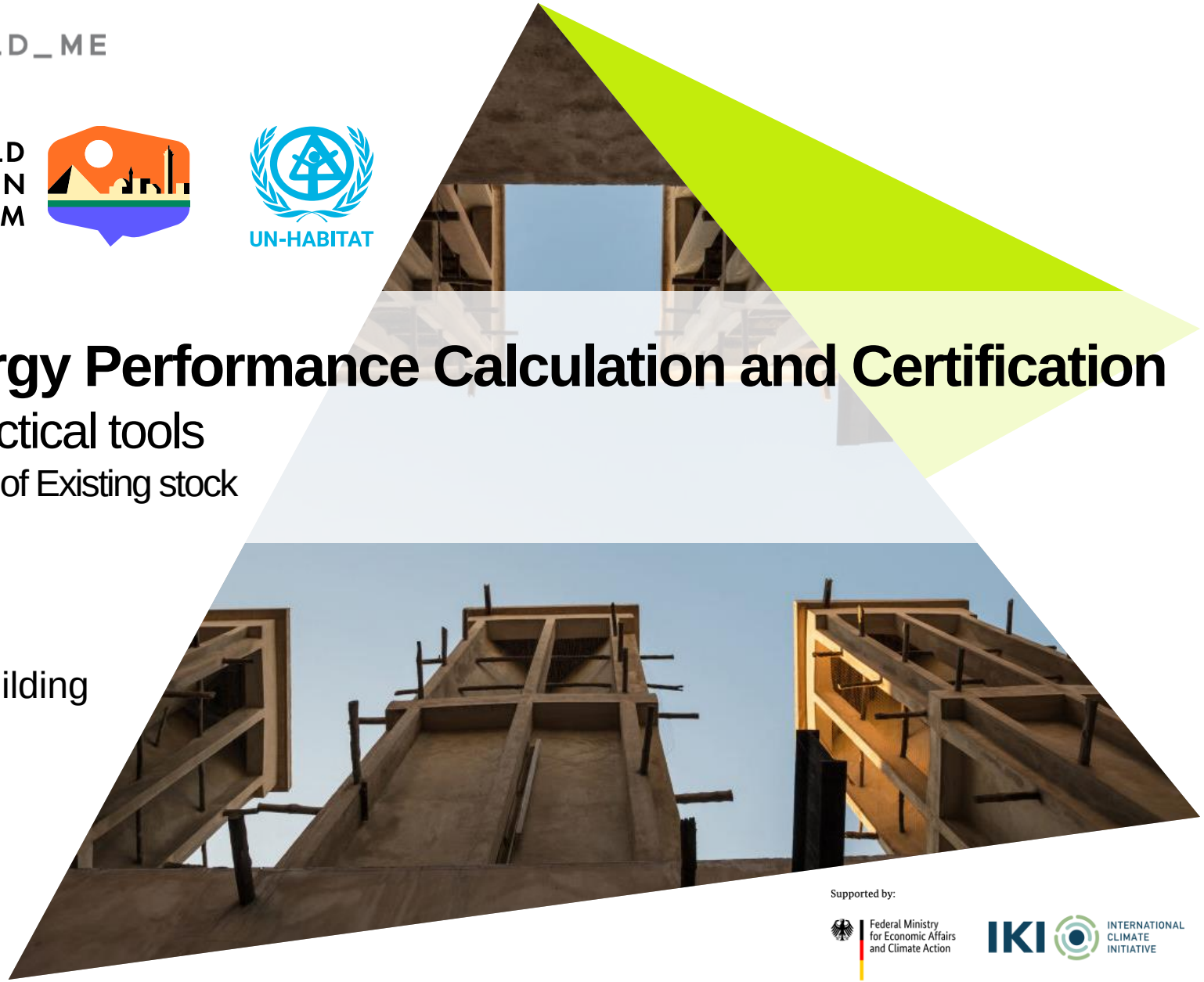
Training on Building Energy Performance Calculation and Certification

Approaches, Strategies and Practical tools

between New Constructions and Retrofitting of Existing stock



BUILD_ME

IKI Project - Accelerating 0-emission building sector ambitions in the MENA Region

November 8, 2024

Supported by:

Federal Ministry for Economic Affairs and Climate Action

IKI INTERNATIONAL CLIMATE INITIATIVE

on the basis of a decision by the German Bundestag

Objective of the training session

1. Get introduced to the background of the BUILD_ME project
2. Understand the roadmap towards energy performance measurement and certification in the MENA region
3. Learn to conduct energy performance calculation and certification using the BEP tool and EPC scheme

Agenda

Part 1: Plenary Discussions	**1h**
Introduction to the BUILD_ME project	10 min
Development of the baseline – *Building typology*	10 min
Logic of the BEP tool – *first intro as live to come*	10 min
Development of energy performance measurement and EPC scheme	25 min
Results (PPs) – *case study*	5 min

Part 2: Interactive Session	**1h**
Hands-on training – *BEP tool walk-through*	45 min
Wrap Up – *why engage with BUILD_ME, Outlook*	15 min

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10 minutes

Introduction to the BUILD_ME Project

Riadh Bhar, Guidehouse

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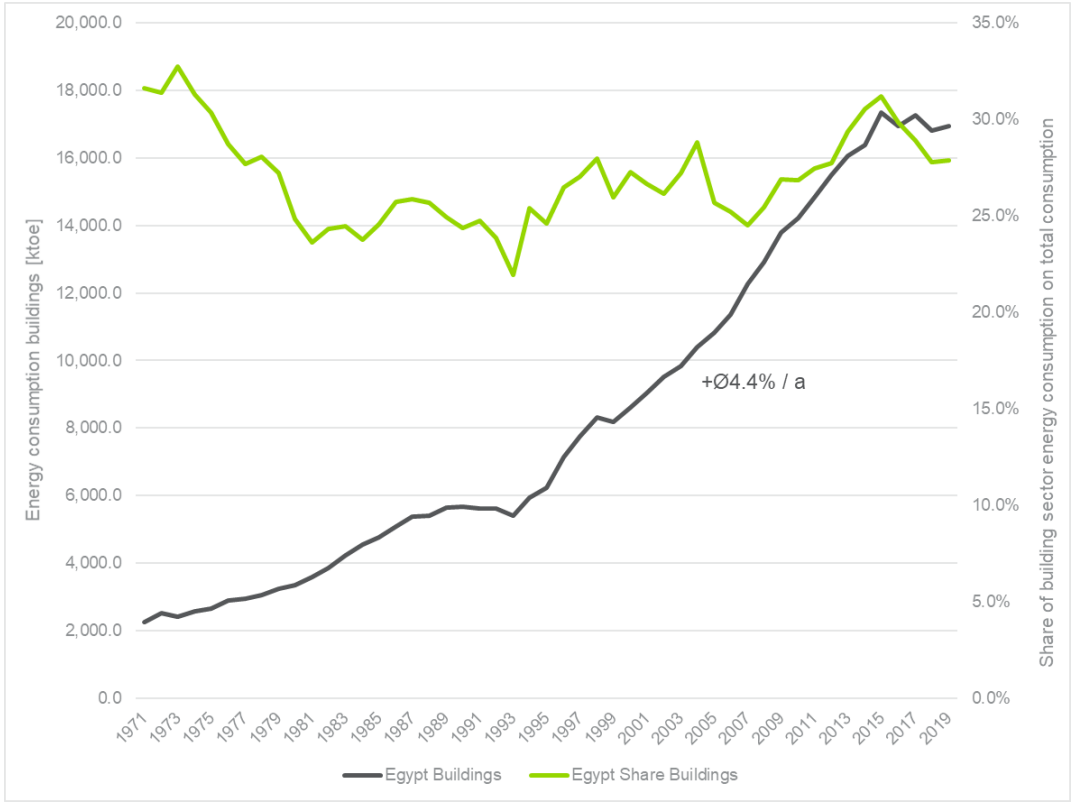
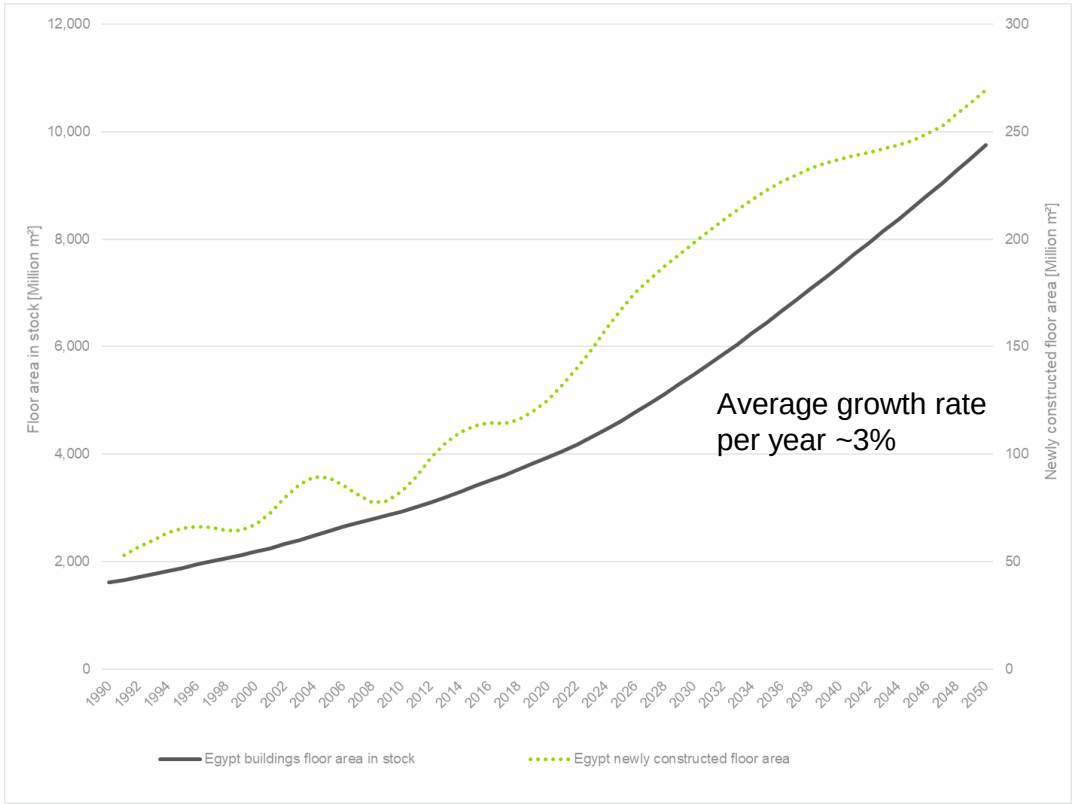
Situation in Egypt

The energy consumption of the buildings sector in Egypt is and will stay highly relevant



Source: IEA energy balances 2021
All energy carriers included



30% share for the building sector (energy consumption)

4% yearly increase of energy consumption

3% future yearly growth of new buildings

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Introduction to the BUILD_ME Project

Starting Point and Objective

Problem Identification

EEBC Enforcement

Data Availability

Benchmarking

NO
energy consumption baseline definition

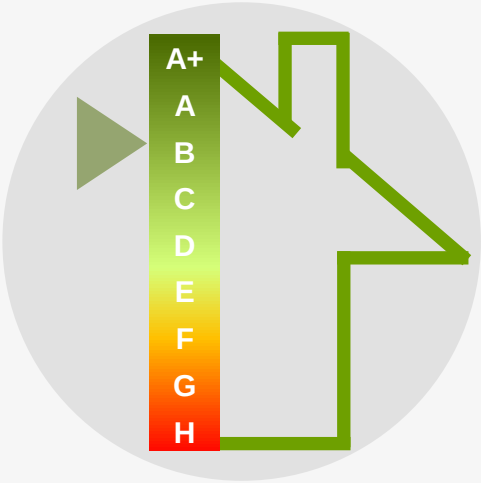
Bottleneck
Not allowing the uptake of finance energy efficient buildings

Expected Solutions

Building Typology

Calculation Tool

Reference Buildings



Classification Scheme
Transparent classification scheme for building energy standards.

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Overarching storyline of BUILD_ME phases

Phase 1
2016 - 2018

Analysis & Recommendations

- Analysis of boundary conditions and stakeholder perspectives
- Formulating recommendations for implementation

Phase 2
2019 - 2022

Prepare the Implementation

- Developing tools for implementation
- Connecting with stakeholders to initiate the implementation

Phase 3
2023-2025

Support the Roll-Out

- Piloting the roll-out to reach implementation
- Scaling up activities to enlarge the impact

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Why another tool

Mohamed Salheen, IDG

Guidehouse

BUILD_ME

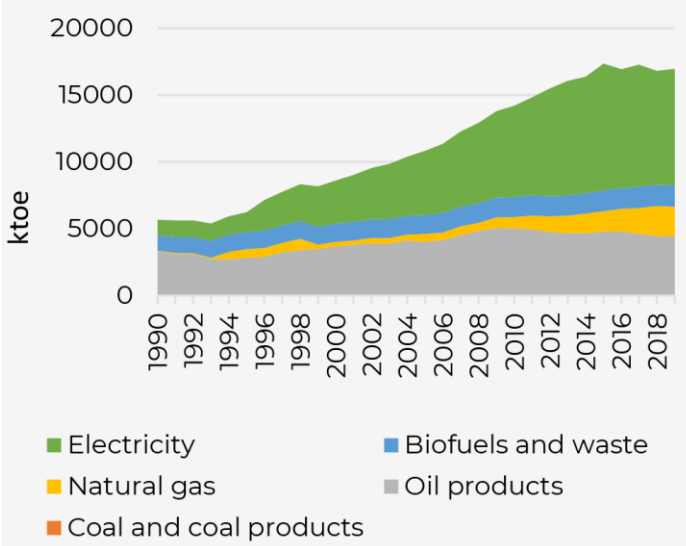
IDG MATRIX
Integrated Development Group
Engineering & Strategic Planning Consultancy

Why? General introduction of the relevance of EE in buildings

Macro-Economic Indicators

101.3M	Inhabitants (2020)
$3,020	GDP per capita (2019)
5.68%	Avg. Inflation rate (2019-2020 per annum)
0.05€/kWh	Avg. Electricity Price (2020-2021)

Final Energy Consumption of the Building Sector



Source: World Energy Balances (2021 edition)

Growth in Building Sector

7.5%	Construction sector growth rate (2020)
3,233 EGP/m²	Avg. cost of new construction (urban multi-family houses) (2019)
1M/12M	Number of single/multi-family households (2017)
94.55 TWH	Energy consumption of building sector (residential, governmental entities, commercial and other uses) (2018-2019)
24% 76%	Dwelling ownership structure: rented/ owned (2019)

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No sufficient alternatives to address the problem

Available green building certificates (internat. and national) are not picked up sufficiently

Scheme	Egypt	Jordan	Lebanon	Total
LEED	32	13	25	70
BREEAM	0	0	11 (20)	11
EDGE	18	3	2	23
National Schemes (public)	GPRS (2)	Daleel (1)	(-)	3
National Schemes (private)	Tarsheed (5)	Sawsana (X)	ARZ (5) GRASS (X)	6

