Methodology -8 building blocs

D4E- Facilitator -Guides for model uses

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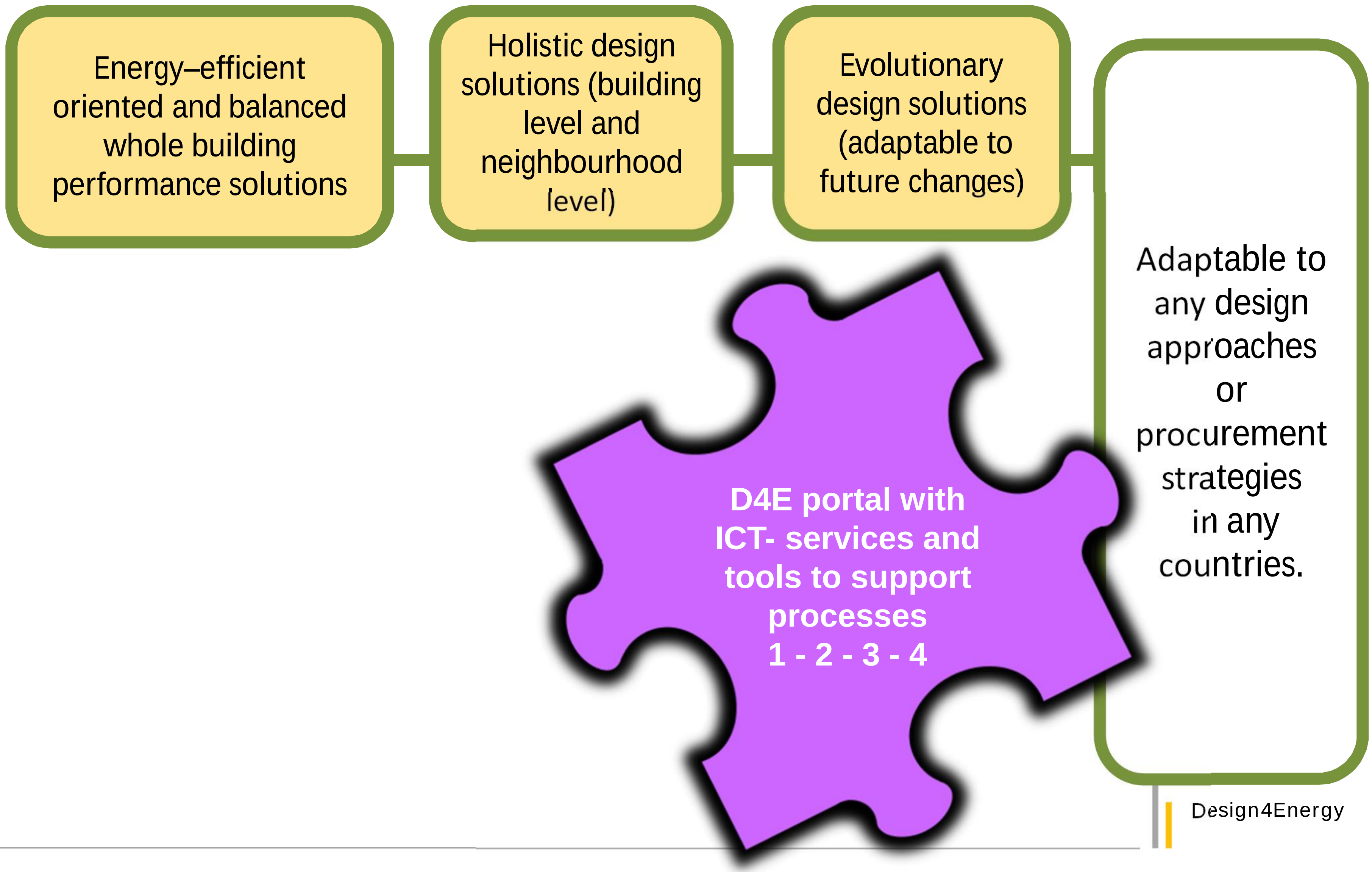
8 building blocks of the D4E methodology => D4E portal



8 building blocks of the D4E methodology => D4E portal

Process 4: Information and services to decision making process

Process 3: Performance based design process

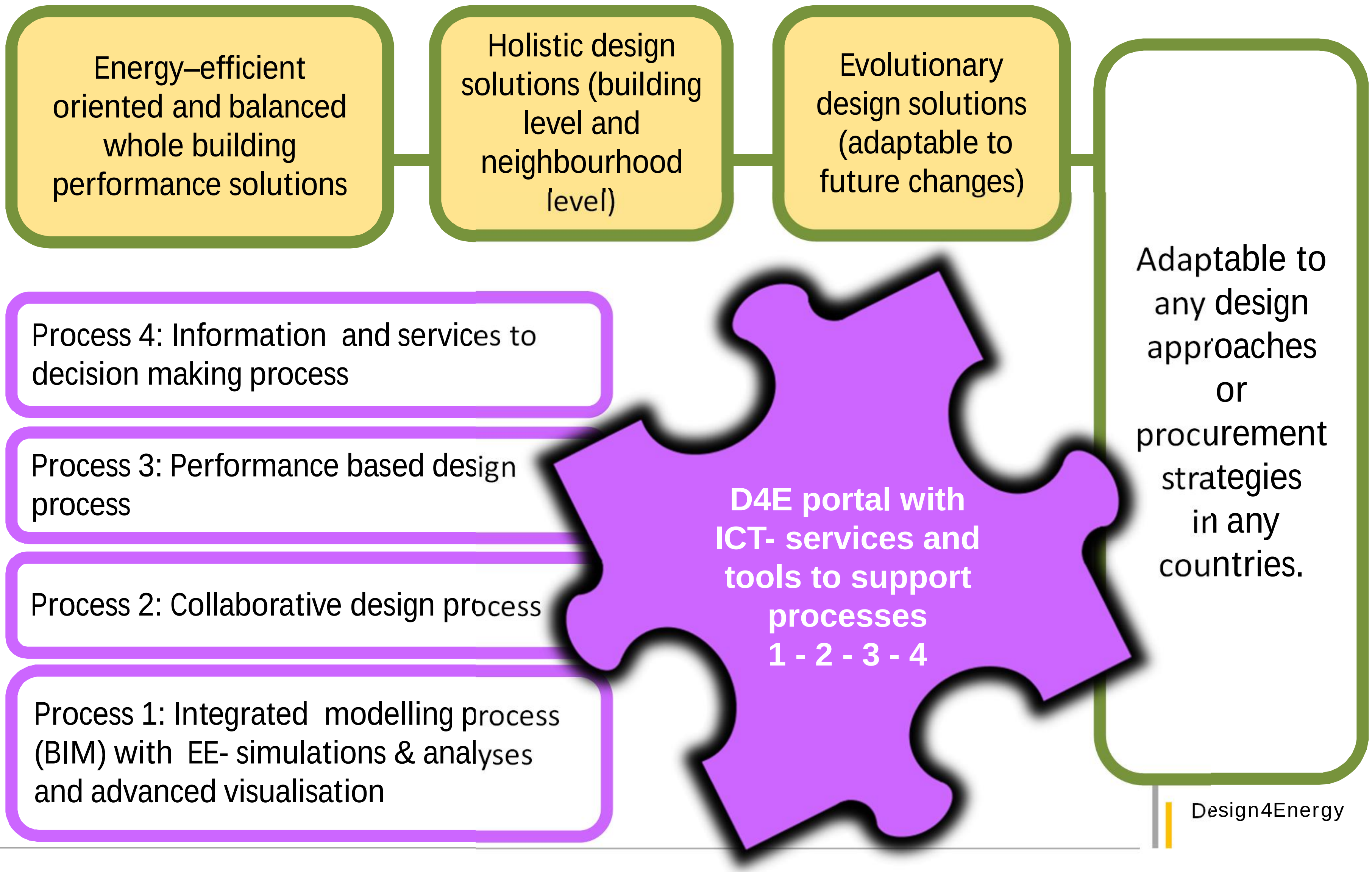
Process 2: Collaborative design process

Process 1: Integrated modelling process (BIM) with EE- simulations & analyses and advanced visualisation

D4E portal with ICT- services and tools to support processes 1 - 2 - 3 - 4

Adaptable to any design approaches or procurement strategies in any countries.

