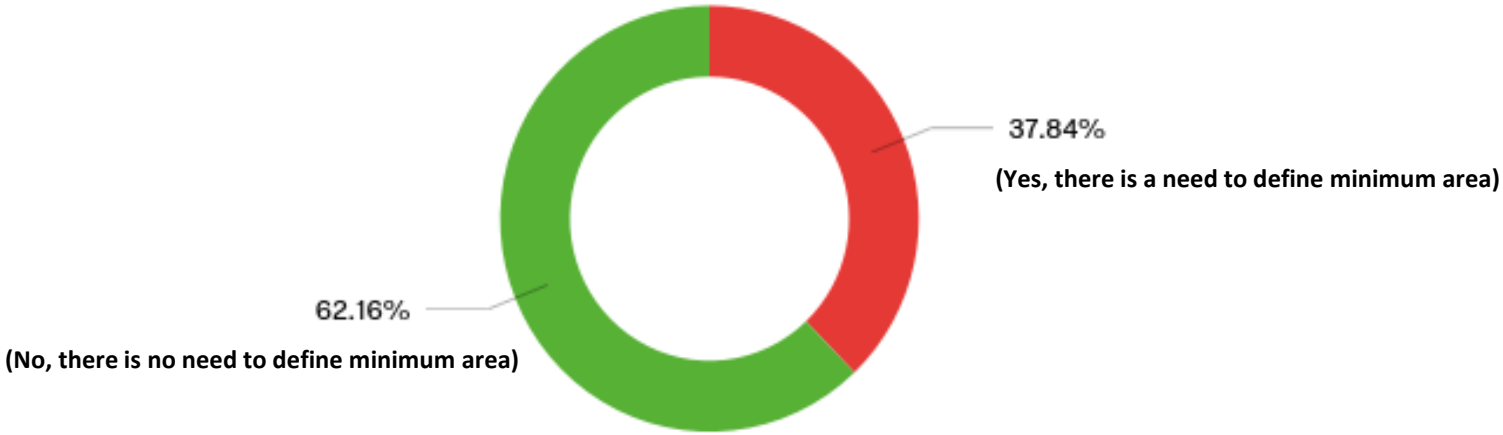
Market Survey: A brief glimpse of responses

Label should be applicable for Individual Residence/Whole building



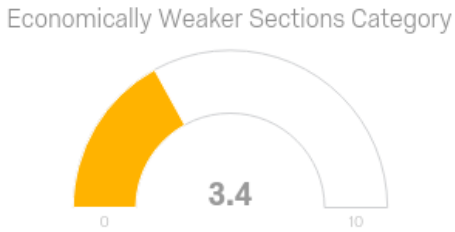
Market Survey: A brief glimpse of responses

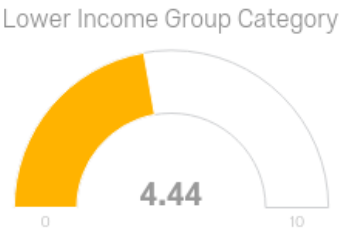
Is there a need to define the minimum floor area for Energy Efficiency Labels to become applicable for a residential labeling?

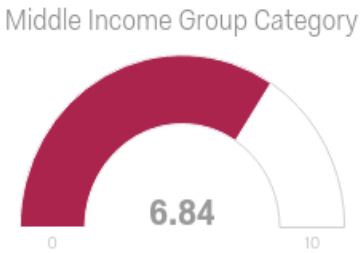


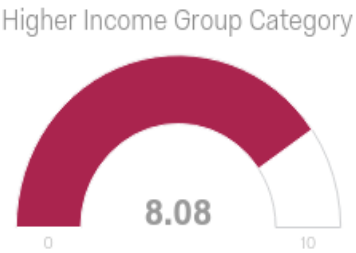
Market Survey: A brief glimpse of responses

Rate (on a score of 10) the residential categories on the basis of their readiness for energy efficiency labels