Map Source: Maksim Grebeshkov

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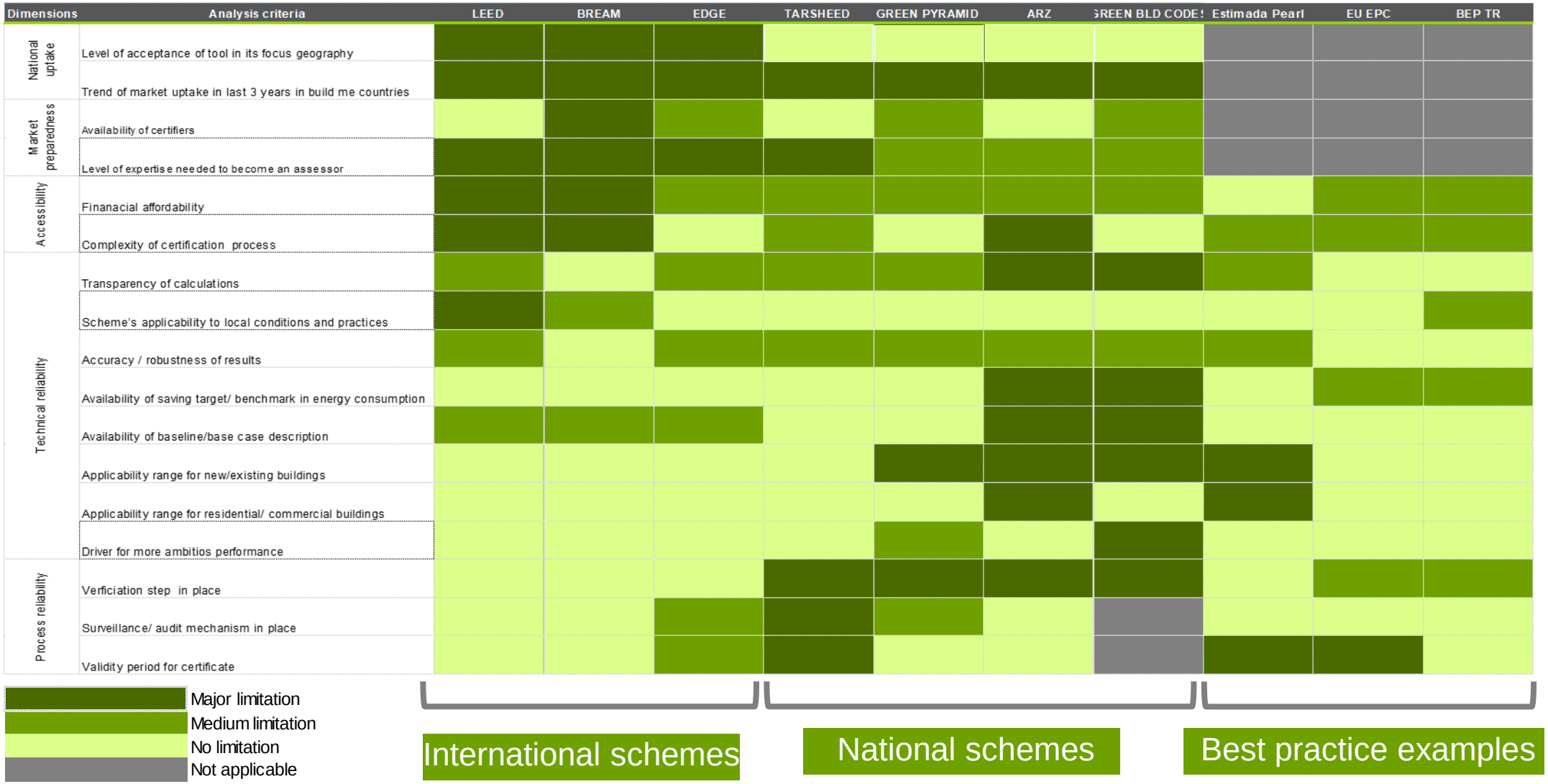
Analysis of existing certification systems



Key conclusions from analysis of current schemes

1. Existing certification schemes in Egypt, Jordan, and Lebanon, some **over 10 years old**, have seen **minimal market adoption.**

2. Without reliable calculation of energy performance, there is a **risk of projects targeting easy and cheap green points** and **not applying impactful measures**

3. Current certification schemes mainly focus on commercial buildings, **neglecting the untapped potential for residential building certification**.

4. There should be a **balance between technical complexity and accessibility** in current certification systems, with some being too complex and others too simplified.

5. International certification schemes fall short in adopting and **reflecting national conditions** and building stock characteristics, **which is a critical success factor for BUILD_ME.**

10 minutes

Development of the baseline – *Building typology*

Mohamed Salheen, IDG

Guidehouse BUILD_ME IDG MATRIX Integrated Development Group Engineering & Strategic Planning Consultancy

Our Integrated Solution

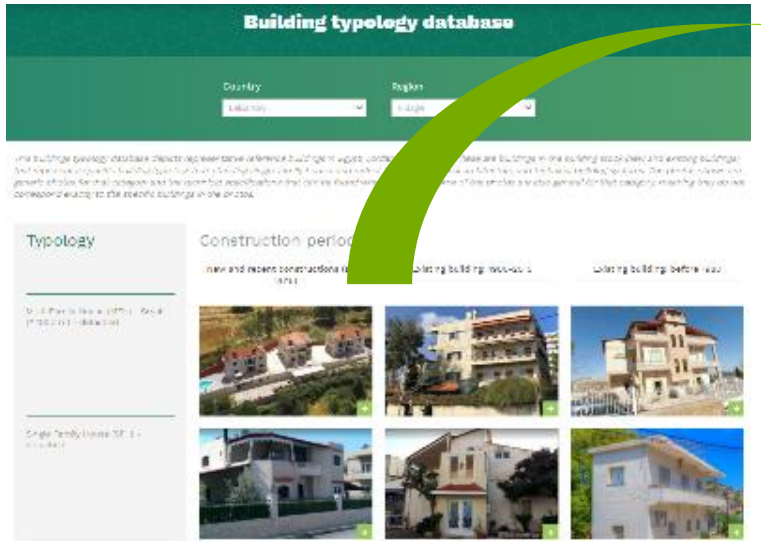
Define own baselines and develop tailored energy labelling scheme for new buildings

- Data from real constructions not older than 3 years
- At least 5 cases per building type covered in each country building typology
- Data from subsidy programs, literature, interviews with relevant stakeholders, permits documents etc.

- BEP tool based on ISO 52016, fed with local data used as calculation engine.

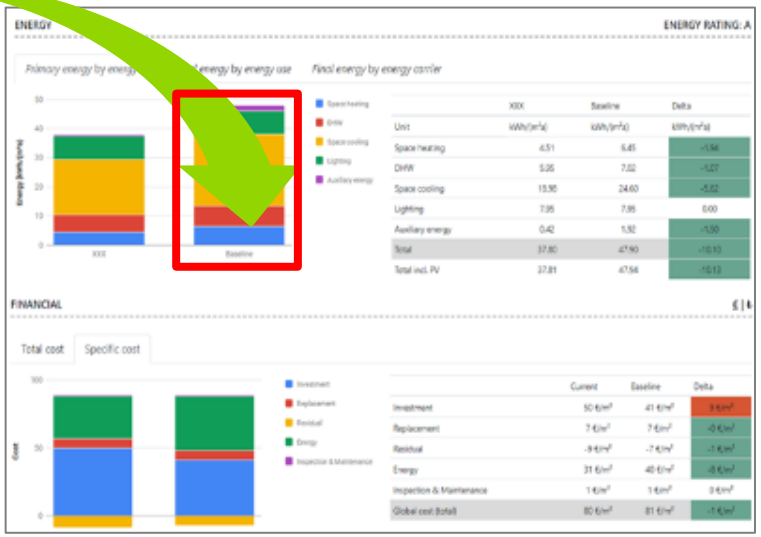
- Researched buildings in building typology represents baseline, which is shown in the BEP Tool as default value.

Reference Buildings and Building Typology



BUILD_ME Building Energy Performance Calculation tool

Classification of buildings compared to baseline



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Building typology

Scope and Purpose

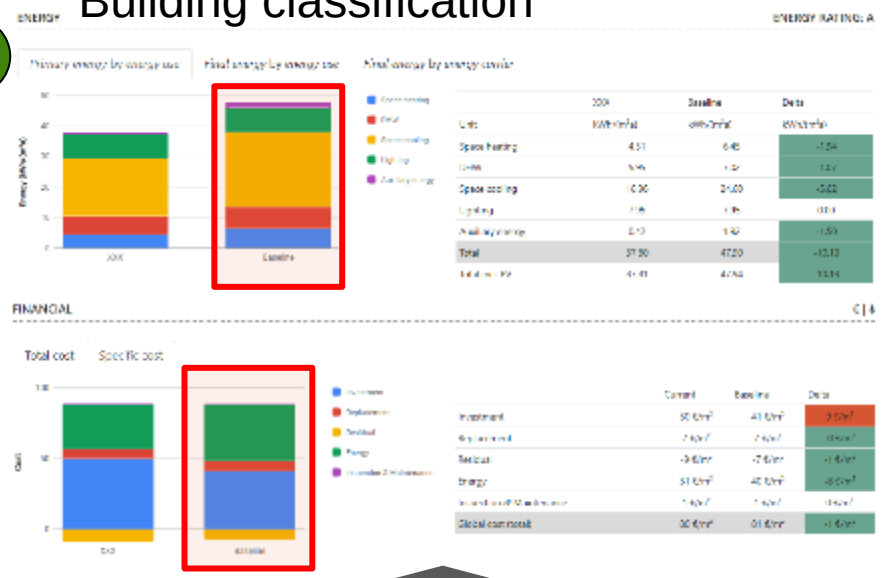
- **Identify** typical construction specifications of new and existing buildings
- **Differentiation** between regions and several building types, Per country
- **Calculating** typical energy demands and financial characteristics
- **Calibrate** with national energy balances and to refine calculation parameters
- **Compare** own project results with typical **baseline** (→ building classification)
- **Developing** different **scenarios and assessments of the entire building sector** e.g. for NEEAPs and NDCs to assess the suitability of future required minimum performance levels of buildings to achieve climate protection targets

Baseline setting

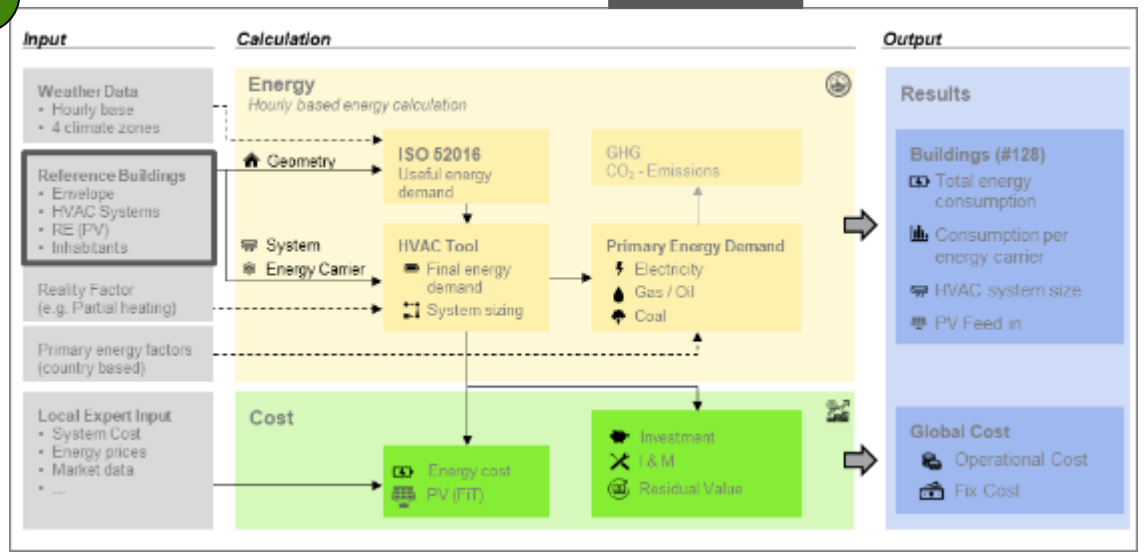
Assessing typical new constructions

- Data from real constructions not older than 3 years
- At least 5 cases per building type covered in typology
- Sources: data from subsidy programs, literature, interviews with relevant stakeholders, permission documents etc.

3 Building classification



2 BEP Tool



1

Main typology with underlying reference building data

Region	Construction period	SFH	MFH	Education	Retail/Trade	Office	Hospital	Hospitality (hotels)	Mixed buildings
Country	Existing buildings								
Country	New constructions (after 2015)								

New construction data for at least 5 cases used to create the representative cases. These cases will be used to calculate or determine average specifications of the new construction cases of the main typology

	S	Education	Retail/Trade	Office	Hospital	Hospitality (hotels)	Mixed buildings
1							
2							
3							
4							
5							

Data

Geometry and Photo

1 The new construction cases in the typology sheet should have a geometry/architecture (and picture) of a building that you consider to be most representative for the new construction market. For this purpose, you could for example just select one of the cases you collected for task AI6.

2 As a second step you then need to specify the technical building parameters (i.e. u-values, heating and cooling systems, eventually PV, etc.). For the u-values, you should just calculate the average of your collected cases from AI6, for the Technical Building Systems (TBS), you should just select the most frequently installed systems.