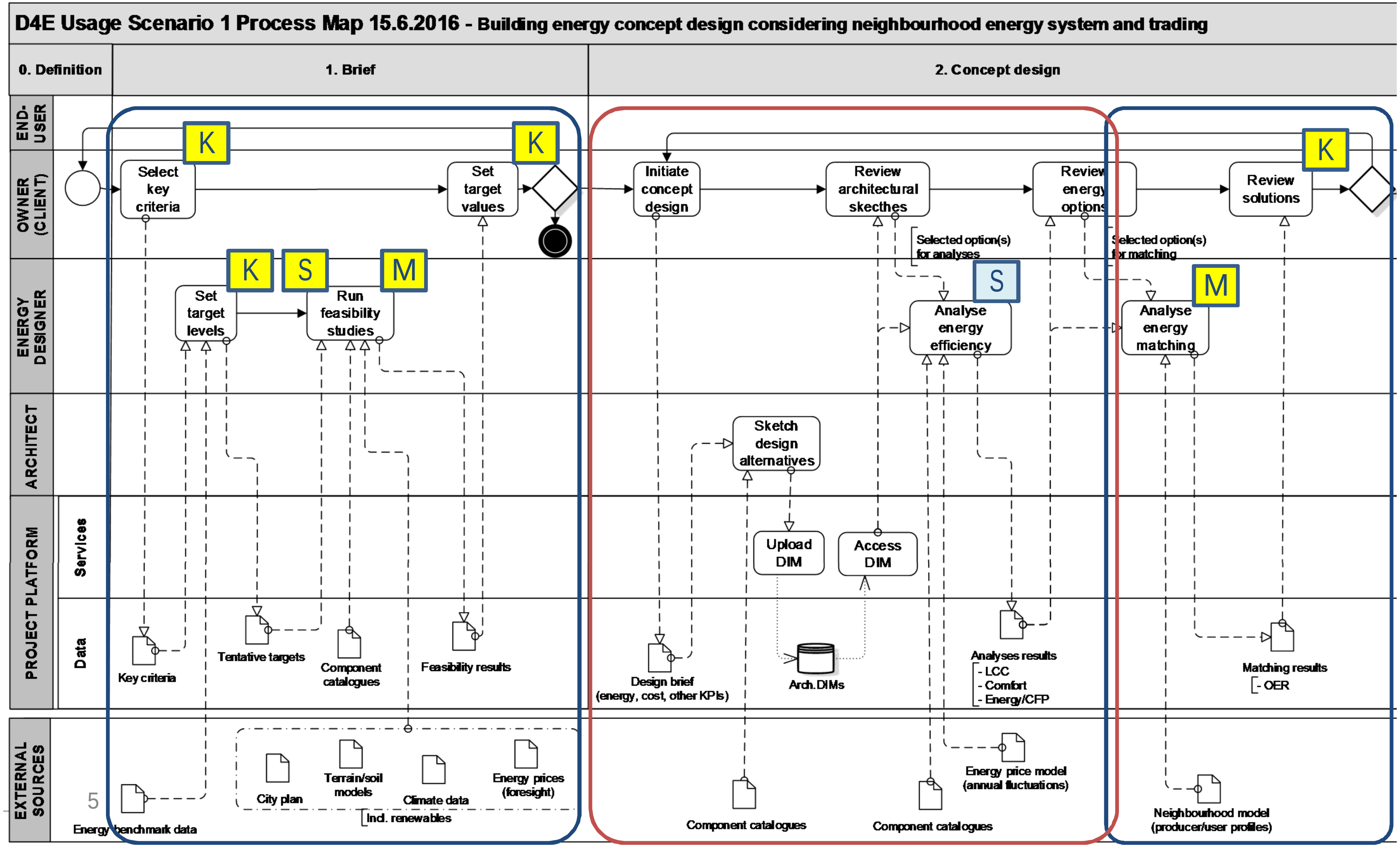
8 building blocks of the D4E methodology => D4E portal



E-Simulation tool and E matching tool are providing metrics fro KPI tool

K KPI tool M Matching tool S Simulation tool

Process view



D4E Facilitators

- Facilitator = Guide for BIM models and Model Uses

- The data-flow process with symbols serves as an attempt to study other media for creating BIM guidelines. Data-flow Maps include links between symbols and To-Do's and Check Lists and Design Advisories.

2 types of symbols:

- The BIM models are pinpointed to the description of data flow.
  - Models may have extra definitions (such as preliminary as-designed BIM). Registers and catalogue symbols show the origin of the model objects and attributes. Symbols of analyses are added to analytical models, which are configures from domain models.
  - the data content of each models and the owner of the model needs to be defined. One way to do this is to link each symbol to a respective content definition of a BIM guideline

- The BIM uses (analyses/simulations/assessment/class detection/viewing) produce results shown in the D4E portal links the data flow to a decision point or to a collaborative session.

=> This map serves as a reference process for chief designers and support model based design management.

3 sets of Facilitators

- Guide for BIM models and model uses in Needs Identification and Requirements & Feasibility study (in this slide set)

- Guide for BIM models and model uses in Concept design, Detailed design and Final design (see separate slide set)
  - Including integrated design review

- Guide for BIM models and model uses in Maintenance/ Retrofit processes (see separate slide set)

Guide for BIM models and model uses in

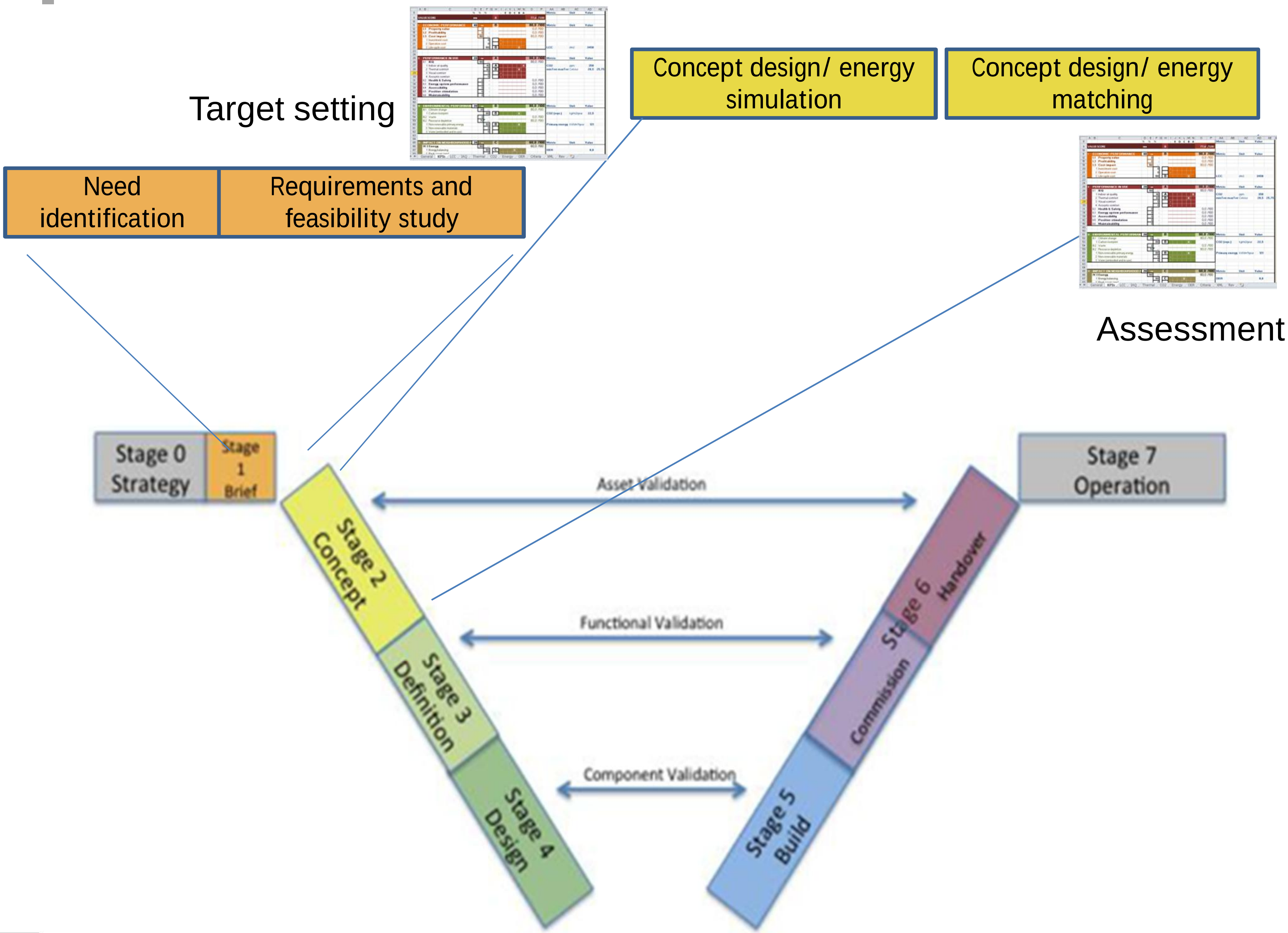
Needs Identification and Requirements & Feasibility study