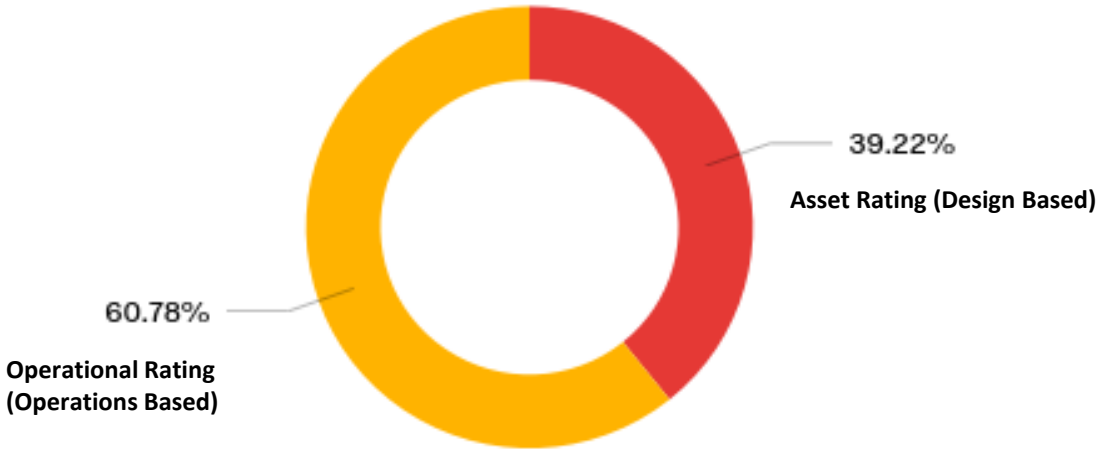






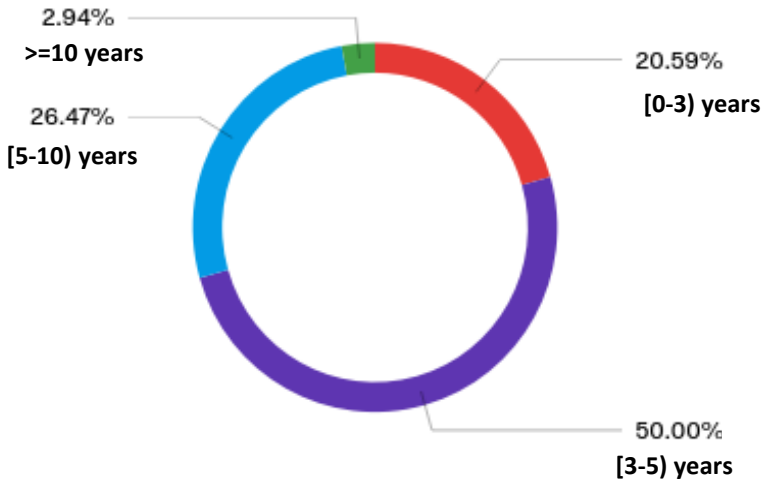
Market Survey: A brief glimpse of responses