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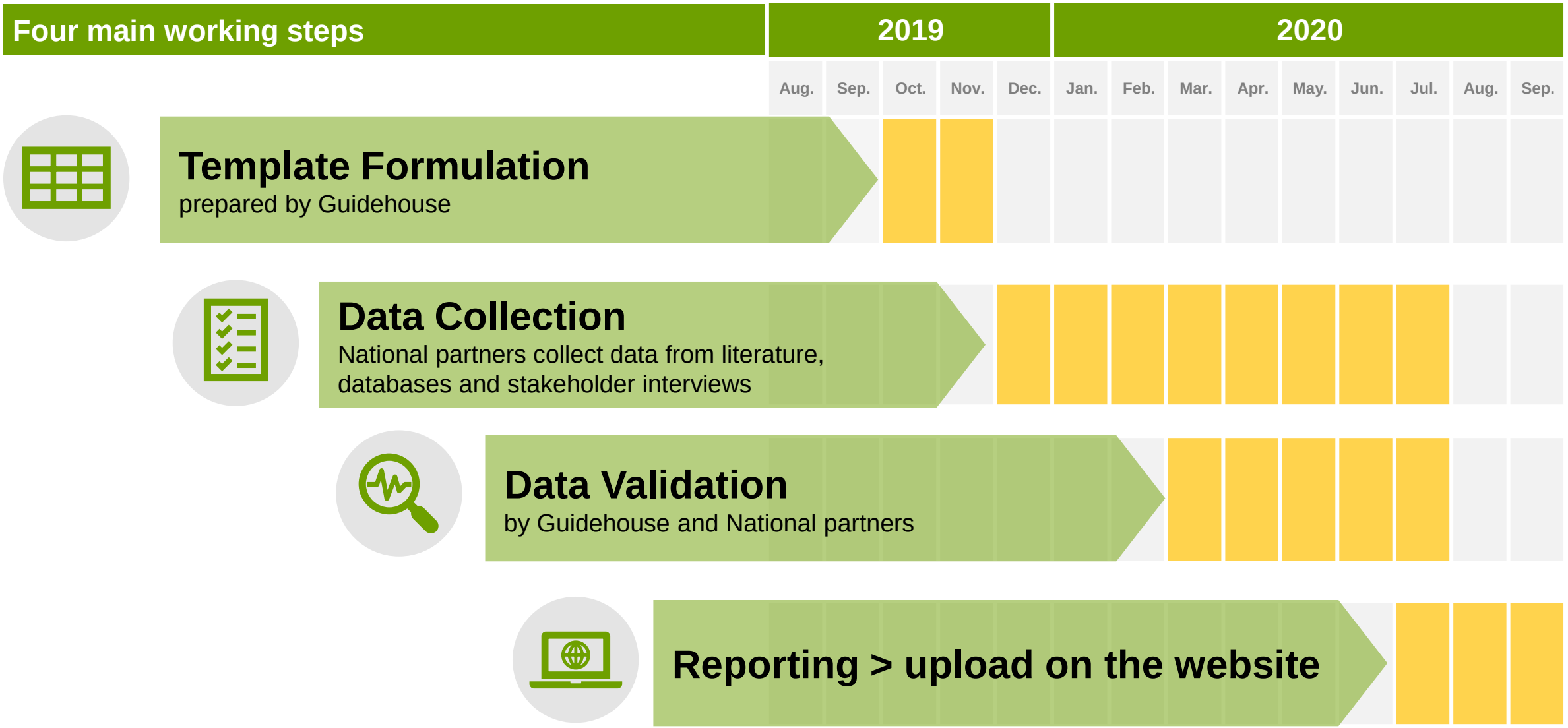
Approach of Building Typology Development



Results, Template Main Sections

A : General information

Country	Project Name	Building type	Region (specify)	Construction Period	ID	Reference ID

B: Geometries

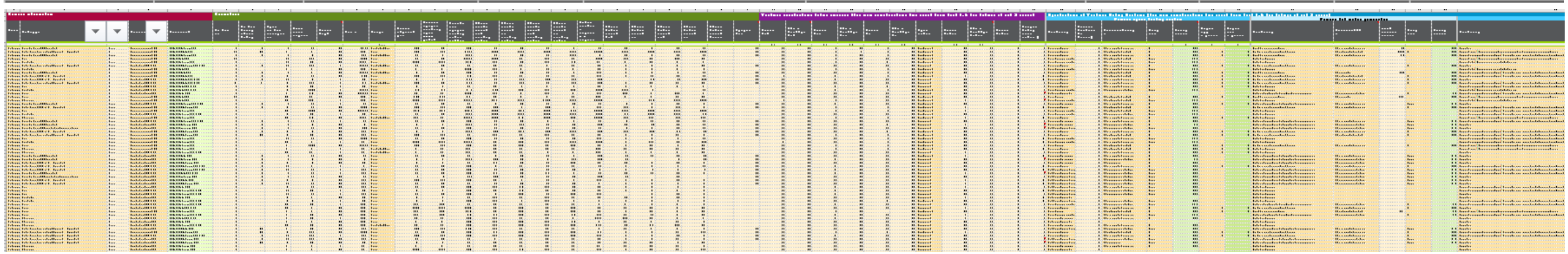
Number of stories	Number of dwellings	Typical number of occupants / users	Net floor area	Clear room height	Volume	Roof type	Area floor slab (ground plate)	Roof area opaque	Façade area opaque	Share of facade oriented north	Share of facade oriented east	Share of facade oriented south	Share of facade oriented west	Window area	Share of windows oriented north	Share of windows oriented east	Share of windows oriented south	Share of windows oriented west	Share of windows oriented horizontal	Opaque doors	Ratio Floor / Ground	Ratio Floor / Roof	Ratio Floor / Facade (excluding windows)	Ratio Floor / Facade (including windows)	A/V

C: Technical specifications building envelope

Thermal heat bridge - Slab	U-value - Roof	Thermal heat bridge - Roof	U-value - Wall	Thermal heat bridge - Wall	Type of window	U-value - Window	Thermal heat bridge - Window	G-value Windows	Avergae shading factor of windows (0-1)

D: Specifications of Technical Building Systems

Primary space heating system	Secondary space heating system	Primary hot water generator	Secondary hot water generator	Primary space cooling system	Secondary space cooling system	Ventilation	Photovoltaics	Lighting	Temperature set-points



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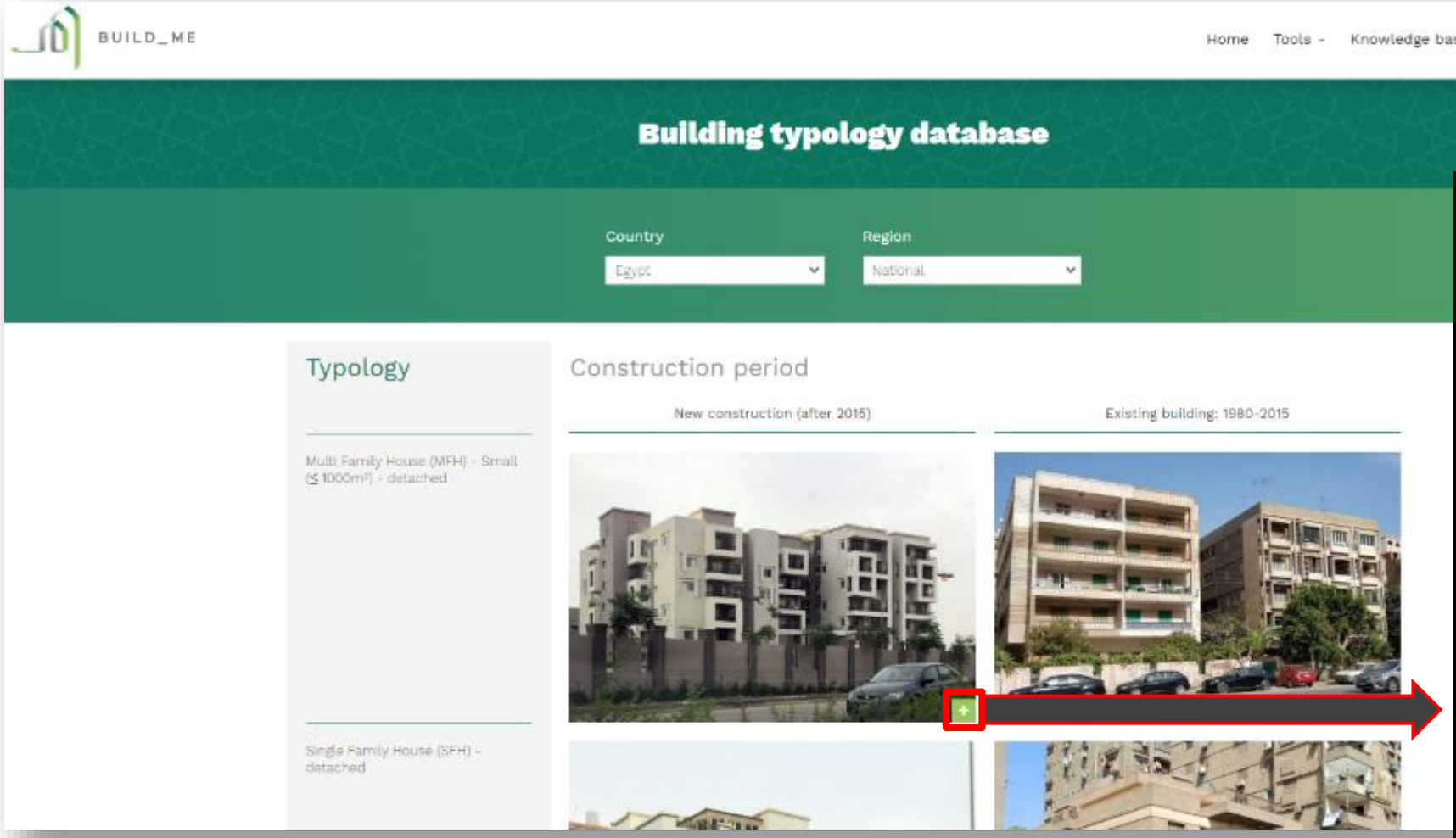
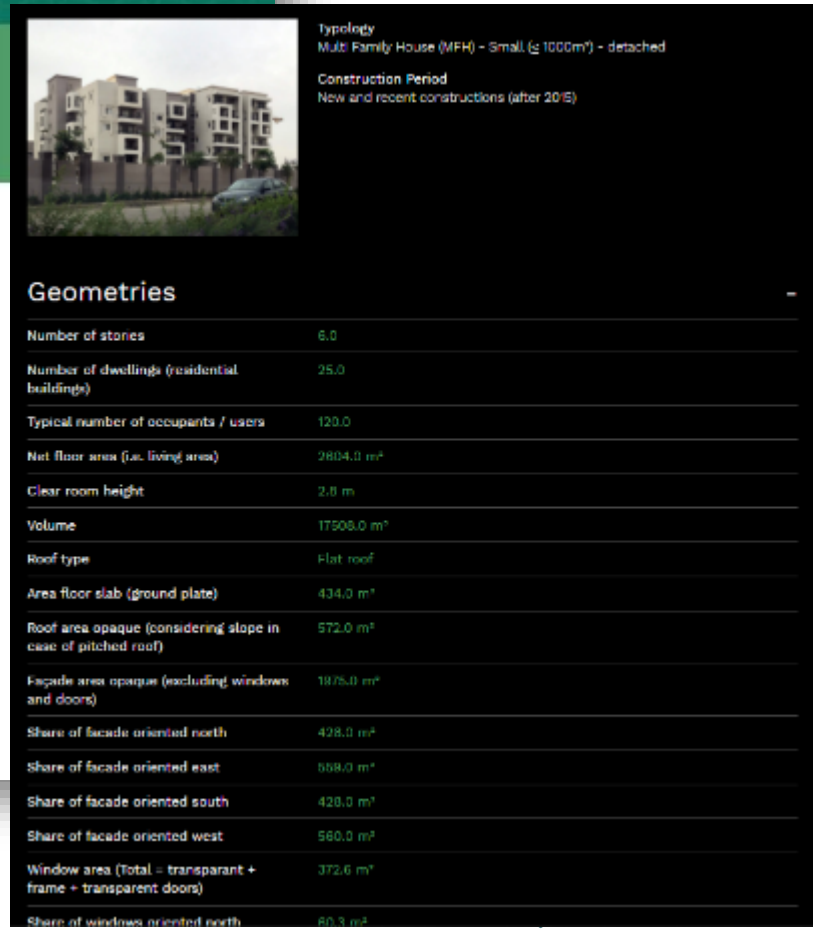
Visit the online BUILD_ME buildings typology

https://www.buildings-mena.com/typologies





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10 minutes

Logic of the BEP tool – *first intro as live to come*

Riadh Bhar, Guidehouse

Guidehouse BUILD_ME IDG MATRIX Integrated Development Group Engineering & Strategic Planning Consultancy

Objective of the BEP Tool

Easier access to financing for energy efficient buildings

How to design and finance an energy efficient project?

BEP Tool shows:

- ✓ [20-30]% energy saving in comparison with **baseline**
- ✓ Financing available at local bank

Intermediating **bank grants credit** based on trusted classification scheme

Project is realised as energy efficient building

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Logic of the BEP tool (2)

Customisable, transparent, adapted to the MENA region

In comparison to other available tools, the BEP tool is

MENA Specific

Up-to-date baseline in the 3 countries

Up-to-date cost data and prices based on market analysis

Updated energy consumption patterns for building types

Easy/Simple to use

No modelling needed

No advanced knowledge required

Allows for Editable Inputs and Third Variants' Addition

Can compare with codes/rating systems

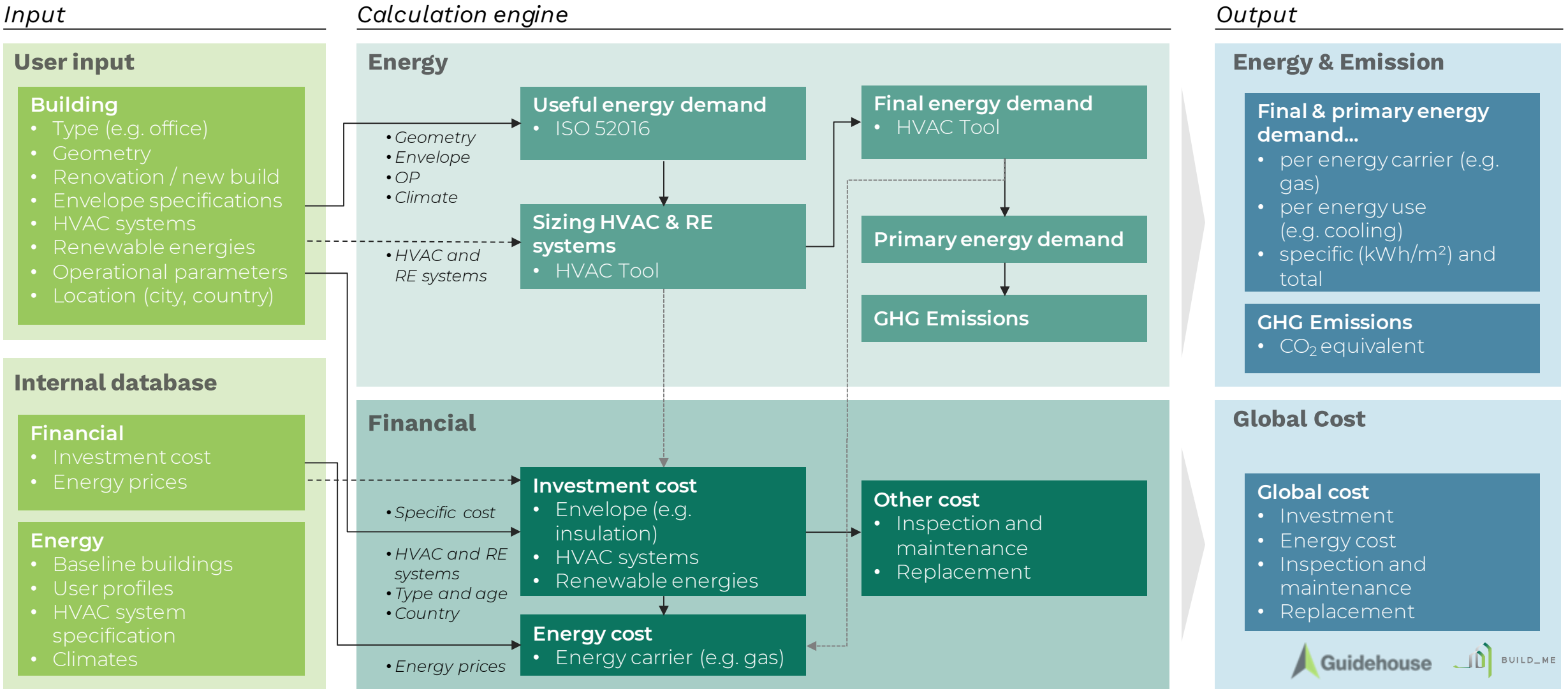
Useful for analysing the retrofitting option