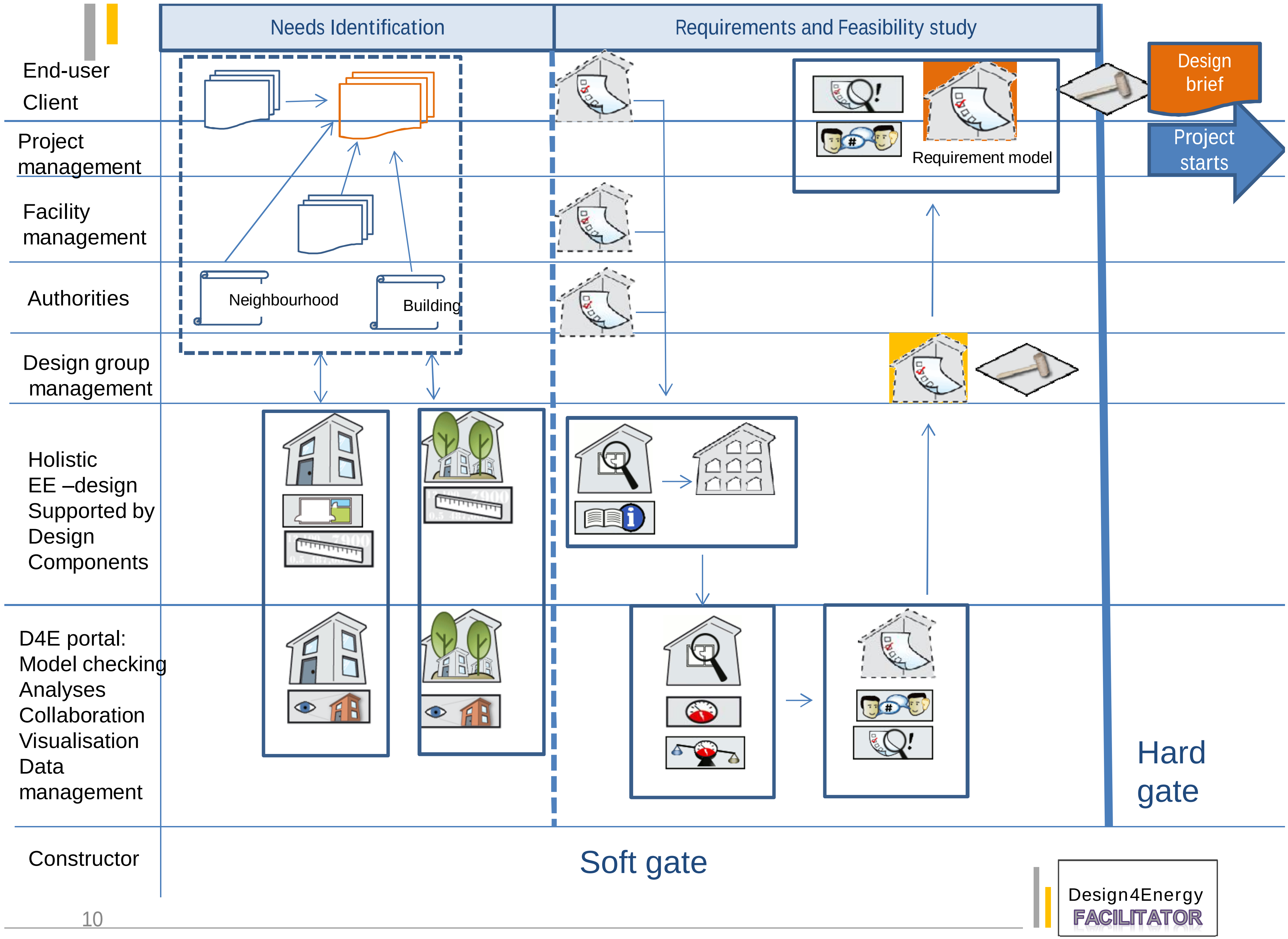
Run the slides in video presentation mode.

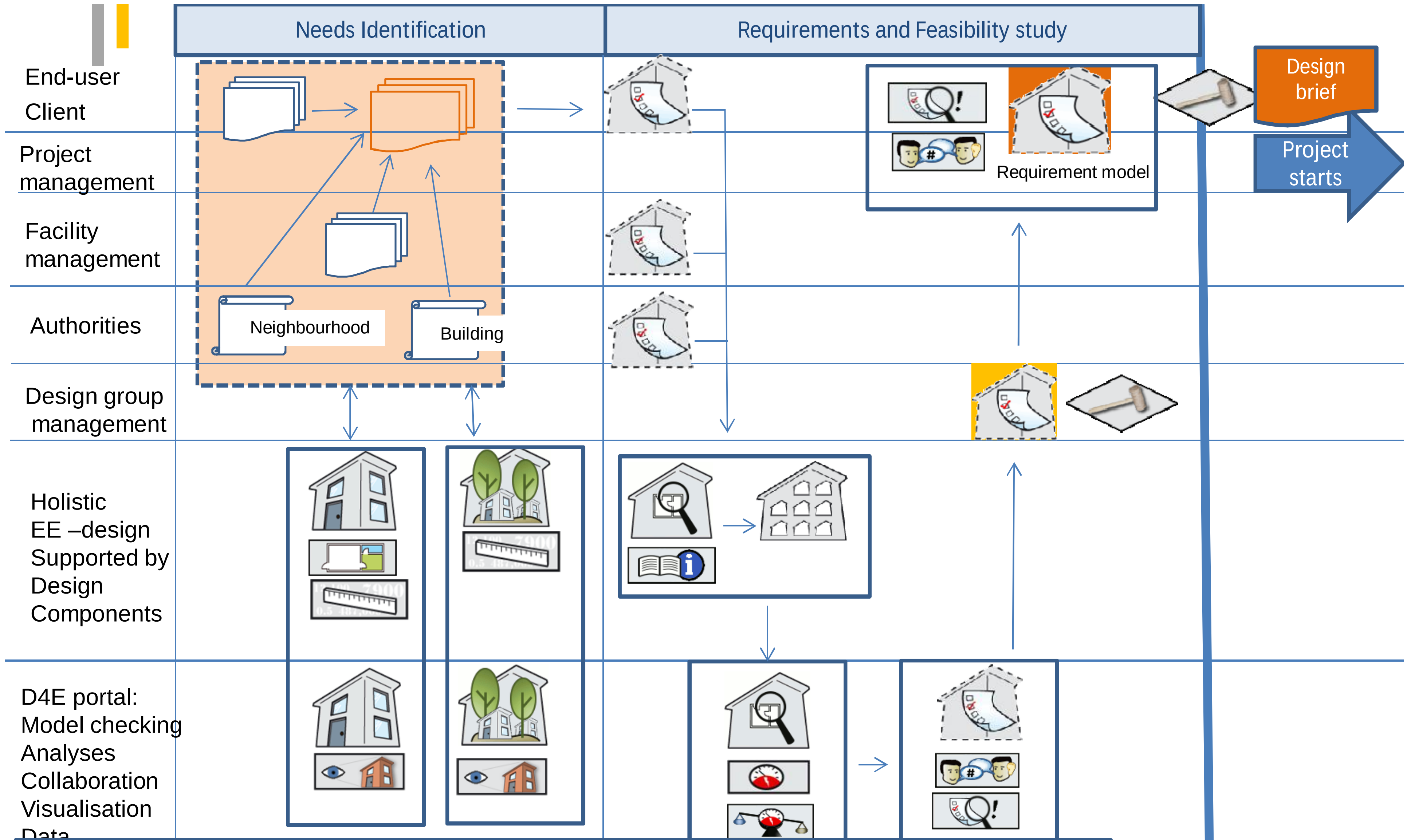
Click areas in the process map for To-Do's and extra information.

DM-TOOL: BIM PROCESS EXECUTION FACILITATOR

(D4E-FACILITATOR)