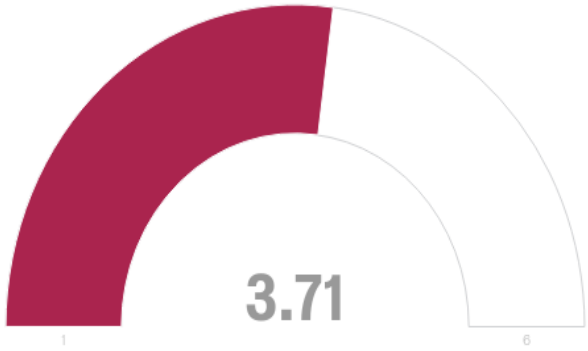
Label developed should be based on



Market Survey: A brief glimpse of responses

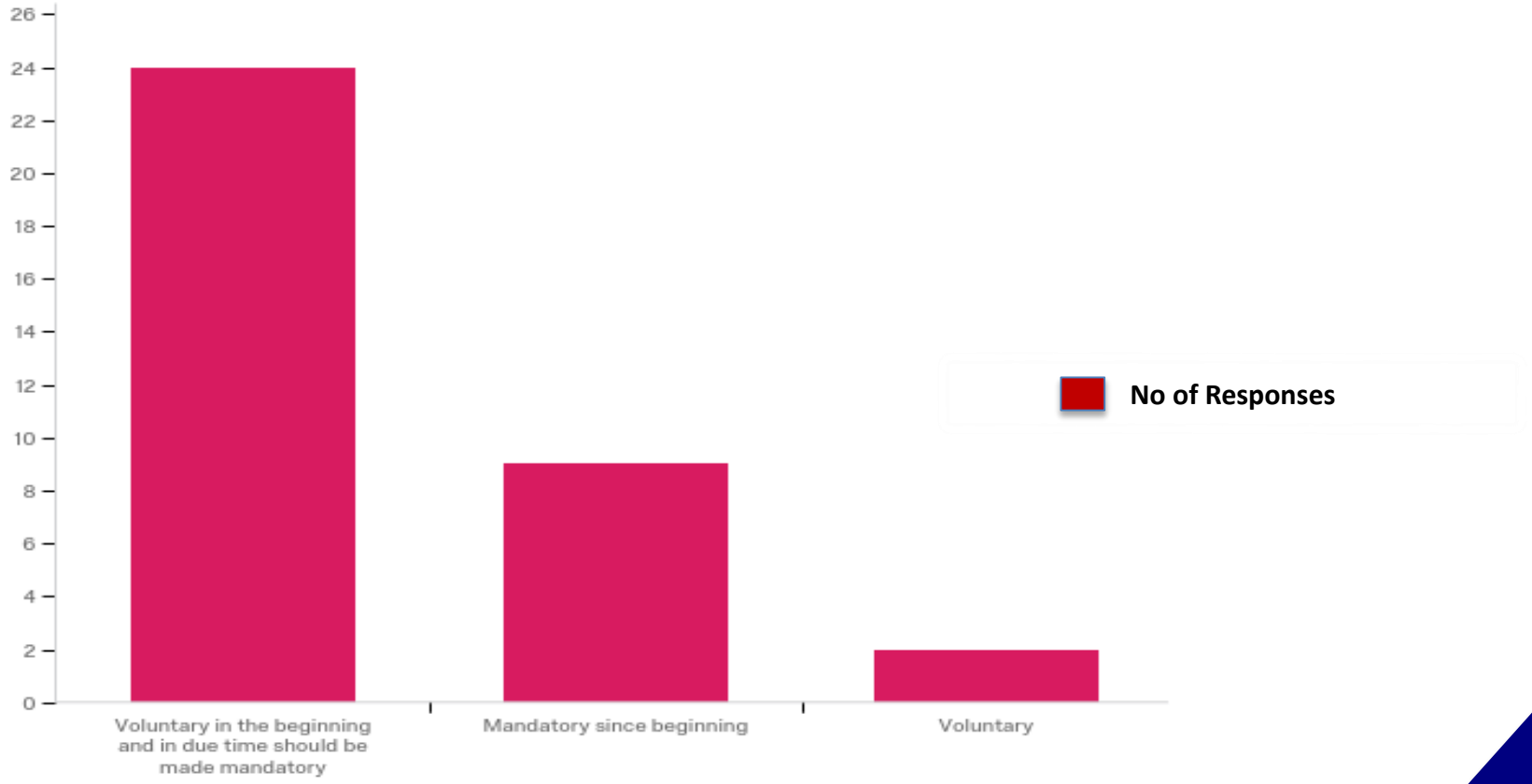
Validity *Period of the Label*