Provides Detailed Explanation of the Results

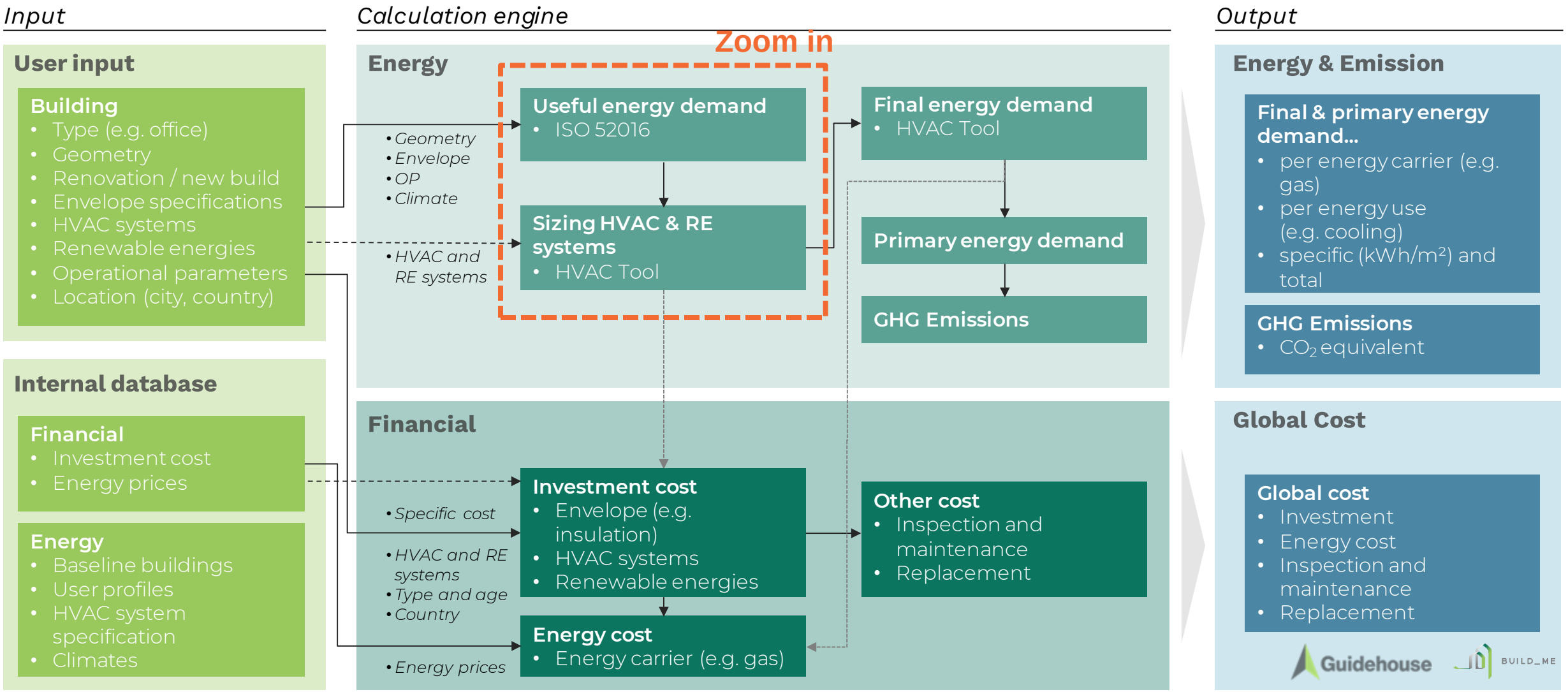
Can convert to primary energy outputs

Can show the distribution of CO2 savings per energy consumer

Calculation methodology



Calculation methodology



Calculation methodology – Zoom into: Useful energy H&C

Inputs

Building
- Type
  - User profiles
- Geometry
  - Area
  - Orientation
- Envelope specifications
  - Thermal transmittance (u-value)
  - Specific heat capacity
  - Absorption
  - Thermal heat bridge
  - Shading variant
  - Air change rate (Free ventilation, Infiltration)
- Operational parameters
  - Conditioned area
  - Set point temperatures for heating and cooling

Climate data
- External air temperature
- Solar irradiation per direction

Calculations

Internal heat gain
- Based on user profiles of different building types - considering no. of occupants, appliances etc

Solar heat gain
- Considering area of windows, direct and diffuse solar irradiance on windows and the shading reduction factor

Heat transfer through Ventilation
- Based on the heat capacity of air per volume and the air change rate

Heat transfer through thermal heat bridge
- Based on the heat transfer coefficient for thermal bridges

Heat transfer through building elements
- Based on the geometry, u-value, specific heat capacity and absorption

Output

Total internal gains
Internal heat gain + Solar heat gain

Total heat transfer
Heat transfer through Ventilation + Heat transfer through thermal heat bridge + Heat transfer through building elements

Internal air temperature
Based on total internal gains and heat transfers

Heating and Cooling energy demand
Based on internal air temp, internal operative temp, and operational parameters of the building

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Calculation methodology – Zoom into: Final Energy

Inputs (Results of previous calculations)

Useful energy demand
- For space heating
- For cooling
- For hot water

Additional Inputs

User Profiles
- For lighting
- For hot water

HVAC systems

- Systems in use
- Efficiency class

RE systems

- PV system in use and module area
- Solar thermal system for hot water

Calculations

Dimensioning of HVAC systems
- Based on useful energy demand, efficiency (COP, EER, etc), user profiles, and operational parameters

Dimensioning of distribution systems
- Considering the pipe length and specific heat loss

Auxiliary energy need
- Based on the HVAC systems and operational parameters

Energy need Lighting
- Based on the lighting technology and the user profiles

RE Production
- From PV (Based on the solar irradiance and PV system parameters)
- Solar thermal system (Based on the system)

Output

Final energy demand of HVAC systems

Useful energy demand / Resulting Efficiency

Energy demand for lighting and auxiliary systems

Energy need for auxiliary systems for Space heating and hot water

Total final energy demand

Sum of all final energy demands

Remaining final energy demand

Total FE demand – demand covered by RE

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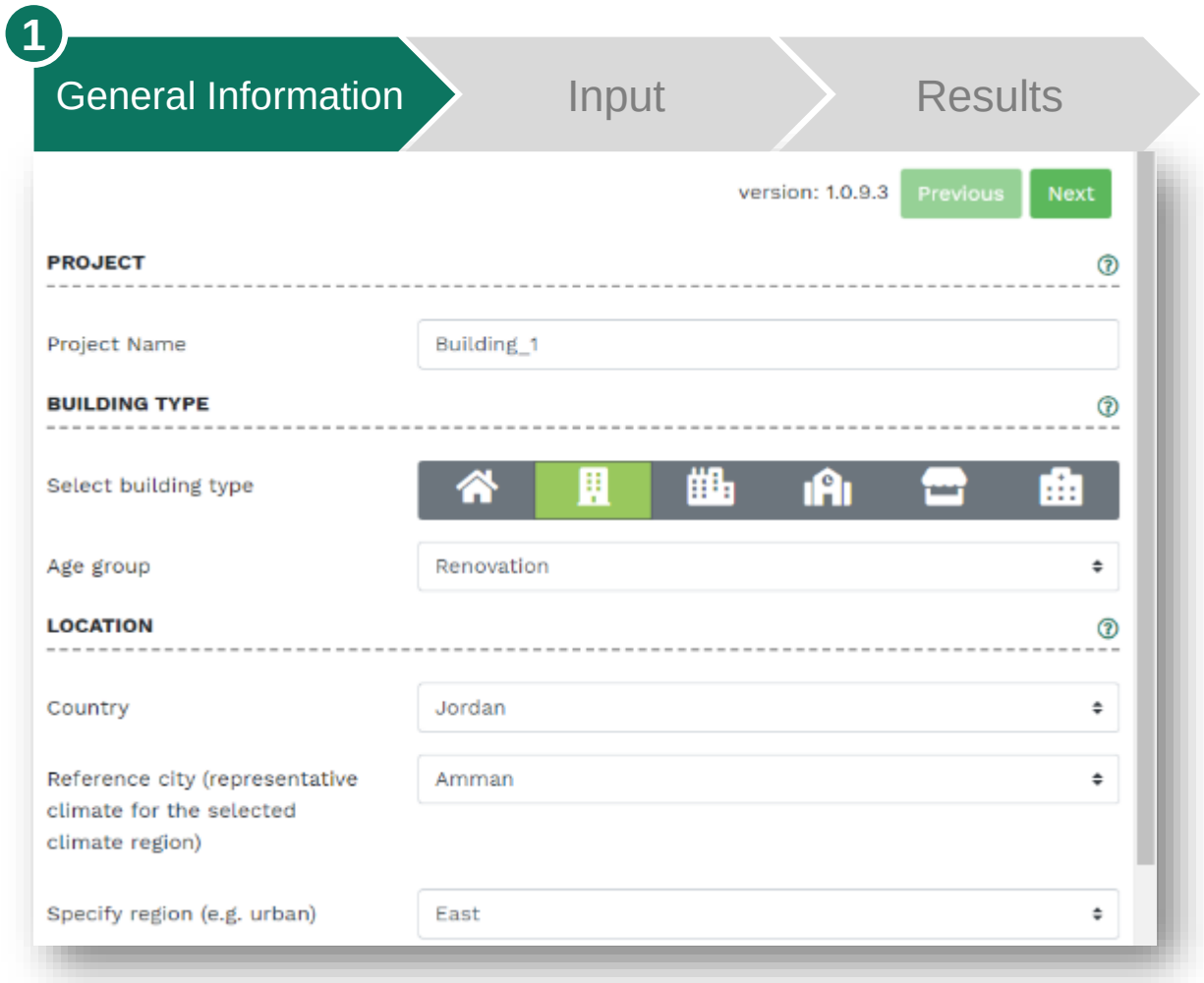
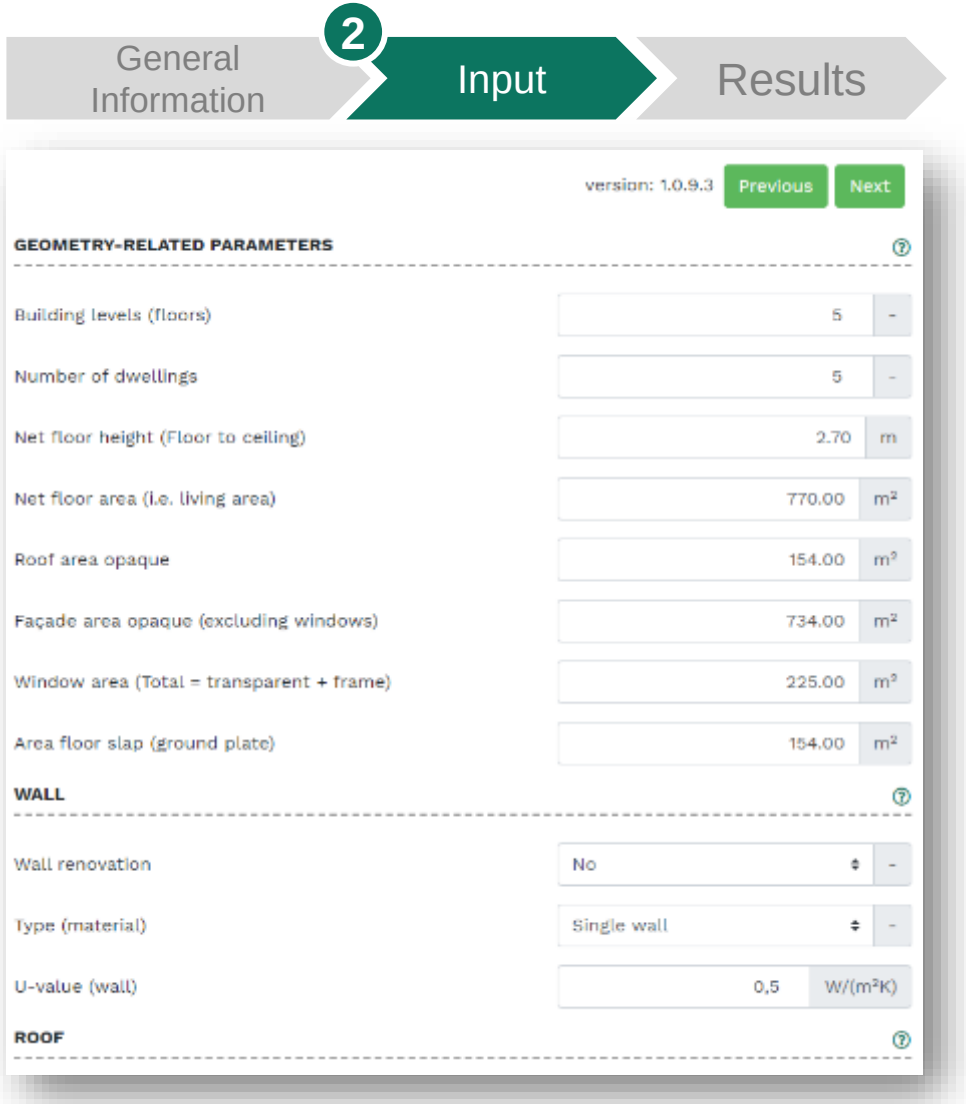
Online Web App - Input