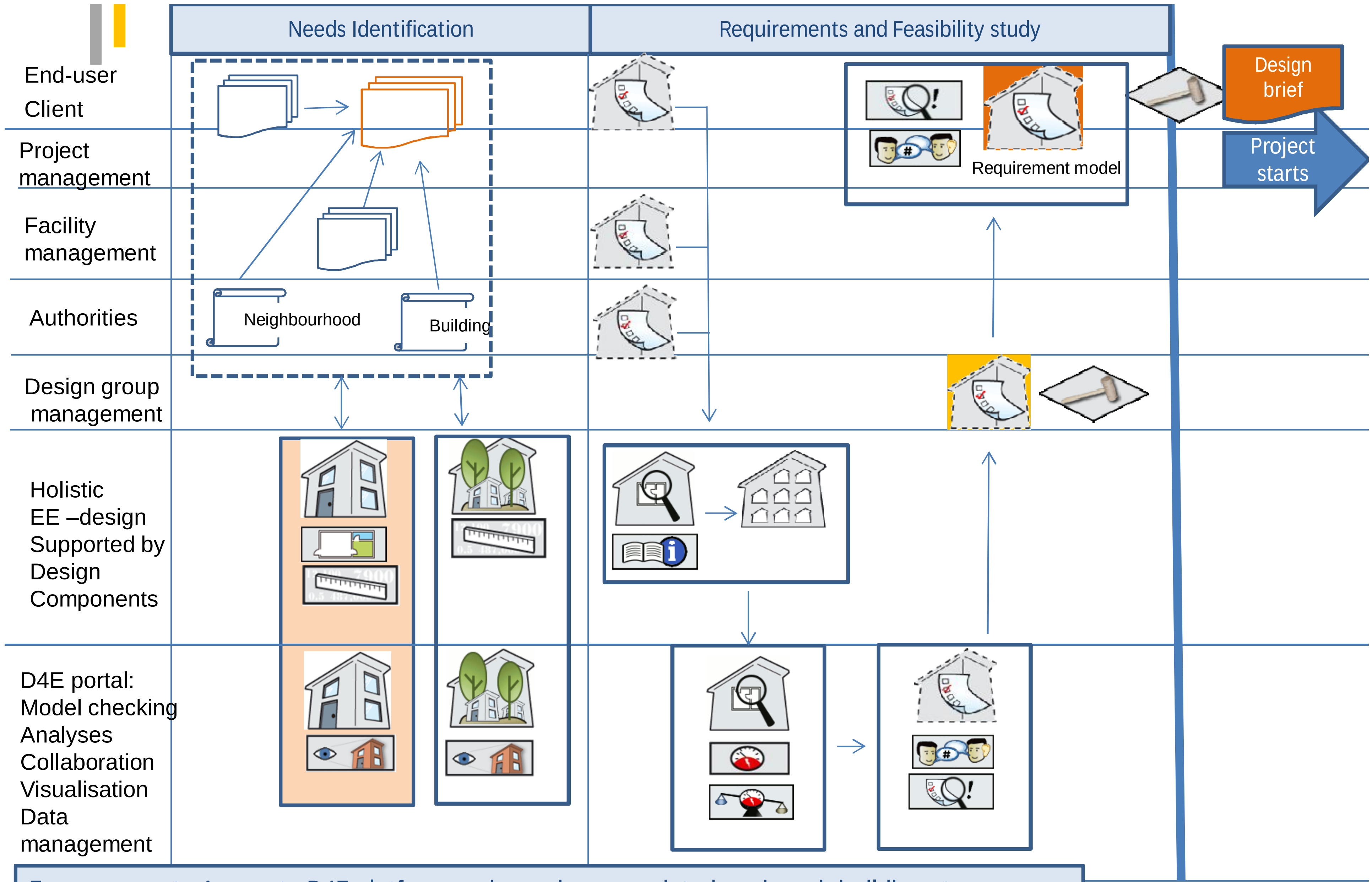

Target setting
Concept design/ energy simulation
Concept design/ energy matching
Need identification
Requirements and feasibility study
Assessment
Stage 0 Strategy
Stage 1 Brief
Stage 2 Concept
Stage 3 Definition
Stage 4 Design
Stage 5 Build
Stage 6 Commission Handover
Stage 7 Operation
Asset Validation
Functional Validation
Component Validation


Needs Identification
Requirements and Feasibility study
End-user
Client
Project management
Facility management
Authorities
Design group management
Holistic EE –design Supported by Design Components
D4E portal: Model checking Analyses Collaboration Visualisation Data management
Constructor
Neighbourhood
Building
Requirement model
Design brief
Project starts
Hard gate
Soft gate
Design4Energy
FACILITATOR



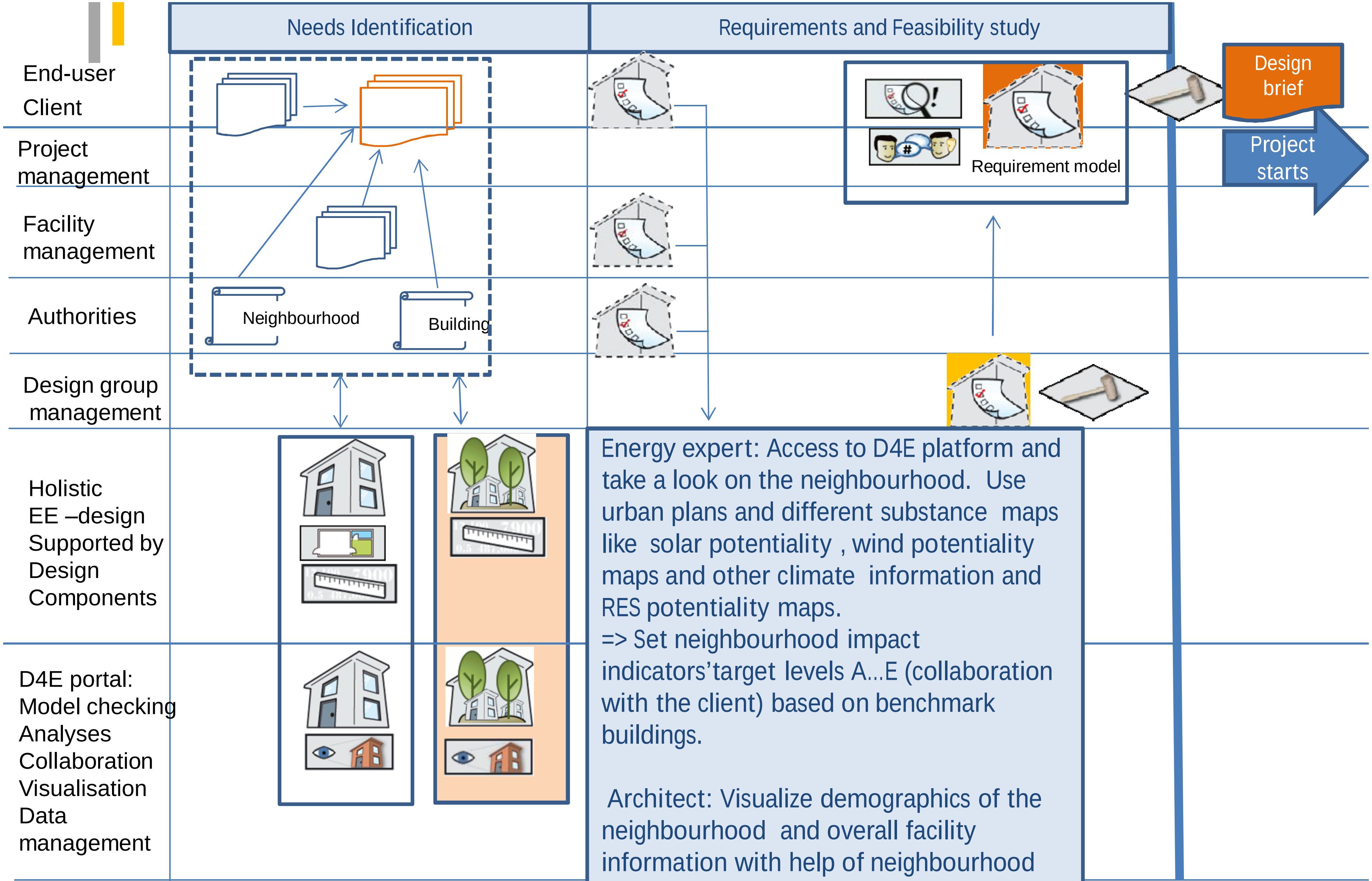
Architect + client: Agree on the indicator framework to be used.
Check the value areas in the D4E Indicator framework.
Select key criteria (client and expert using target setting in collaboration), project general characteristics and high level objectives. Set a normative value on each indicator (A...E)
Value the framework areas and each indicator by giving weights.

Design4Energy
FACILITATOR



Energy expert: Access to D4E platform and search appropriate benchmark buildings to communicate existing successful case studies to the client.
=> Set building performance indicators' target levels A…E (collaboration with the client) based on benchmark buildings.