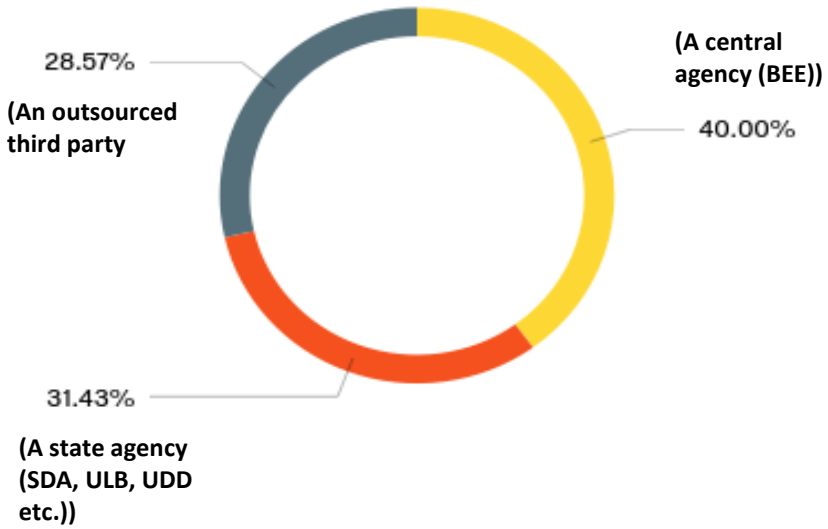
Market Survey: A brief glimpse of responses

Energy efficiency label scheme should be Voluntary/mandatory



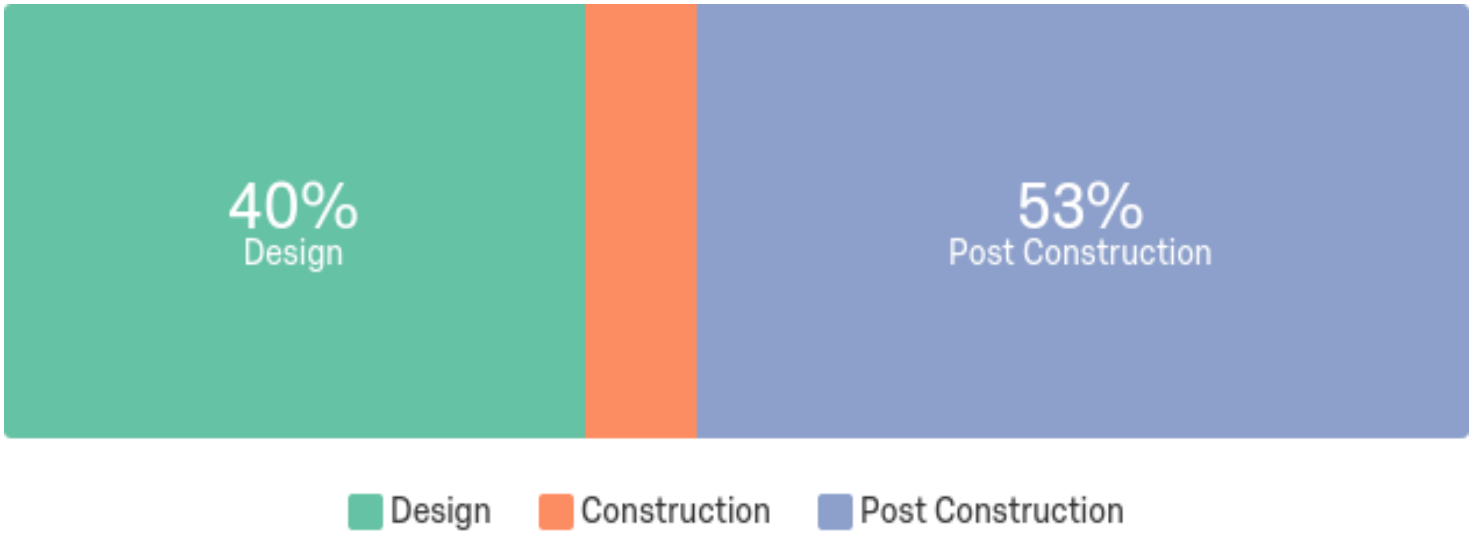
Market Survey: A brief glimpse of responses