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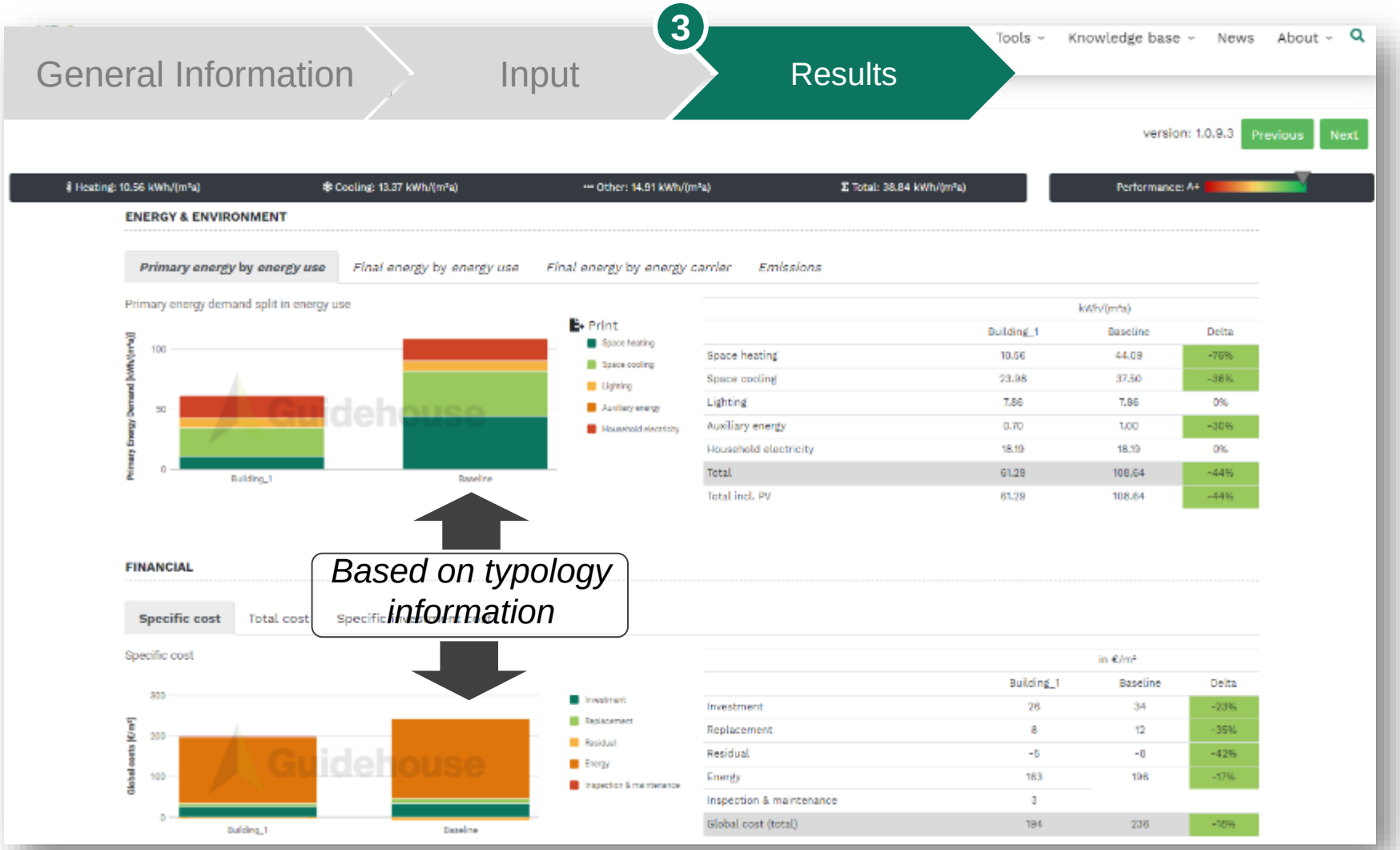
Online Web App – Results



Online Web App – Results detail

1| Quick overview

The main facts.

2| Output selection

4 tabs to select the energy performance indicator.

3| Overview chart

Comparison to the baseline building.

4| Results table

Detailed results in numbers.

5| Baseline building

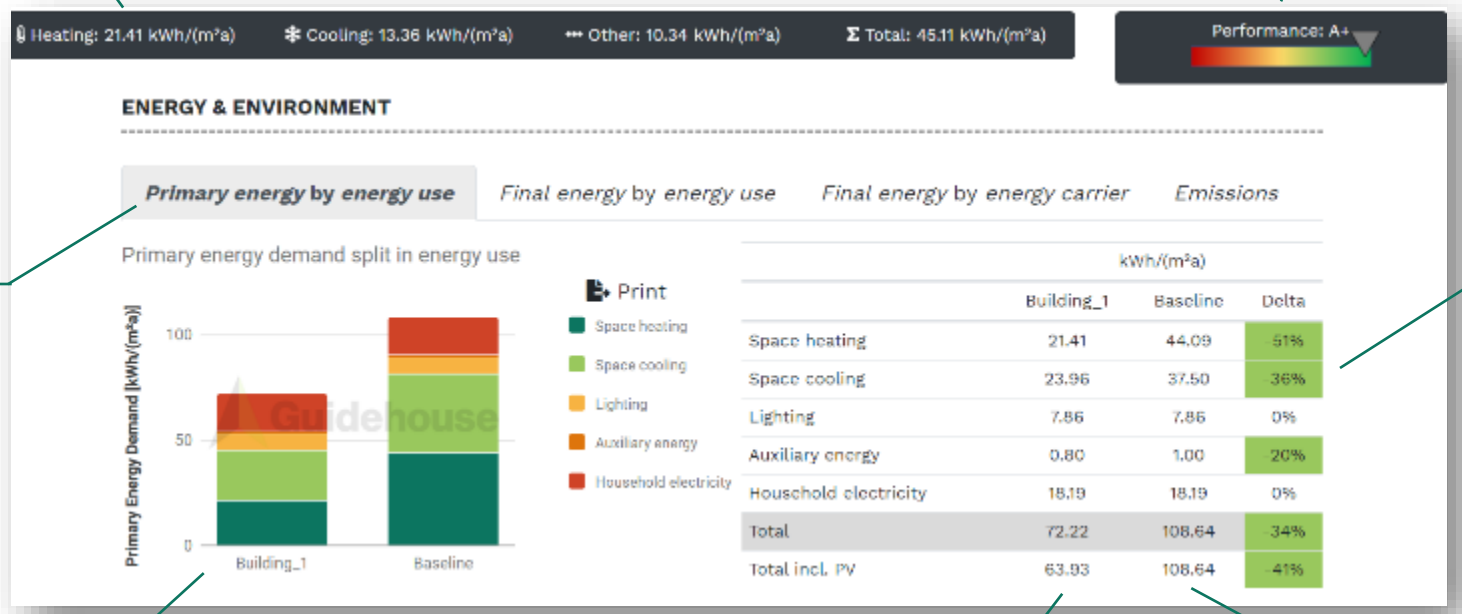
Detailed results of the baseline building.

6| Comparison

Difference to the baseline buildings.

7| Performance rating

C = equal to baseline



Tested BEP Tool with 13 supported pilot projects

Project developer confirmed convincing result illustration and user friendliness

Lebanon

Frames / Baasir

Collège Notre Dame De Nazareth

Kye Beachfront Resort

City Towers Project

KLEOS / Ashrafieh Appartments

Arcade Suites II

Egypt

Cairo West Residence

Beverly Hills - 229

Palm Hills, Badya

Palm Hills, Alexanderia

New Mansoura university

Misr Alghad

Jordan

KONN Modular Houses

Dar Al-Oqoud, Amman (Jordan)

Private Residence

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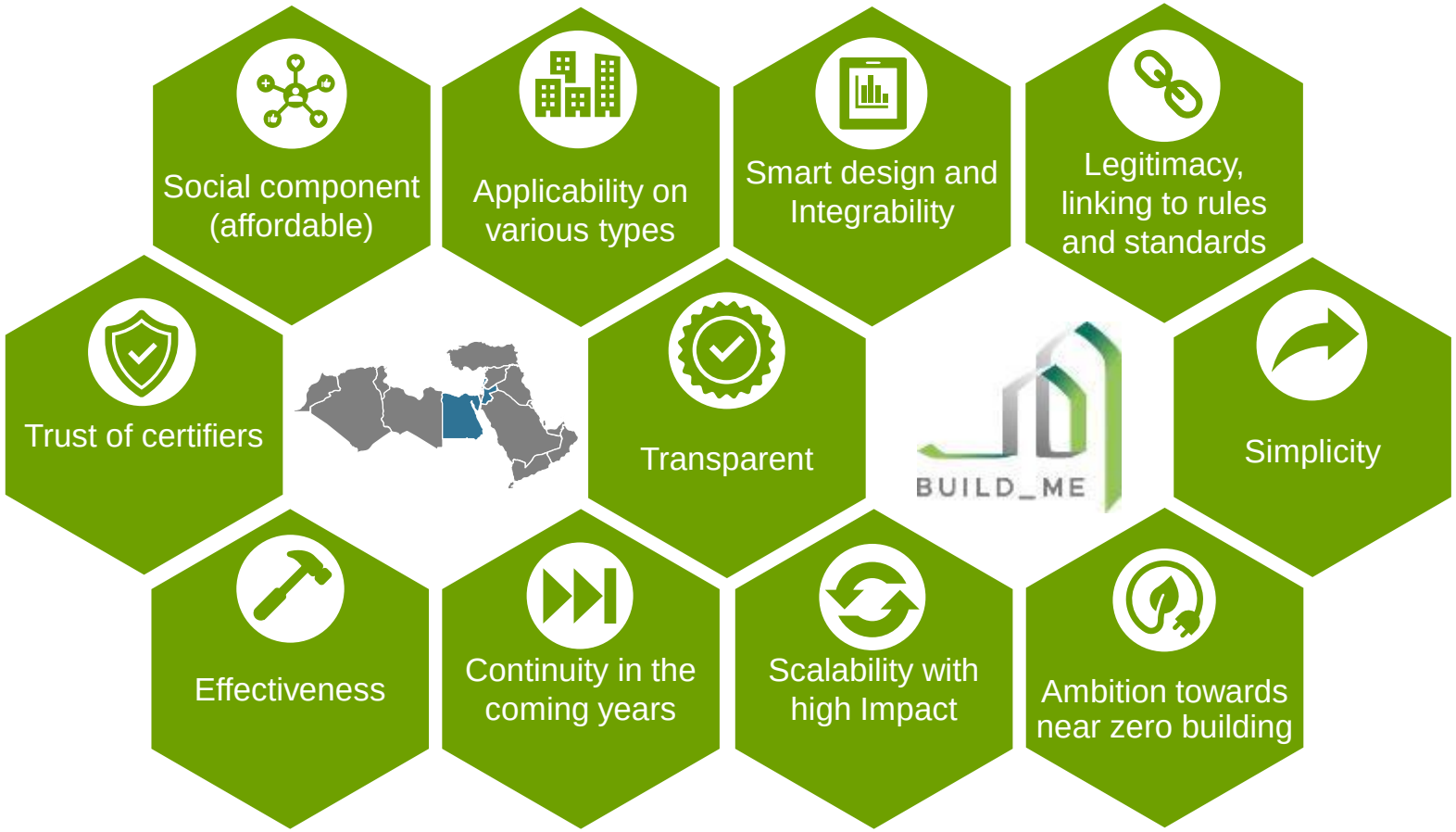
Conclusion BEP Tool

Developed for the MENA region: Database from **local partners** & **international** calculation methodology



Internal market data is **collected from local partners** for Egypt, Jordan and Lebanon.

International energy calculation methodology.

Country specific climate data, incl. multiple climate zones within each country.

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15 minutes

Development of energy performance measurement and EPC scheme

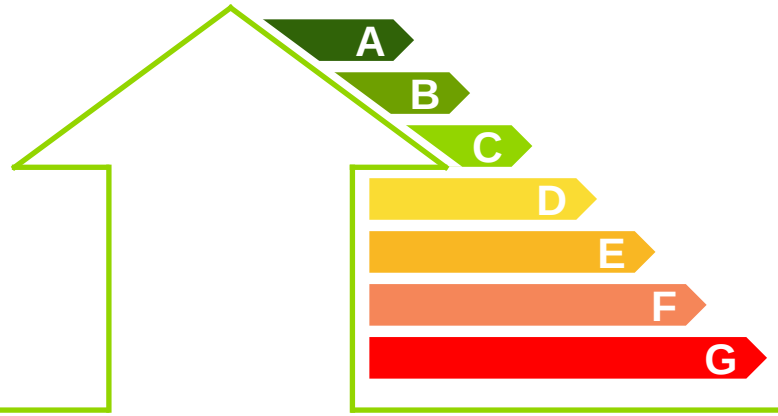
Mohamed Salheen, IDG

Guidehouse BUILD_ME IDG MATRIX Integrated Development Group Engineering & Strategic Planning Consultancy

Definition

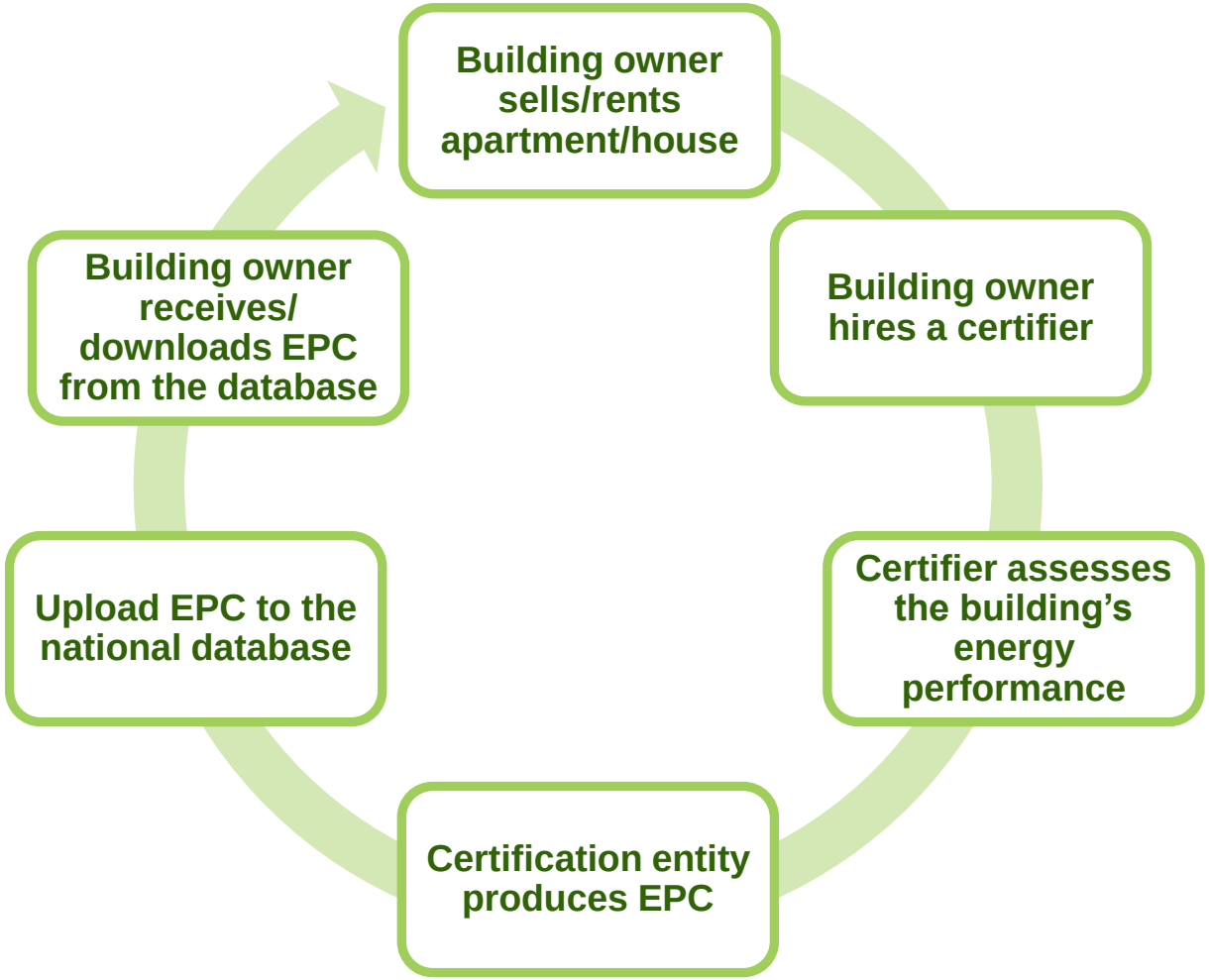
Energy Performance Certificate

“Energy performance certificates (EPC) indicate the energy performance of a building or a building unit, calculated according to a methodology complying with the common general framework adopted at the national or regional level” [EPBD]



How does it work?