Design4Energy
FACILITATOR



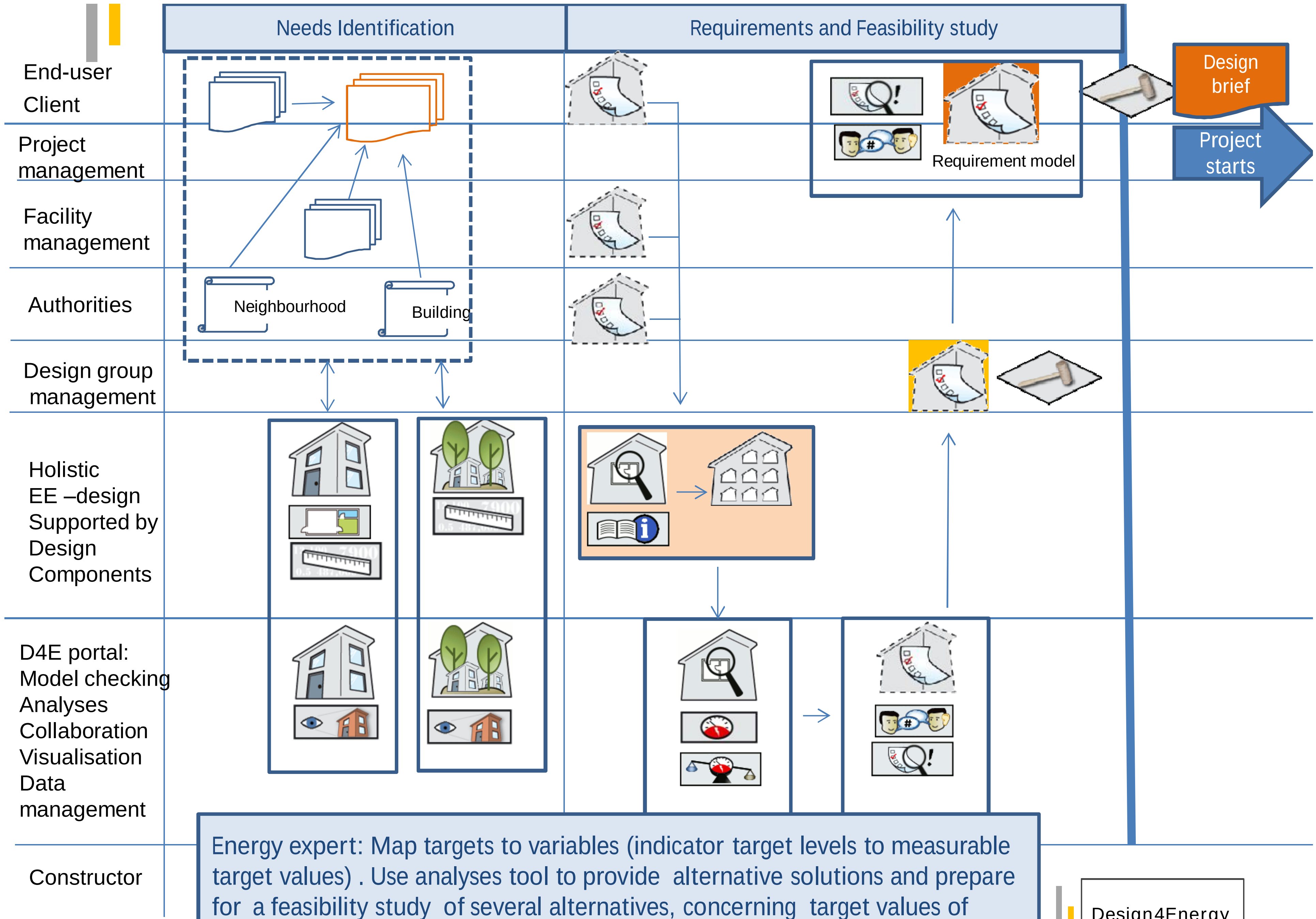
Energy expert: Access to D4E platform and take a look on the neighbourhood. Use urban plans and different substance maps like solar potentiality , wind potentiality maps and other climate information and RES potentiality maps.

=> Set neighbourhood impact indicators'target levels A...E (collaboration with the client) based on benchmark buildings.

Architect: Visualize demographics of the neighbourhood and overall facility information with help of neighbourhood web tool.

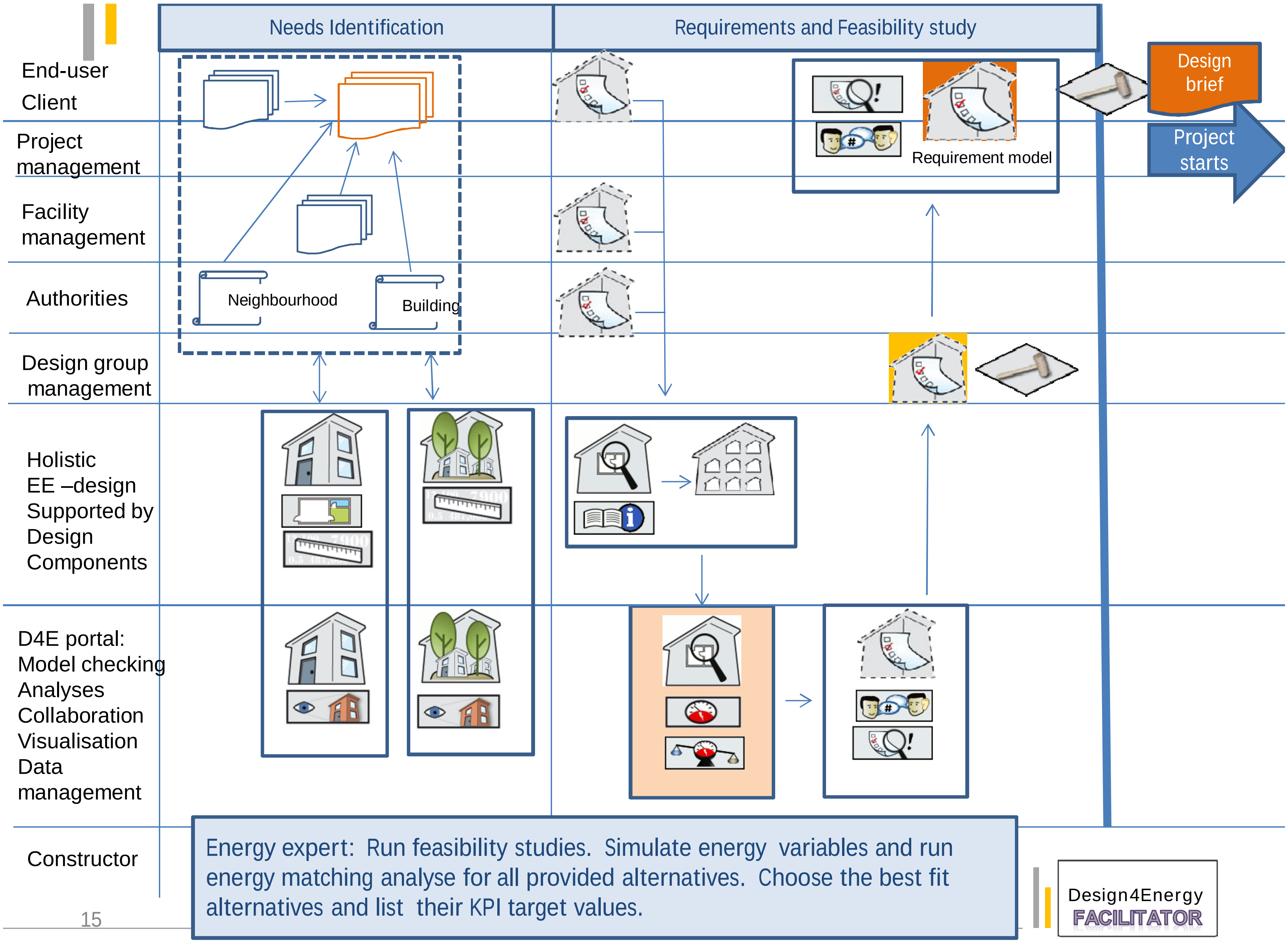
Facilitate a collaborative meeting with client to support the setting of project goals.