Who should run the energy efficiency labelling Program



Market Survey: A brief glimpse of responses

At what stage (s) of building life cycle, energy efficiency label should be availed



Proposed Labelling Framework for India

8

Labelling framework for India

Parameter	Proposed
Scope	• New Homes initially and then existing homes in a span of 2-3 years
Single/Multiple Dwelling	• Typical houses on ground floor, intermediate floor and top floor
Stakeholders responsible for seeking the label	• Developer or owners
Agency responsible for providing Label	• Bureau of Energy Efficiency (BEE)
Tool	• A simplified tool needs to be developed for calculation of label
Validity	• 5 Years

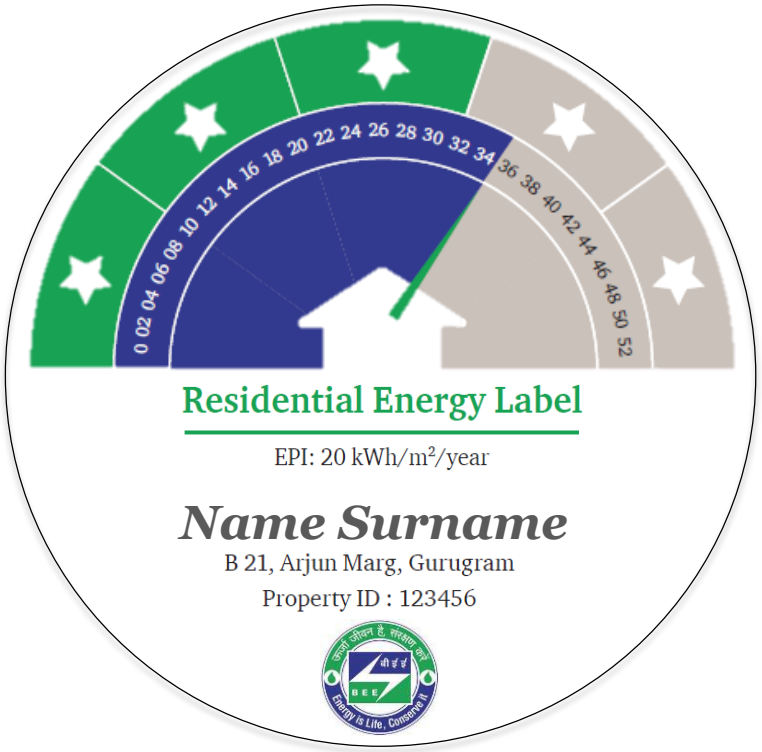
Labelling framework for India

Parameter	Proposed
Label Renewal if the property ownership changes/ is rented	• No as it depends on the validity of label
Label Renewal post expiry	• Development of database of labelled homes with details of ownership and date of expiry
Cost	• To be decided for India and could be linked with INR/Sqft as used in various labelling systems globally.
Inclusion of Common services	• Not to be included as the label is at dwelling level rather than at building level
Impact developer faces if there is any deviation in rating from design to actually constructed building	• Quality assurance mechanism for third party assessors need to be defined • Legal implications need to be defined in case it is linked with financial incentives
Compliance process	• Design • Construction • Post construction stage

Label Display

Label

Official plaque issued by BEE certifying the residential property's energy performance and efficiency commitment



Building Passport

Official Document issued by BEE certifying the residential property's energy performance and efficiency commitment

Option 1

OPTION 1

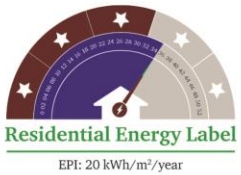
Option 2

OPTION 2

Building Passport

BUILDING PASSPORT

BUREAU OF ENERGY EFFICIENCY



EPI: 20 kWh/m²/year

Name

Address

City

Pin Code

Place

Date

Property ID

EPI (kWh/sqm/annum)