Energy Performance Certificate



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Objectives and scope of the Energy Performance Certificate (EPC)

The BEP tool connected with EPC for easier facilitating of Green finance

Customized for the local conditions

The EPC and BEP tool and the EPC will provide a new channel for project developers interested to construct EE projects. (no competition with the existing schemes).

Energy Focused

The EPC and BEP tool focus on energy savings and the associated GHG emissions.

Locally managed by official entities

The EPC and the tool well be managed and owned by the official entities (HBRC) responsible of implementing the codes and/or the construction sector.

Voluntary EPC towards mandatory

The EPC will initially start as a voluntary scheme.

Ensuring a transition to mandatory scheme – relevant to become one of the key policy instruments

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Roadmap formulation for setting the new EPC Scheme

Energy Performance Certificate

1. Ownership and management
2. Certification scheme
3. Operational framework
4. Testing and roll-out
5. Evaluation and update

Roadmap formulation for setting the new EPC Scheme

Energy Performance Certificate

1 Ownership and management

- Defining goals
- Developing a governance model
- Defining the legal framework
- Creating brand value
- Provide guidance documents
- **Defining a certification and verification model**
- Maintaining a database or register with the certification results
- Communication to the public and building industry stakeholders

2 Certification scheme

- **Scope of the scheme**
- Target Market
- Rating score
- Derivation of the energy performance
- Updates and validity of assessment
- **Design of the certificates**
- Database
- Cost of the certification
- Engagement with stakeholders

3 Operational framework

- **Certification and labelling process**
- Computational model for the rating
- Set of award criteria for certification
- **Set of criteria to be an assessor**
- Design of the label
- Verification, monitoring, surveillance and enforcement (including penalties)

4 Testing and roll-out

- Phased implementation
  - Building sector
  - Professionals
  - Target groups
- **Capacity building programmes**

5 Evaluation and update

- Regulatory impact assessment (ex-ante evaluation)
  - Costs
  - Benefits
  - Regulatory context needed
- Plan and mechanism for evaluating the effectiveness of the scheme (ex-post evaluation).

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Energy Performance Certificate for Egyptian buildings

Boundary conditions of framework

Scope

- New buildings
- (SFH, small and large MFH, offices – later schools, hotels)

Target Market

- Residential buildings: Single family houses SFH and Multi-family houses MFH.
- Offices and schools

Deriving energy performance

- Asset rating; as designed.

Updates and validity of assessment

- 3 to 5 years.

Energy Performance Certificate for Egyptian buildings

Rating score

Rating scores inspired by EN 15217 Standard and market needs

Class	Term	Score
A+	better than the Energy Performance Regulation Reference (+75%)	≤ 0.25
A	better than the Energy Performance Regulation Reference (+50%)	0.26 - 0.5
B	better than the Energy Performance Regulation Reference (+25%)	0.51 – 0.75
C	**1 stands for the Energy Performance Regulation (new buildings according to EEBC / national Build_ME baseline)**	**0.76 - 1**
D	between the Energy Performance Regulation Reference, and the Building stock reference	1.01 – 1.5
E	Building stock reference starts here	1.51 - 2.0
F	poorer than the Building Stock Reference	2.01 – 2.5
G	poorer than the Building Stock Reference	> 2.5

10 minutes

EPC certification, roles and process

Ashraf Kamal, HBRC

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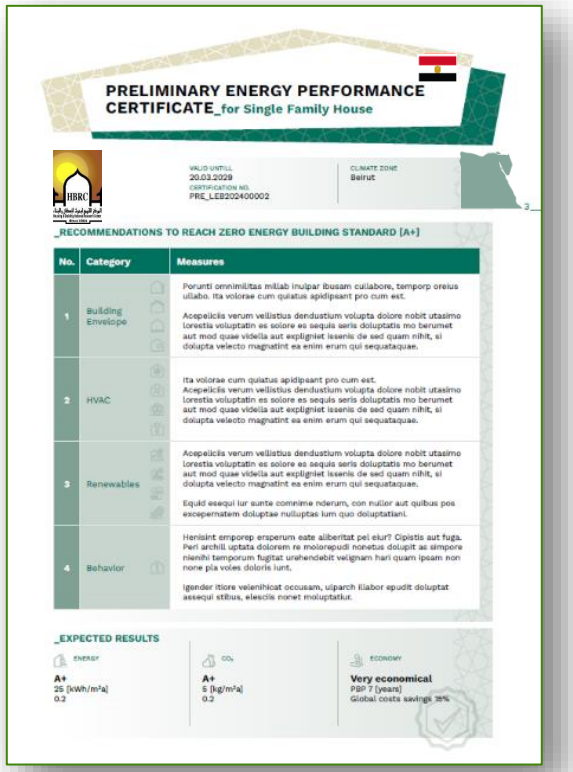
Output of the BEP tool

Energy Performance Certificate (Preliminary)

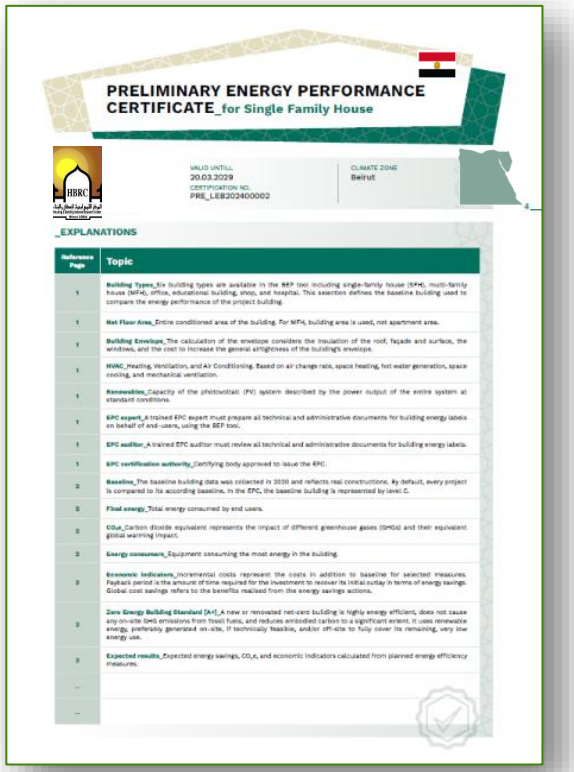
General building info

KPIs

Recommendations



Explanations



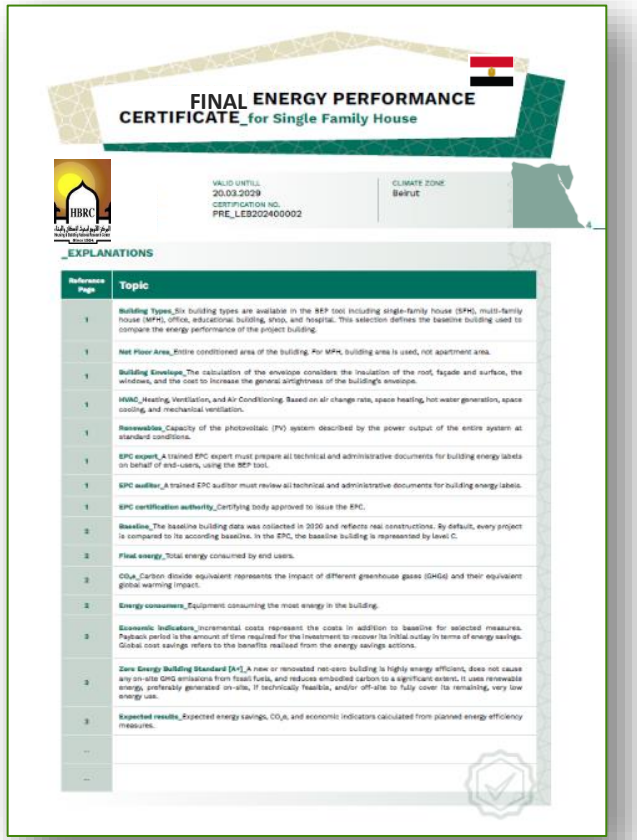
Output of the BEP tool

Energy Performance Certificate (Final)

General building info

KPIs

Explanations



Scope
Functions & Roles

EPC Expert
In collaboration with Project Developer + Project Team

- Register for EPC certification
- Perform calculations via EPC software (BEP tool)
- Prepare & submit documentation to Auditor
- Provide clarifications & coordinate site visits

EPC Auditor

- Review & approve application and supporting documents
- Recommend certification to Scheme Operator
- Perform site visit post construction

EPC Scheme Operator

- Lead and Manage EPC process
- Issues EPC certificate
- Provides quality assurance
- Trains EPC Experts and Auditors

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Independent at Project Level

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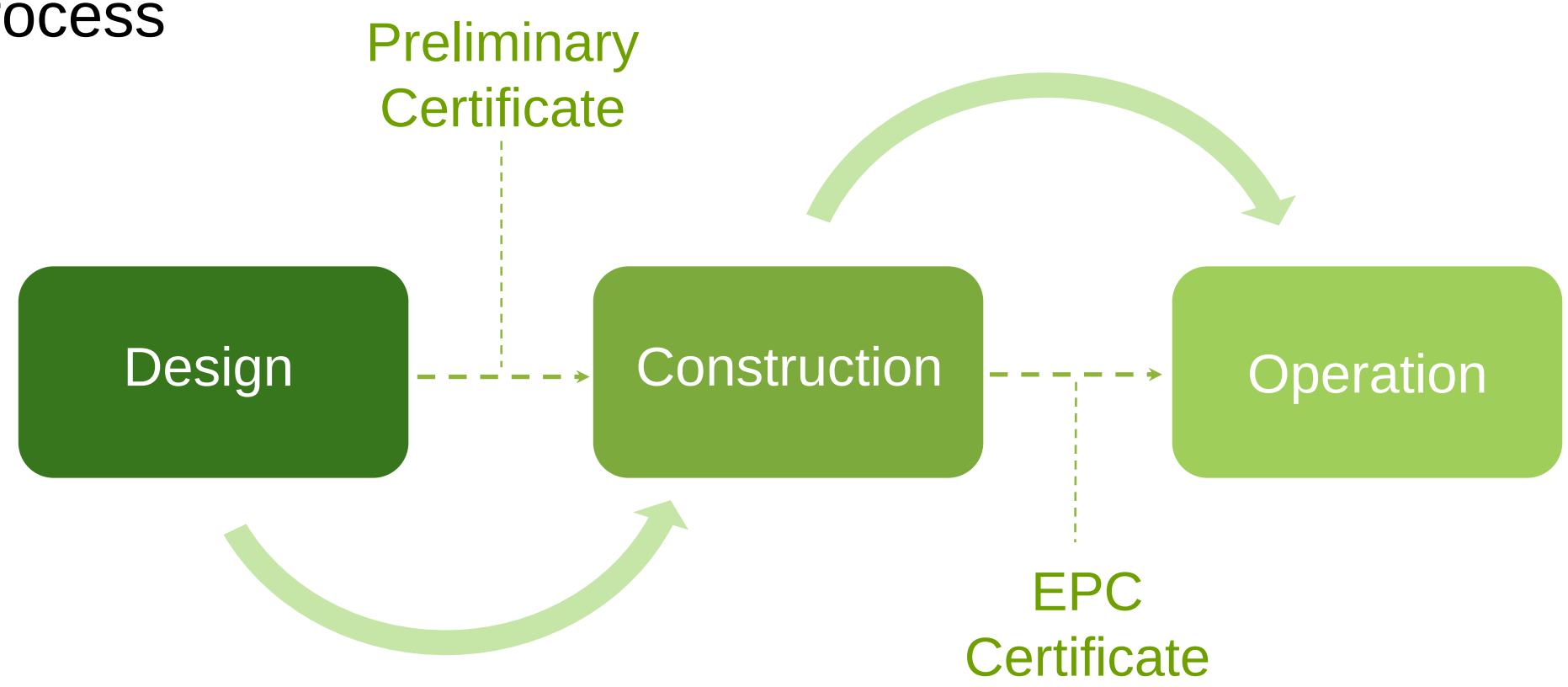
Scope

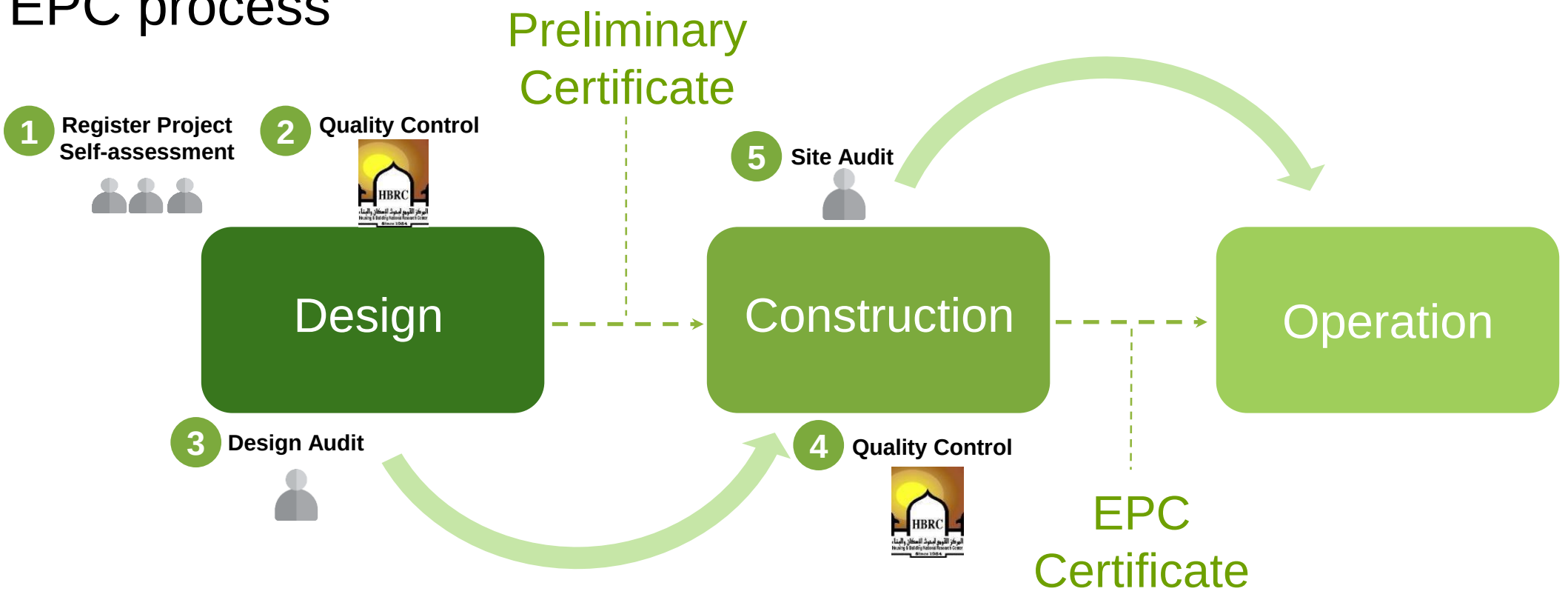
EPC process



Initial **Preliminary Certificate** for design stage and a final **EPC Certificate** after construction stage. There is no EPC certificate for operation stage.