Design4Energy
FACILITATOR



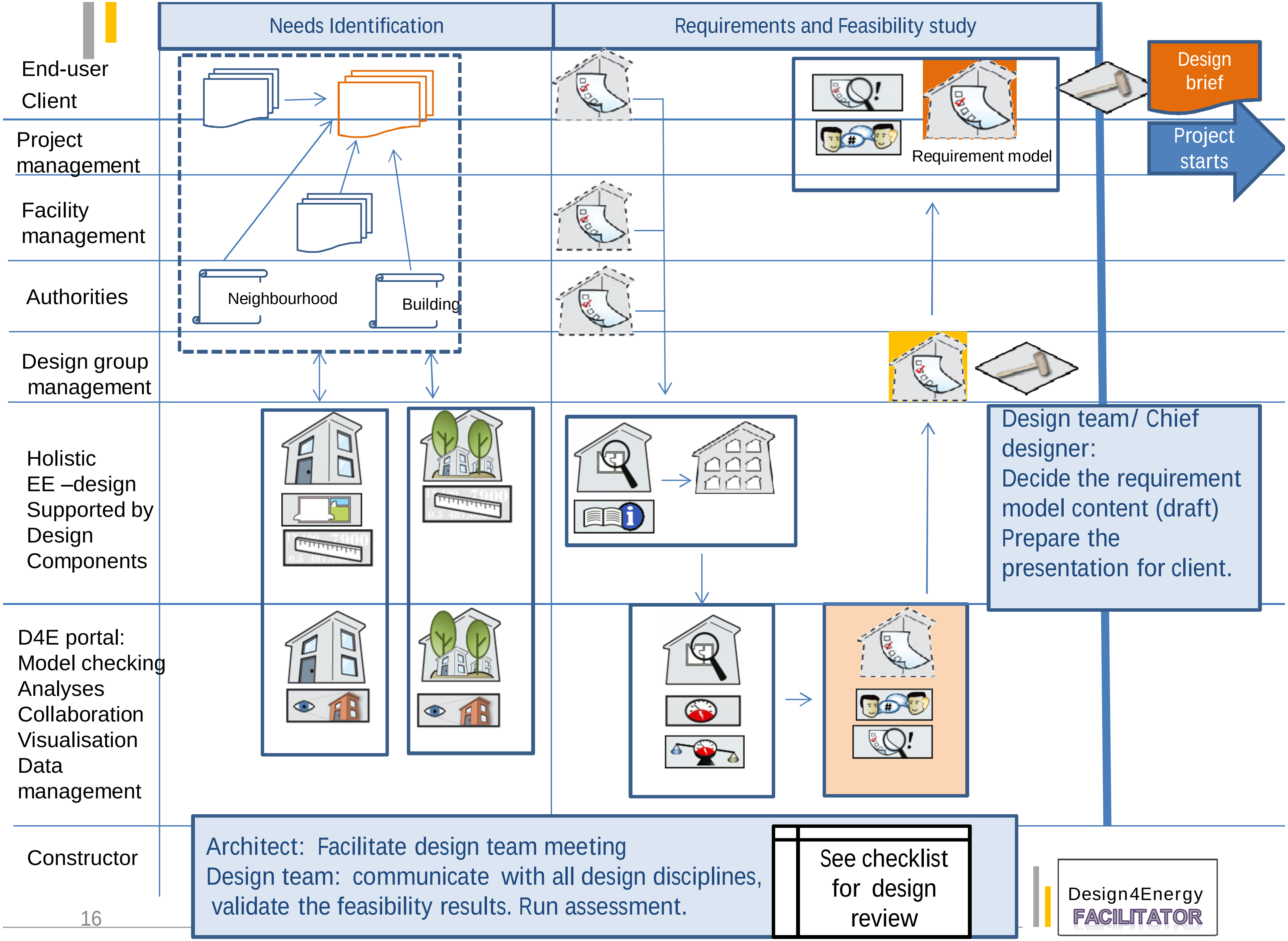
Energy expert: Map targets to variables (indicator target levels to measurable target values) . Use analyses tool to provide alternative solutions and prepare for a feasibility study of several alternatives, concerning target values of energy related indicators.

Design4Energy FACILITATOR

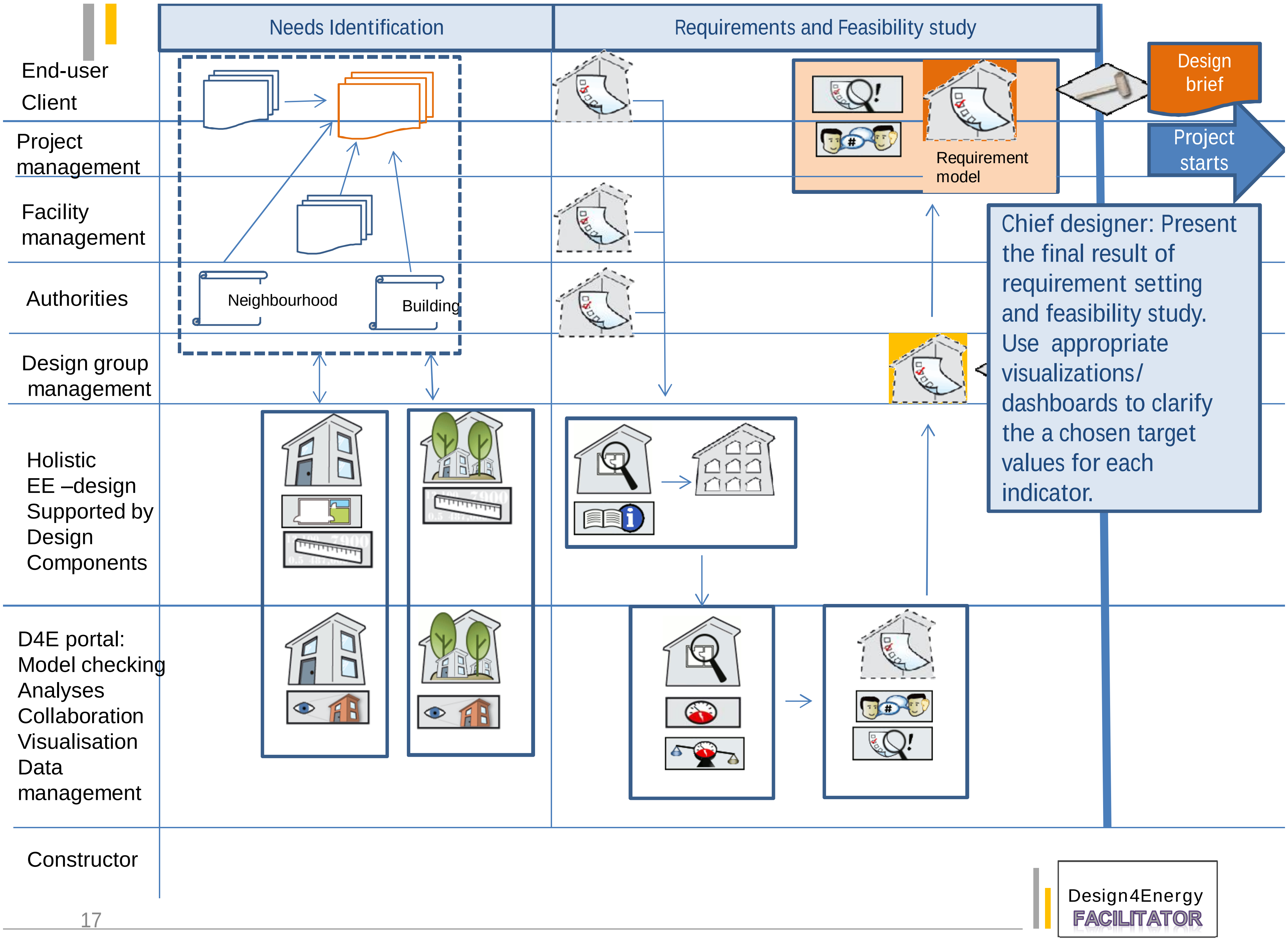


Energy expert: Run feasibility studies. Simulate energy variables and run energy matching analyse for all provided alternatives. Choose the best fit alternatives and list their KPI target values.

Design4Energy FACILITATOR



Needs Identification
Requirements and Feasibility study
End-user
Client
Project management
Facility management
Authorities
Design group management
Holistic EE –design Supported by Design Components
D4E portal: Model checking Analyses Collaboration Visualisation Data management
Constructor
Neighbourhood
Building
Requirement model
Design brief
Project starts
Design team/ Chief designer:
Decide the requirement model content (draft)
Prepare the presentation for client.
Architect: Facilitate design team meeting
Design team: communicate with all design disciplines, validate the feasibility results. Run assessment.
See checklist for design review
Design4Energy
FACILITATOR


Needs Identification
Requirements and Feasibility study
End-user
Client
Project
management
Facility
management
Authorities
Design group
management
Holistic
EE –design
Supported by
Design
Components
D4E portal:
Model checking
Analyses
Collaboration
Visualisation
Data
management
Constructor
Neighbourhood
Building
Requirement
model
Design
brief
Project
starts
Chief designer: Present the final result of requirement setting and feasibility study. Use appropriate visualizations/ dashboards to clarify the a chosen target values for each indicator.
Design4Energy
FACILITATOR