Building Characteristics

Walling Structure

Window Type

Glass Type

Space Configuration

Space Cooling

RETV

Energy Bill

Total savings

Indicator 1

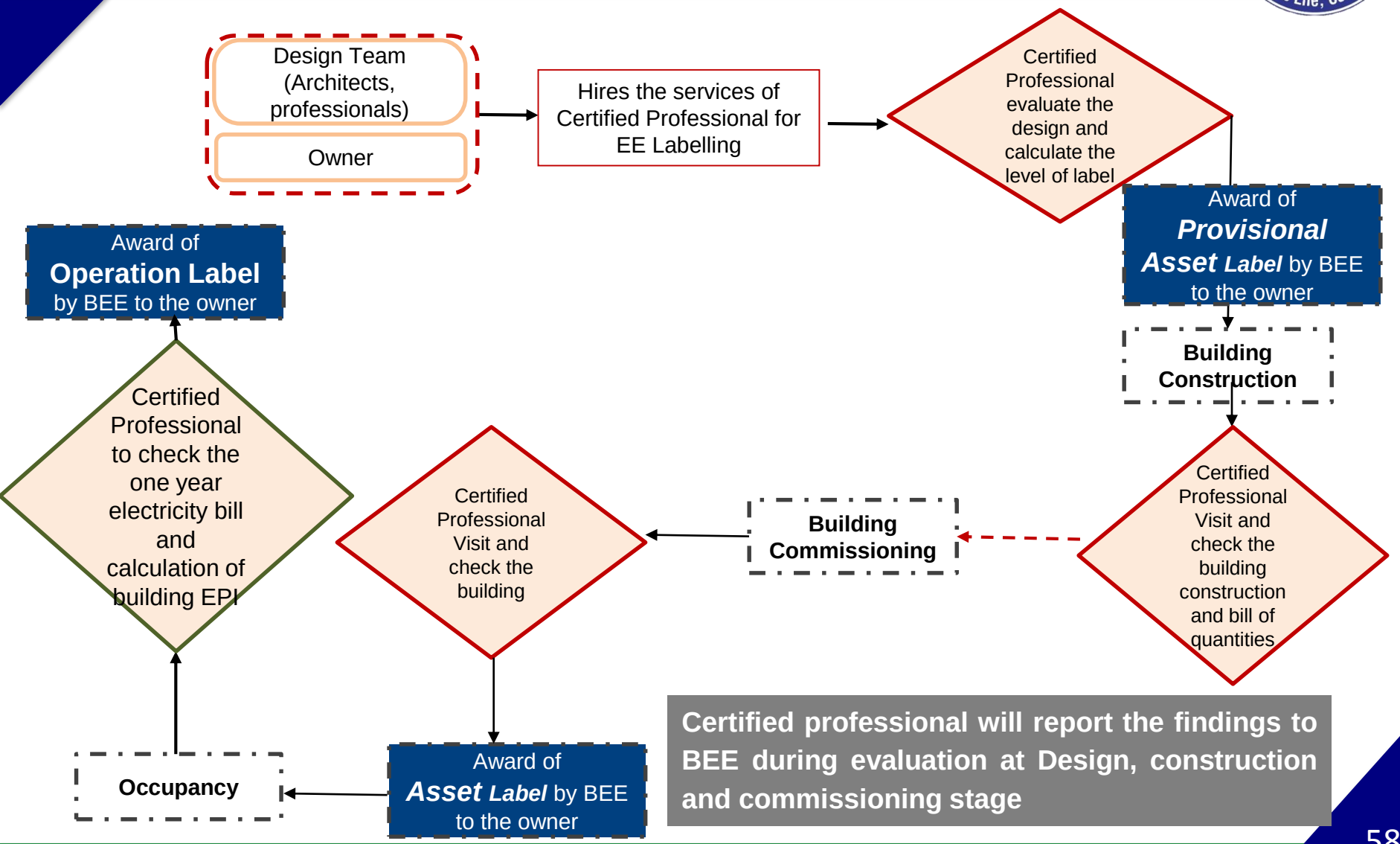
Indicator 2

Indicator 3

Bureau of Energy Efficiency
Residential Energy Efficiency Label
Awarded in 2019

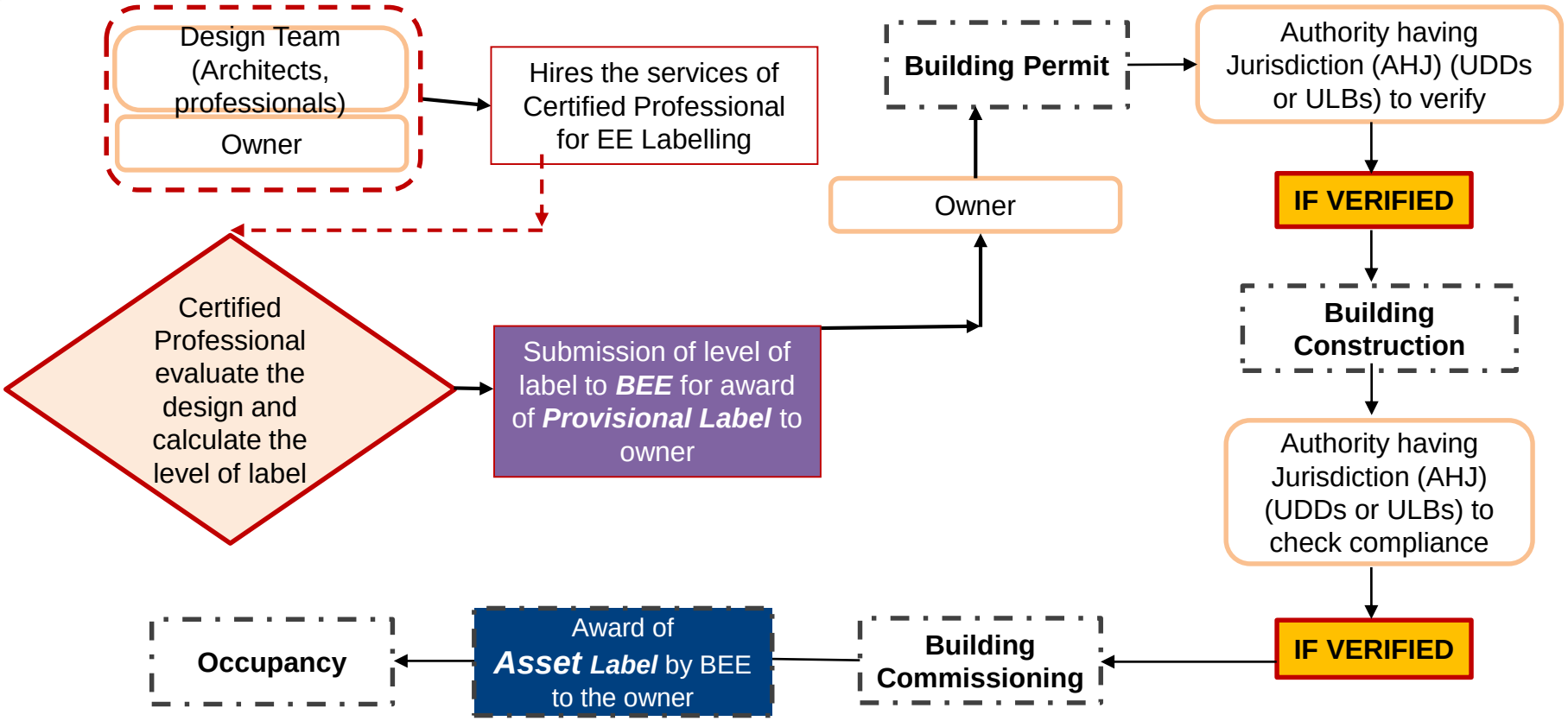
Actual energy consumption depends on building operation and maintenance

Lifecycle of labelling in India – Indicative (for new construction)



Certified professional will report the findings to BEE during evaluation at Design, construction and commissioning stage

Lifecycle of labelling in India – Indicative (for new construction)-Linked with Building Approval process



Baseline & Benchmarking

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Hybrid Method (Building Characteristic and EPI)

The hybrid approach provide whole building performance information while taking in to consideration both asset and operational performance.

Asset characteristics

- Building design
- Materials
- Construction
- May also include appliance, Lighting system and comfort system