Scope

EPC process



Initial **Preliminary Certificate** for design stage and a final **EPC Certificate** after construction stage. There is no EPC certificate for operation stage.

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Process in detail

EPC process

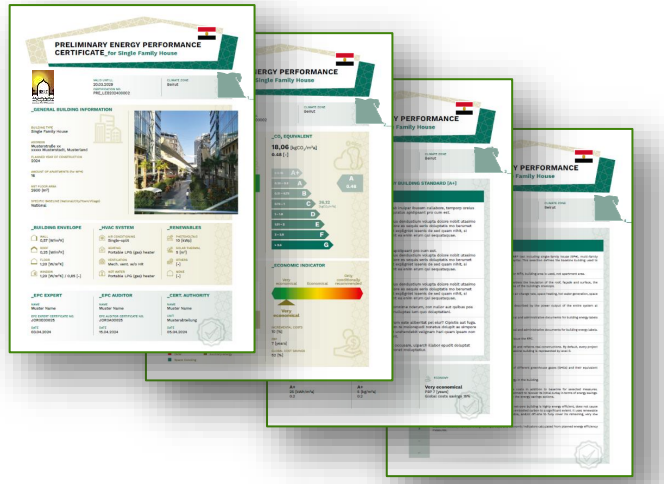
Expert Hiring

- Project Registration
- Design Inputs into EPC
- Design Documentation Submission

Auditor Review

EPC Check by HBRC

Preliminary Certification



As-Built Inputs into EPC

Project Final Registration

As-Built Documentation Submission

Auditor Review and Site Audit

EPC Final Check by HBRC

EPC Certification

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Case study: Palm Hills, Badya

Comparative overview

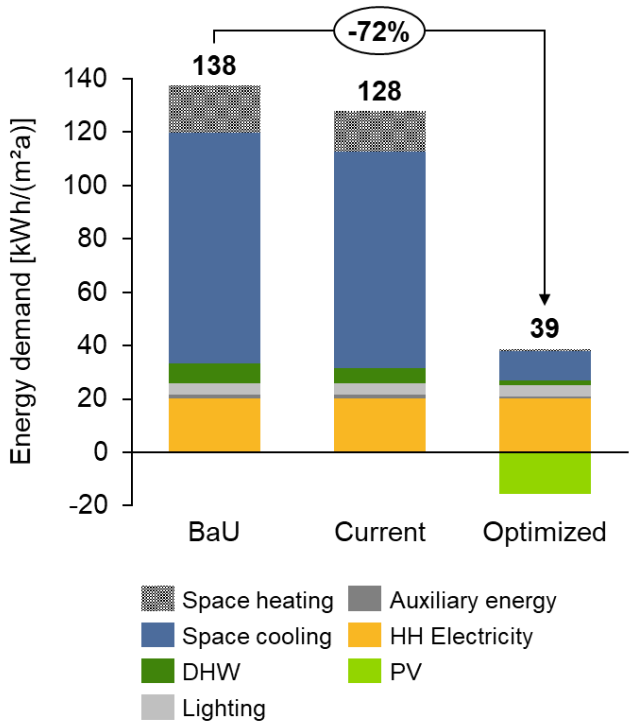
Results of a Egyptian MFH in final energy demand [kWh/m²a] and global cost

The suggested measures of the selected package and the optimized lead to a **significant decrease in energy demand and cost savings.**

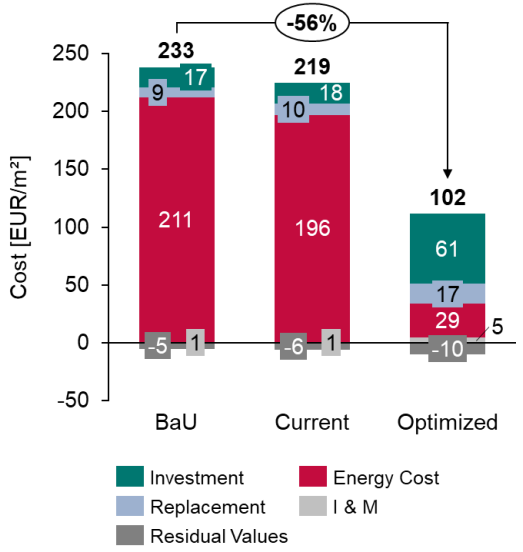
Savings compared to BaU

Variants	Energy	Costs
Optimized	72%	56%

Final Energy Demand



Global Cost



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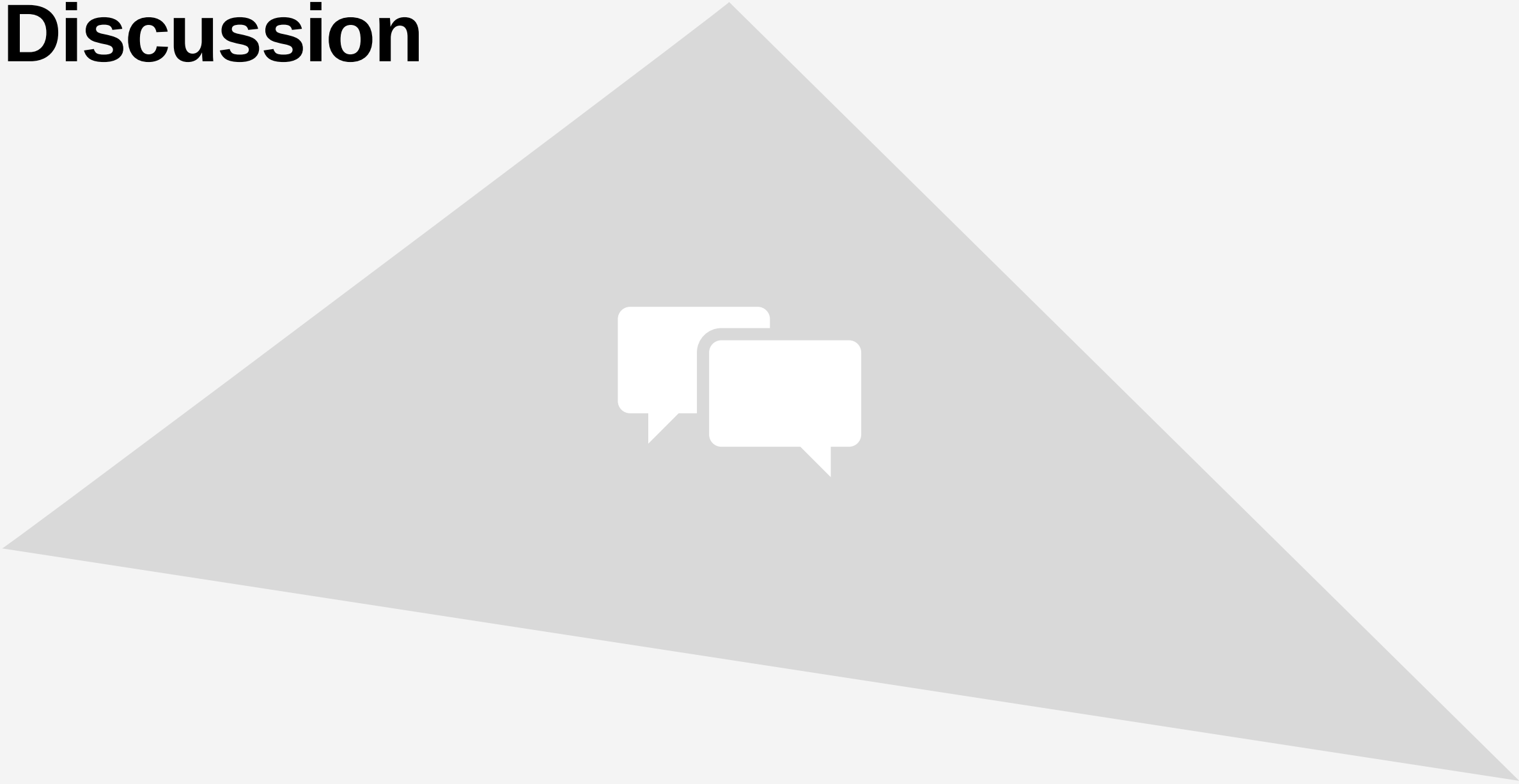
Discussion



Agenda

Part 2: Interactive Session	**1h**
Hands-on training – *BEP tool walk-through*	45 min
Wrap Up – *why engage with BUILD_ME, Outlook*	15 min

45 minutes

Hands-on training: BEP tool walk-through

Jince John, Guidehouse

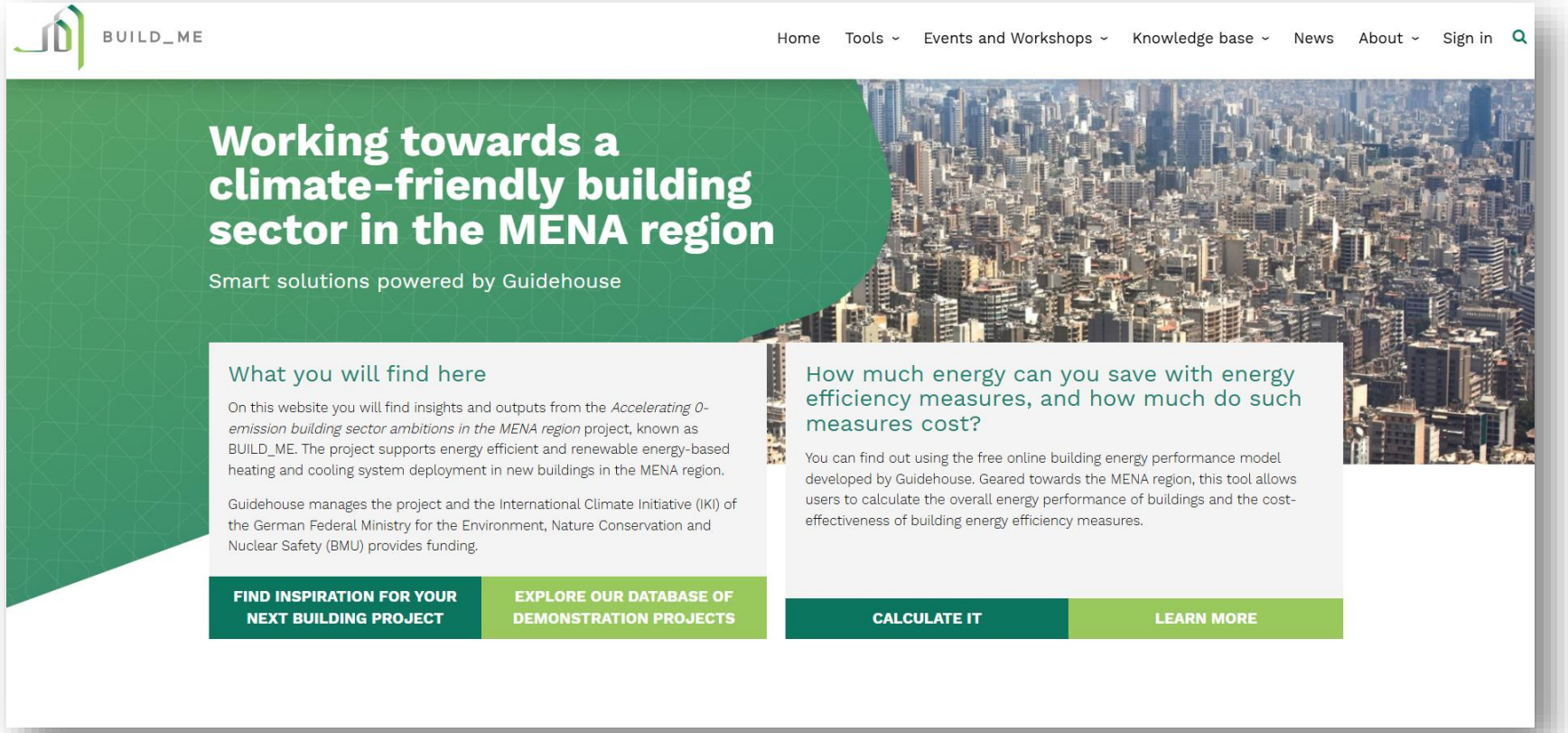
Guidehouse

BUILD_ME

IDG MATRIX
Integrated Development Group
Engineering & Strategic Planning Consultancy