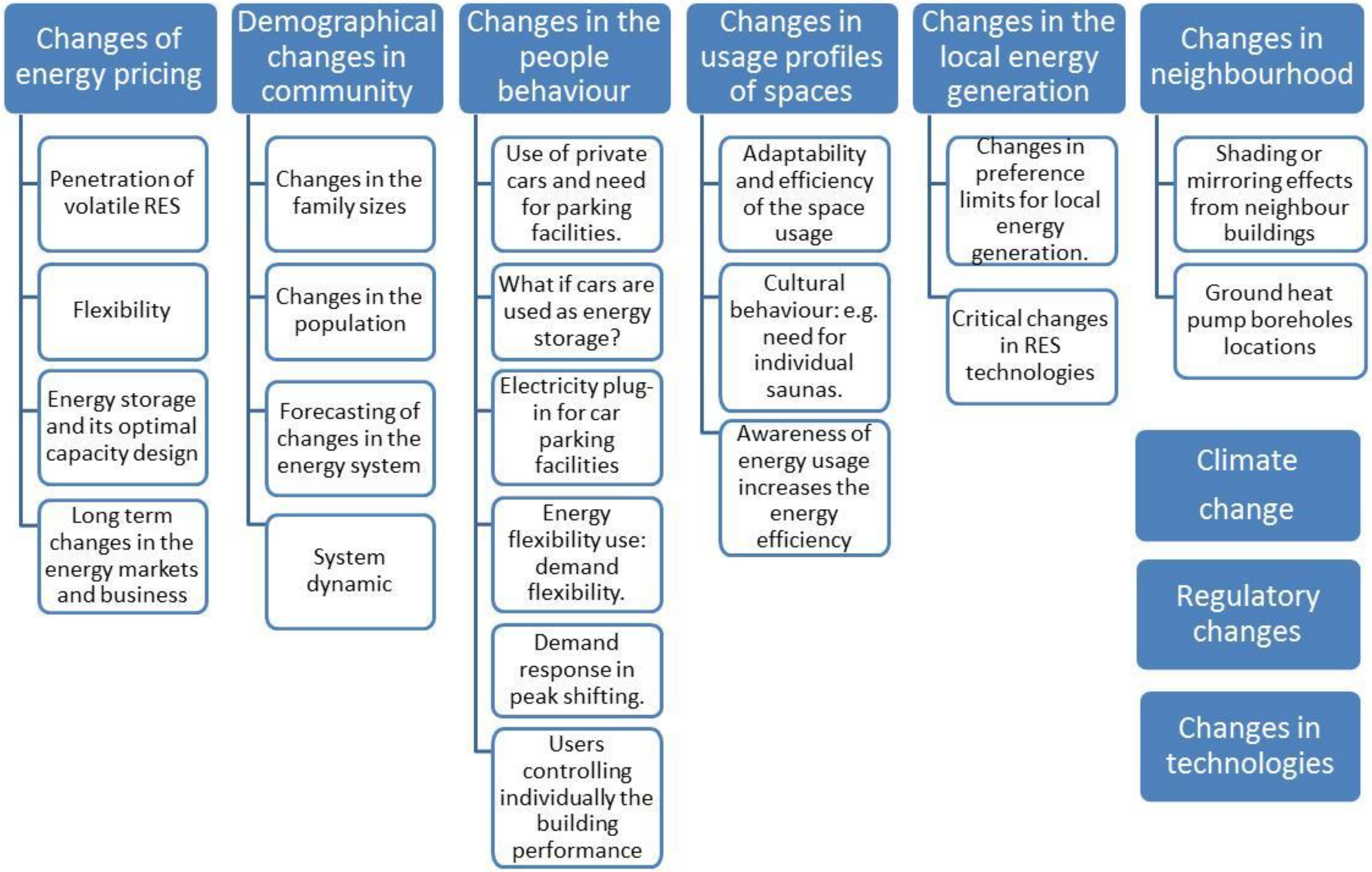
Check list for internal design group review for running KPI assessment

A short checklist to support the preparation for main KPI assessment (before each hard gate).

- Calculate each strategic indicator with appropriate method (all results are based on energy simulation and energy matching analysis).
- Run multi-criteria calculation in the assessment tool.
- Assessment results are visualised in the virtual working space. Study each indicator.
- Compare design value and indicator specific scores to the target value levels.

- Seek for design solutions (with a component library), which reach the target values.
- Consider neighbourhood aspects through each design level (holistic design).
- Consider flexibility for future changes (evolutionary design).
- Collaborate with the design team to find most balanced design solution. Use integrated BIM to support discussion.

The design team identify what could be the potential future changes and their possible outcomes and effects to the building energy design.
If there are many possible solutions to adapt to change situations, their performance should be assessed and the best alternative selected.



Check list for design reviews. ARCHITECT Energy efficient building design (“ passive mode ”):

Location and Site selection:

- Appropriate use of passive solar energy in winter Orientation of the building
- Passive cooling, e.g. natural shading for reduced summer time cooling demand ‘
- Consider shadow effects (buildings around and tall trees)
- Consider general climate parameters

Building volume

- Consider efficient form (Volume factor <1)
- Look for usable lay-outs/ considering functionality
- Efficient massing and lay out considering low energy demand.
- Avoid unnecessary corners/ windows/ bay window in the principal massing, as they increase thermal losses of the envelope.
- Use rectangular volumes as principal massing concept.
- Use entry locks.

Openings

- Primary function is focusing on natural lighting and views out through openings.
- Secondary Passive solar utilisation during heating season.
- Optimize with appropriate shadings for good summer thermal comfort (avoid overheating).

Micro climate

- Check that reflecting sun of neighbouring buildings and its impact to the indoor climate.
- Check that local winds are supporting usability
- Consider vegetation as shading to support comfort
- Orientation of building block to best directions considering use of renewable energy sources

Massive walls

- Use for sun harvesting with internal massive structural elements between heating and cooling season (spring and autumn). Be careful with overheating.
- Use for balancing heat gains to minimize cooling peak during summer time.

Shadings against sun (external and internal)

- Use shading elements to block the sun (heat load). Do not spoil your design concept of natural lighting and views out.
- Use supplementary building parts and elements of the facade to create sufficient shading.

Co-design with energy expert and HVAC for technical spaces

- Locations and size of energy production and storage equipment
- Spatial needs for systems and equipment

Efficient renewable energy production on-site:

- Preliminary identification of possible placing of renewable energy production equipment (e.g. solar panels and heat collectors on roof surfaces, heat pump (pumping station at the building and location of bore holes in the yard).
- Efficient use of roof for active solar systems by adequate roof pitch

FACILITATOR

Check list for design reviews.
ENERGY EXPERT

Use of renewable energy sources

- Identify local available renewable energy sources (solar, wind, geoenergy, bio fuels) and their maximum potential for utilisation.
- Check the availability of the space and the preliminary plans for on-site renewable energy production from architect and from structural designer (e.g. space for a mounting of solar panels, heat collectors or a wind mill).

Energy concept

- Preliminary design of energy production needed for the energy demand (district heating, cooling, gas, boiling, etc.) and inform HVAC planner about this energy concept.
- Respond to energy demand with dimensioning of energy mix using as much renewable energy sources as possible
  - Geothermal
  - Sun power
  - Wind
  - Biofuels

Analyses and collaboration

- Analysing of energy matching and neighbourhood impacts with the indicators from the target setting.
  - Optimising of energy parameters and cost with Energy simulations and Energy matching analyse and cost estimation (LCC).
  - Decisions based on KPIs
- Sizing / dimensioning
  - Sizing of the local energy grid connection (for heating, cooling, gas, electricity)
- Co-design with architect and HVAC for technical spaces
  - Locations and size of energy production and storage equipment
  - Spatial needs for systems and equipment
- Preliminary and detailed design of energy storages if required.

Check list for internal design group review

ARCHITECT together with STRUCTURAL and HVAC DESIGNERS

Aim for as simple as possible solutions to increase the reliability of the solutions.

- Compactness of the house for reduced heat losses.
  - In detailed design: use HVAC and building components from D4E library
- Window design for passive solar energy utilization.

- Spatial needs and lay-outs
  - Routing needs and technical room in dwelling unit design.
  - Placing of kitchen appliances, heating equipment, water heaters etc. for utilization of internal heat loads.

- Thermal and moisture technical design and analyses
  - Thermal insulation of building surfaces.
  - Minimize thermal bridging or use exterior insulation systems to reduce thermal losses.
  - Consider the need of all structural components; they may influence on thermal properties and cost efficiency.
  - Use modular dimensions, e.g., 600 mm for frame walls and windows.
  - Consider moisture dry-out from thick structures; avoid double vapour barriers in wet rooms.

Indoor climate

  - Design for air barrier. Installations inside air barrier for air tightness.
  - Design for wind barrier.
  - Consider ways and means to seal all components leading through a structure.

- Ventilation
  - Space allocation for routing of ventilation duct work.
  - Terminal inlets and directness of ventilations duct work in spatial planning.

- Quality
  - Consider the order of site work already in design.

Check list for design reviews.
STRUCTURAL DESIGN

Spatial needs

- Consider space requirements for HVAC installations

Indoor climate

- Minimize thermal bridging or use exterior insulation systems to reduce their effects.
  - Design for air barriers for through-holes of technical installations.
  - Design joints with air barriers. Consider ways and means to seal all components leading through a structure.
  - Design for wind barrier
  - Use modular dimensions, e.g., 600 mm for frame walls and windows, in order to minimise thermal bridges

Energy concept

- Massive walls
  - Use for sun harvesting with internal massive structural elements between heating and cooling season (spring and autumn). Be careful with overheating.
  - Use for balancing heat gains to minimize cooling peak during summer time.
- Consider the need of all structural components; they may influence on thermal properties and cost efficiency.

Quality

- Consider the order of site work already in design.
- Consider moisture dry-out from thick structures; avoid double vapour barriers in wet rooms.

Check list for design reviews.
HVAC DESIGNER

Design level KPIs are communicated these metrics as starting points for concept design phase:

- Thermal loss parameters of envelope components
  - U-value and G-value of windows
- Occupancy
- Hot water consumption, Hot water heat recovery
- Internal energy loads according to purpose use
- Lighting profiles according to purpose use

Management of EE key performance indicators

- Technical system selection and sizing: heating, cooling, ventilation, electricity and automation.
  - Choosing systems, equipment and building objects from component catalogue based on performance
  - Decisions based on KPIs

Consider space requirements for HVAC installations and renewable energy production.