Operational Characteristics

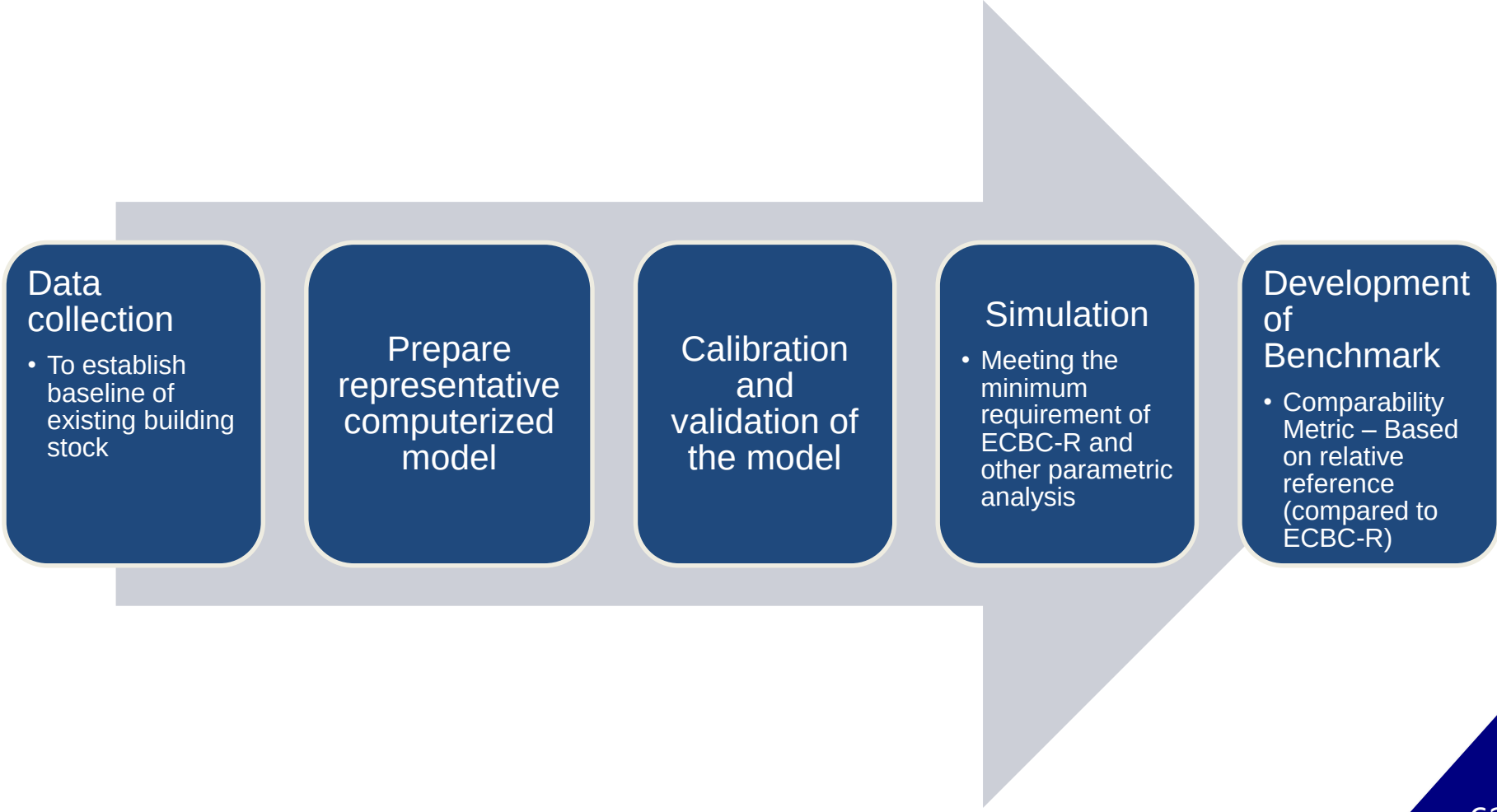
- Building usage
- Operation
- Occupancy

Rationale for Hybrid Approach

Advantages

- **ECBC R can be set as a baseline**
- Helps to evaluate the building asset (envelope) independent of how it is being operated (Usage hours, occupancy).
- Ascertain how well the building is operated under standard asset quality
- Provides valuation for energy efficiency during real estate transactions
- **Basis for implementation of ECBC-R**

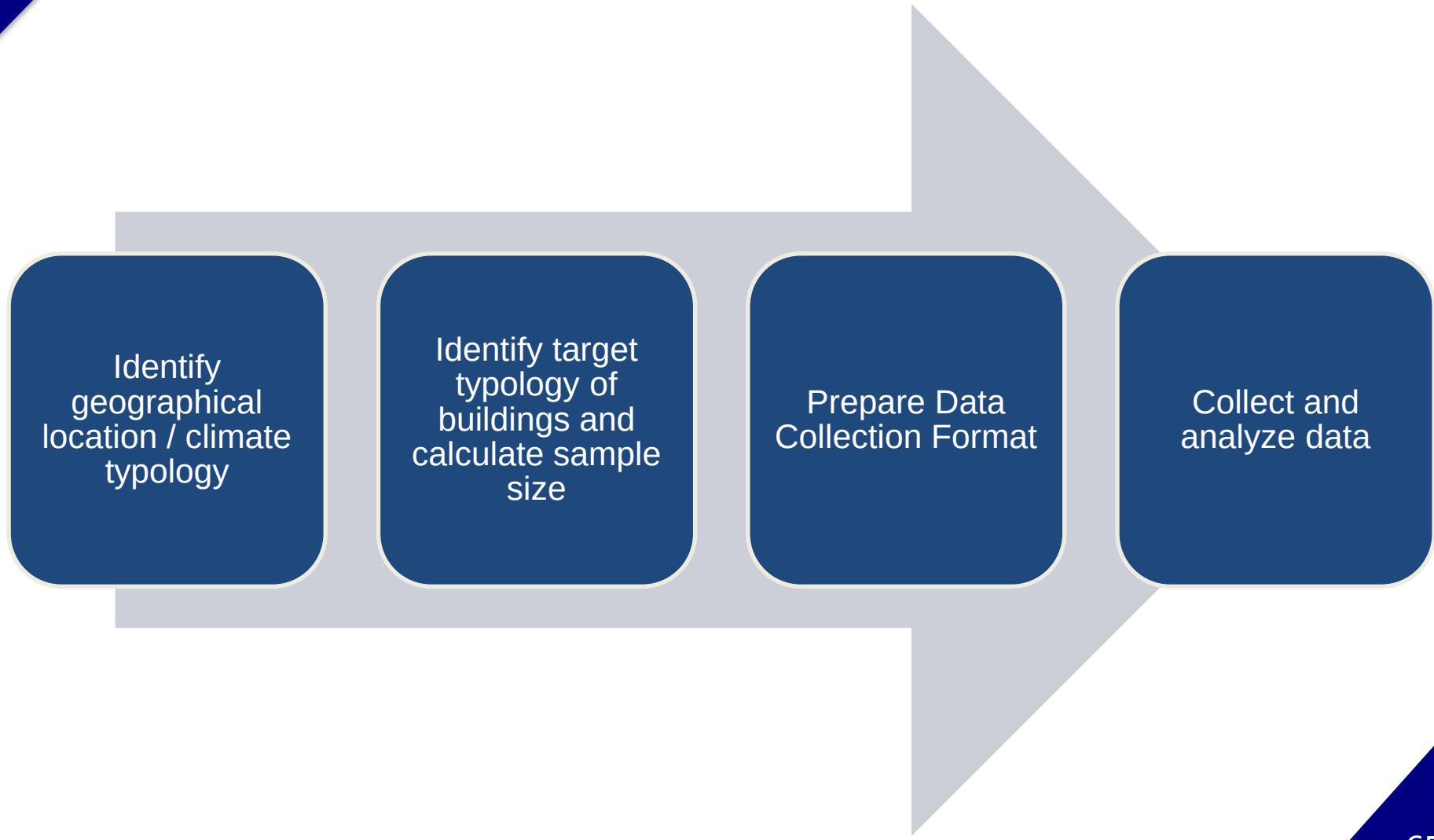
Overall Approach to establish baseline and benchmark