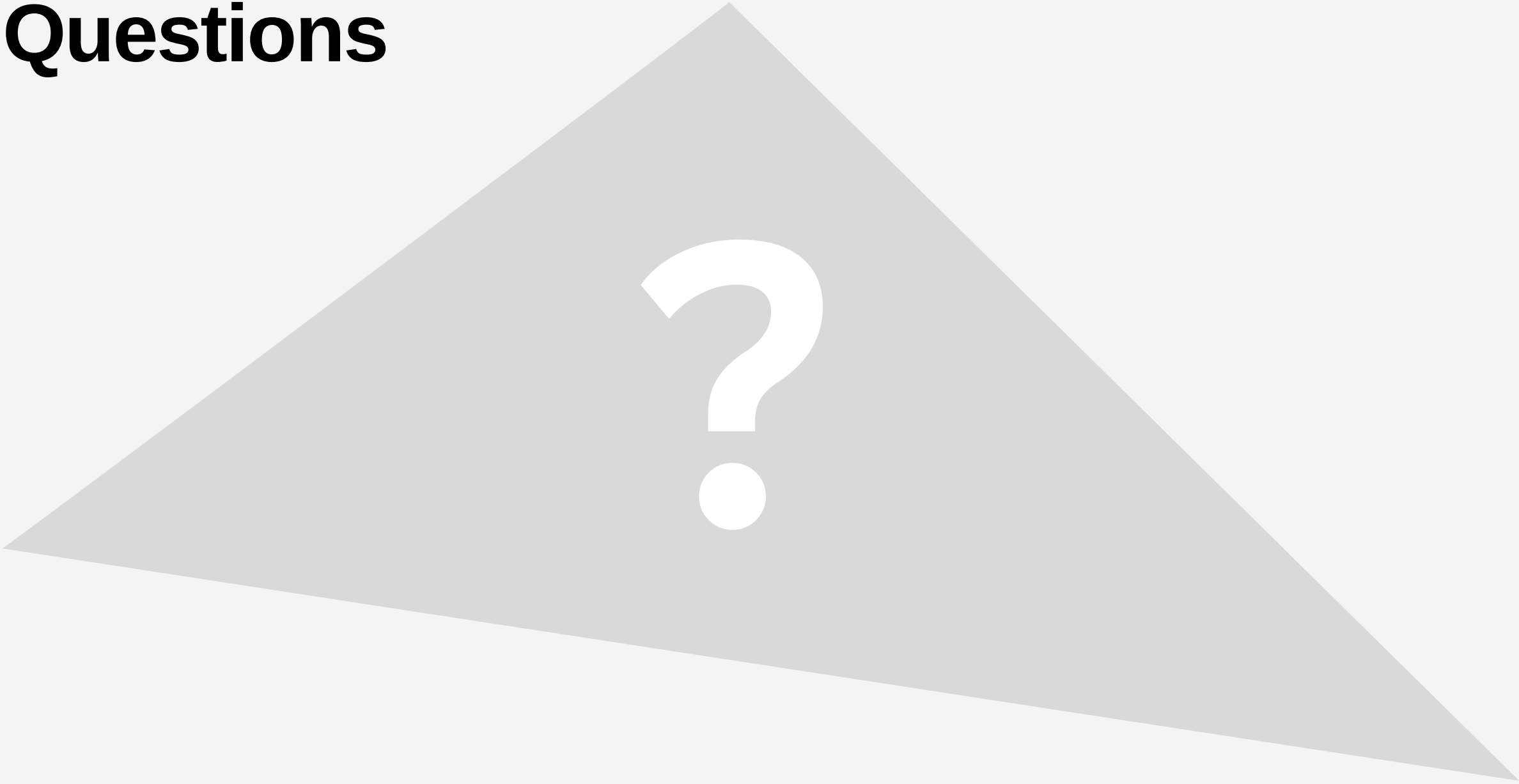
Walk through the website

www.buildings-mena.com



[Towards a low-carbon building sector in the MENA region - BUILD_ME (buildings-mena.com)]

Questions



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10 minutes

Why engage with BUILD_ME

Mohamed Salheen, IDG
Ashraf Kamal, HBRC

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Benefits for financial institutions

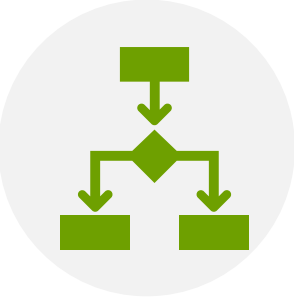
Why engage with BUILD_ME?

Provides Transparency

- Provides robust and comparable results to assess the building energy efficiency.
- Well-established governing system including experts, editors, and banks.

Acts as a basis for decision making

- To govern the building sector and drive it towards energy efficiency.
- Tested and operated in several countries.



Helps to assess and “green” your own portfolio management

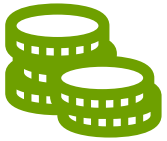
- Provide decision-useful information for the policy makers.
- Clear criteria for FIs and banks to qualify projects for green finance.

Benefits for project developers

Why engage with BUILD_ME?

Learn how to **conceive low energy buildings**

Assess cost benefits of energy efficiency and renewable energy measures



Potential **financial support**

Enhance **project visibility**

manage energy use, costs and productivity in your buildings

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Conclusion

Why does the EPC will bring in added value for Egypt

Prepared for Egypt

Developed by national and international experts

- Robust international norm (ISO 52016) adapted to the Jordanian context.
- Trusted by experts and financial institutions (GGF, EBRD etc.)
- Will be handed over to national authority with full rights allowing possible further development.

Energy focused

Certificate focusing only on Energy

- Coexistence and complementarity with other sustainable schemes.
- Less complexity and higher implementation chance.
- The addition of the economic analysis, fast and visual – was highly welcomed by project developer.

Linked with finance

Link with international and national financial institutes

- To accelerate the access to finance of EE buildings.
- Affordable prices for project developer due to slim, smooth and automized process.
- Create new jobs (EPC experts, EPC auditors).

Policy instrument

Important national policy tools in the built environment

- Leads to transparency regarding the energy consumption of buildings
- Allows targeted policy formulation (aggregation).
- In line with requests of global initiatives like buildings breakthrough (BBT) – Egypt joined at COP 28

Enabling the government to lead the accelerating finance to EE building sector

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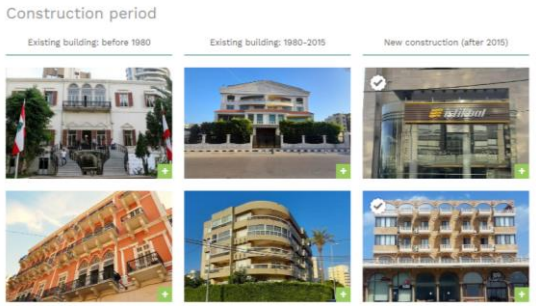
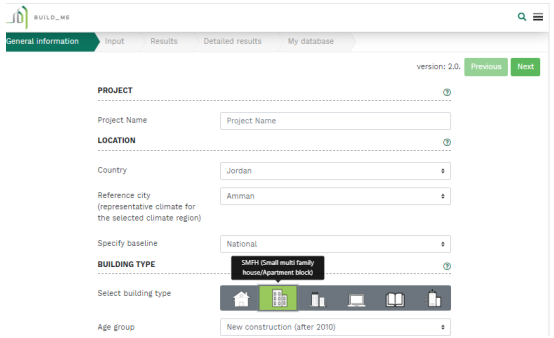
Achieved results

The BUILD ME approach resulted in a trustworthy and recognized scheme in Egypt



Building Typology

Representative of the building stock and covering different building types, different time periods, ages, and energetic characteristics.



User-friendly and online tool

To calculate the Building Energy Performance and financial Feasibility of the energy efficiency measures.

Officially Adopted

Building Energy Classification Scheme adopted in the countries of Jordan, Egypt and Lebanon.

Roll Out

more than 800 experts trained on the BEP tool and the establishment of capacity building programmes for EPC experts and auditors.

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5 minutes

Outlook; what are our next steps

Rana Mohamed, IDG

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Trainings

Concept of target orientated capacity building – 4 target groups

Finance & Project Developer

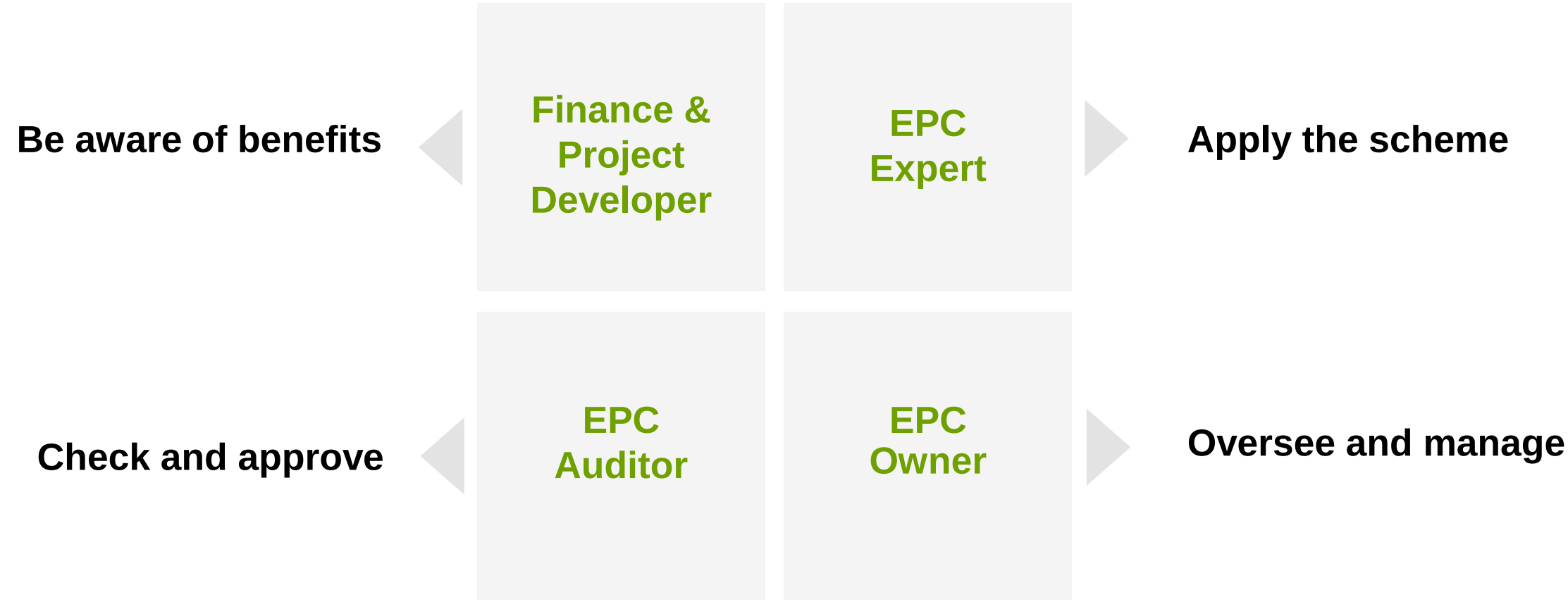
EPC Expert

EPC Auditor

EPC Owner

Trainings

Concept of target orientated capacity building – 4 target groups



Trainings
Objectives

- Increase awareness of the importance and financial attractiveness of investing in EE measures
- General understanding of the BEP tool and EPC scheme

Finance & Project Developer

EPC Expert

- Basic understanding of EE/RE measures and their impact on buildings energy performance
- Enable the utilization of the tool and reporting formats

- Understand the Audit process
- Enable utilization of the tool and reporting formats
- Assess whether the building meets the EPC requirements

EPC Auditor

EPC Owner

- Reporting and issuing of the EPC
- Supporting tools
- Issue and review tests / exams

Trainings

Eligibility criteria

EPC Auditor

- An EPC Expert or other equivalent certificates (e.g., EDGE, LEED and BREEAM)
- Hold a higher education qualification in a construction industry related field.
- +3 years of practical work experience in the construction industry.

EPC Expert

- Hold a higher education qualification in a construction industry related field.

Trainings planned dates

Physical – *8hr including exam*

EPC Expert

- Exam held one week after taking the training

Date: Wednesday, 27 November 2024

Venue: Housing and Building National Research Center – HBRC

El-Tahrir St. EL-Dokki, Building Nr. 87

Scan to register

Trainings planned dates

Physical – *8hr including exam*

EPC Auditor

- Exam held one week after taking the training

Date: Wednesday, 15 January 2025

Venue: Housing and Building National Research Center – HBRC

El-Tahrir St. EL-Dokki, Building Nr. 87

Survey

BUILD_ME Training - World Urban Forum (WUF12) - Cairo, Egypt

https://forms.office.com/r/ffMs0GeNvf

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Sign up for our **newsletter** by emailing us at **BUILD_ME@guidehouse.com**

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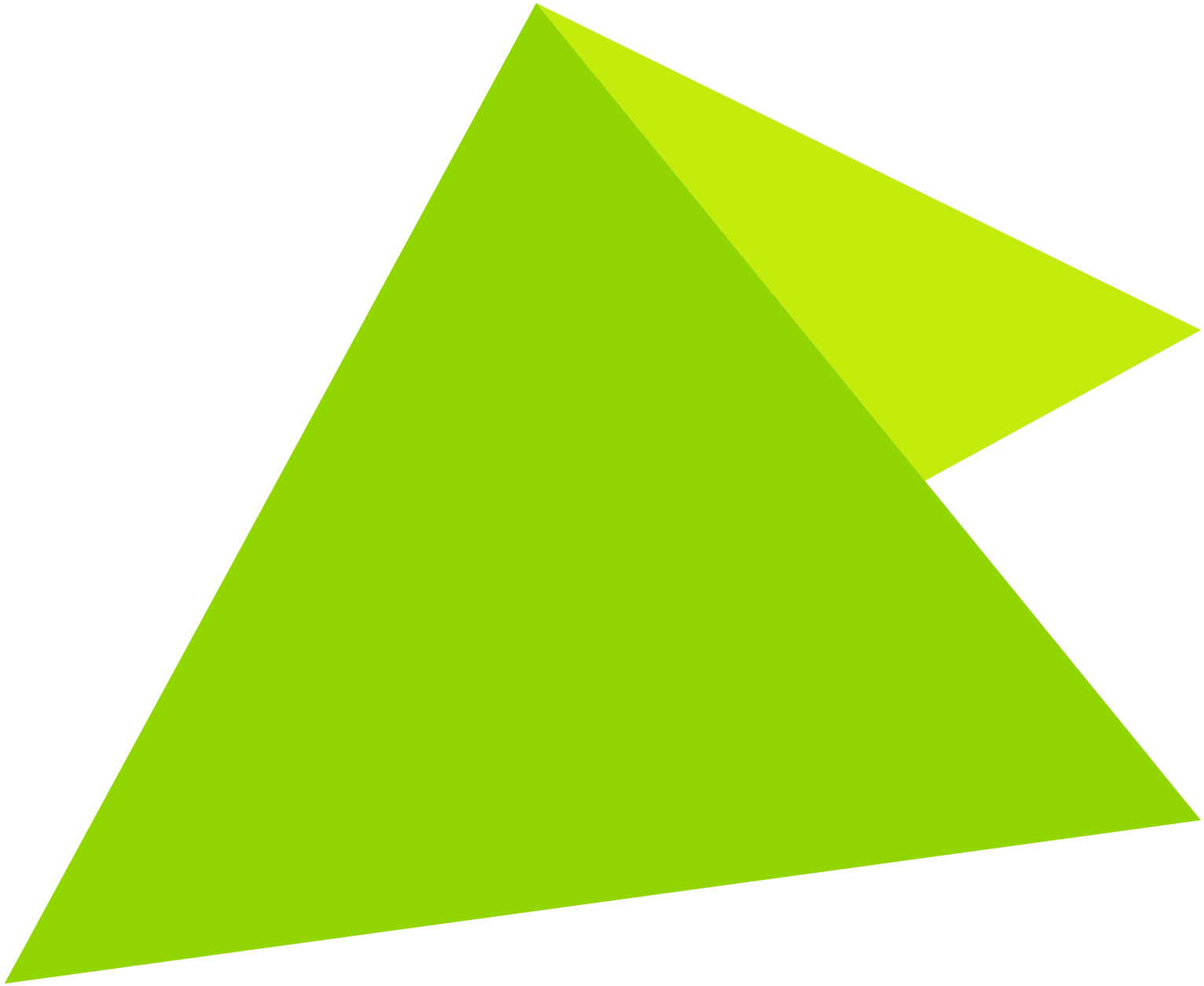

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