Data required for the approach (Indicative)

DATA POINTS	SOURCE
City weather data/Climate Zone	IMD - Weather data files
Dwelling type and number of floors	Developer
Building envelope details	Developer, BDA, ECBC
Connected load	DISCOM
Floor plans with habitable / non habitable area details	Developer, Occupant, RWA
Number of bedrooms in a unit (space cooling)	Developer, Occupant, RWA
Floor plan layout including air-conditioned and non-air-conditioned spaces	Developer, Occupant, RWA
Number and location of air conditioning systems	Occupant
Number of occupants and age group	Occupant
Number of appliances, their power usage and operational patterns	Occupant
Energy consumption bills (monthly / bi-monthly)	DICSOM, RWA, Occupant

Data Collection Approach



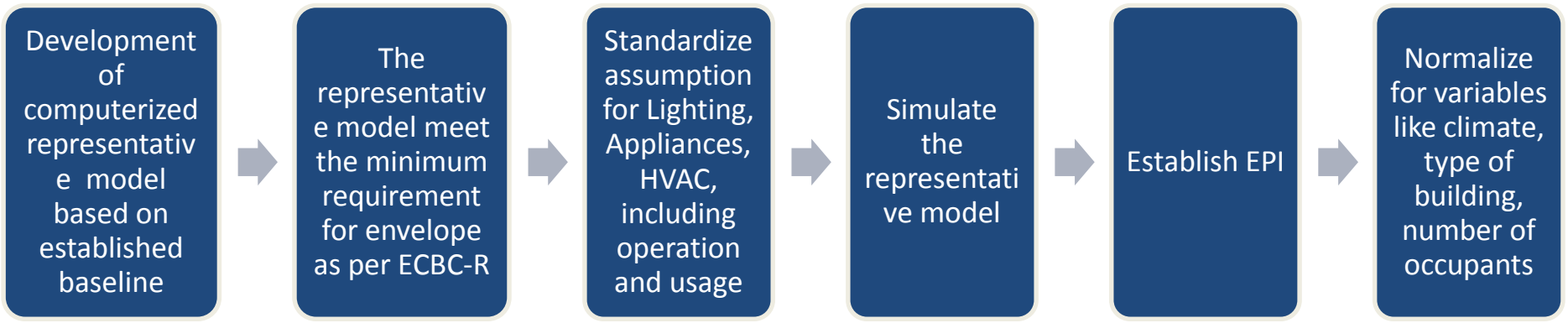
Data analysis for the approach (Indicative)

- Calculate RETV value for the envelope of the residential unit (W/sqm) (as per ECBC-R)
- Calculate EPI of the residential unit (kWh/sqm/year)

Possible Variables for normalization

- Number of Occupant
- Climate
- Efficiency and Operating hours of various equipment like air conditioners, lamps, fans etc.

Benchmarking approach



Relative reference established via simulation compared to code

Next Steps

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Next Steps

Baseline & Benchmarking (Nov 2018)

Label design (Nov 2018)

Second Technical Committee in Nov 2018

Development of Tool for label generation (Dec 2018)

Compliance and Enforcement framework for labels (Dec 2018)

Administrative Plan for labels (Dec 2018)

Third Technical Committee in Dec 2018

Thank You