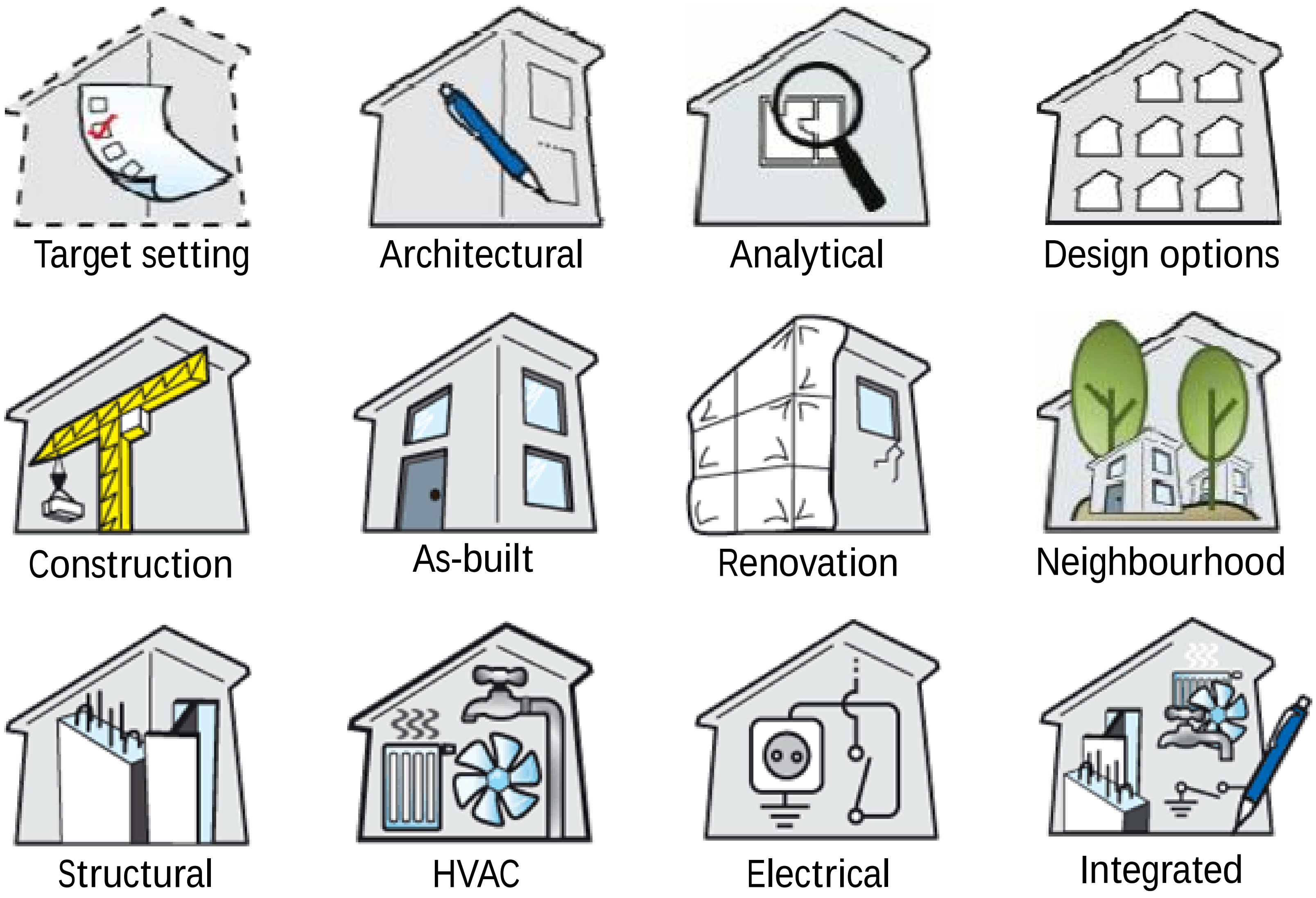
- Check Routings together with architect and structural designer

- Facade
  - Draught control and window size
  - Solar control
- Control
  - Thermal mass assessment
- Dimensioning
  - Ventilation heat recovery
  - Ventilation air flow and schedules
  - Minimum ventilation rate and control
- Indoor climate
  - Ventilation Inlet terminal placing
    - place and mixing strategy
  - Draught control
  - Lighting levels
  - Overheating and simulations
  - Noise control
- Comfort
  - Wet room heating
- Energy calculation

Explanation of the symbols used in Facilitator

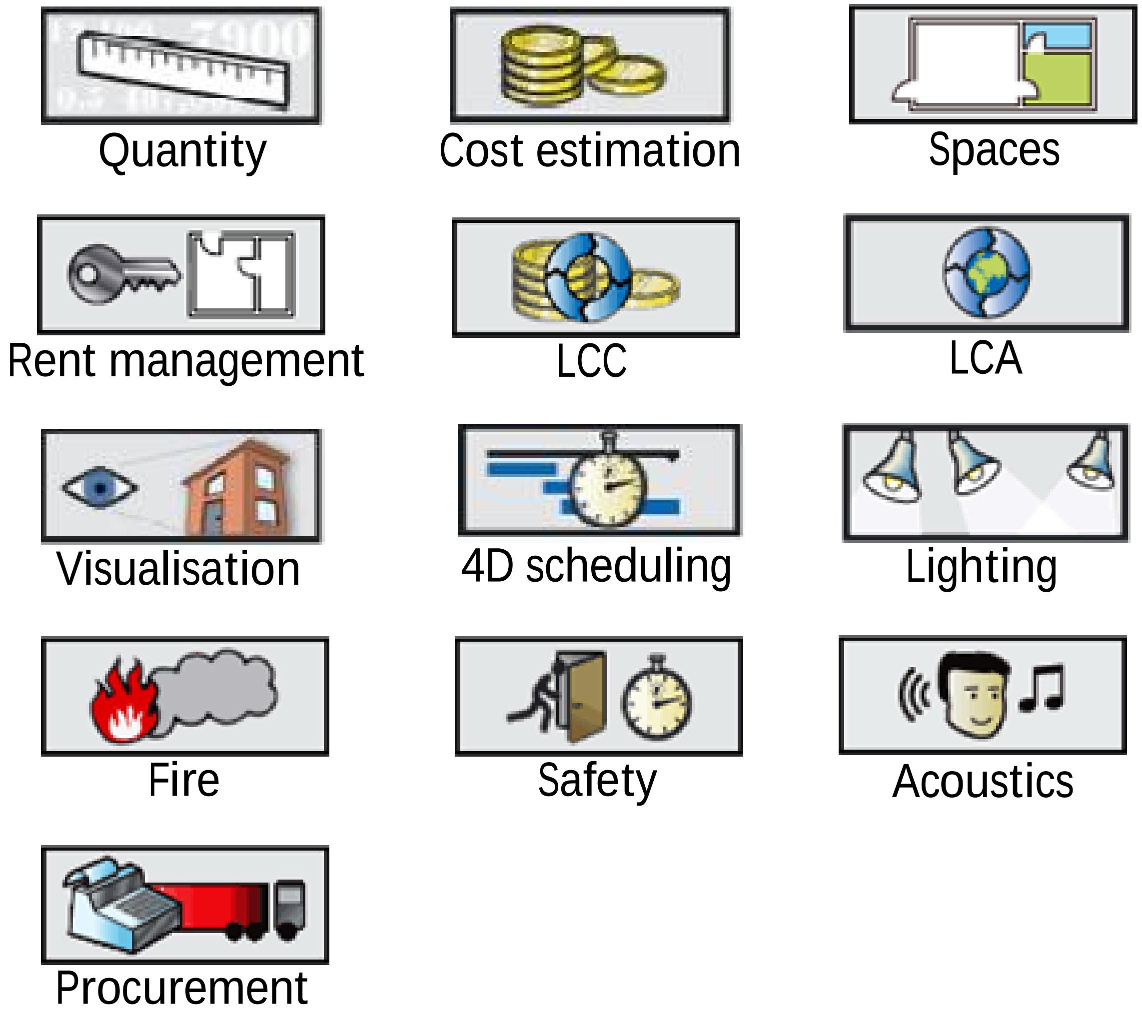
SYMBOLS

Models

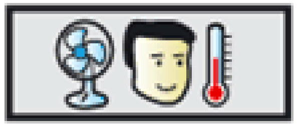


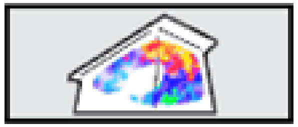
Target setting
Architectural
Analytical
Design options
Construction
As-built
Renovation
Neighbourhood
Structural
HVAC
Electrical
Integrated

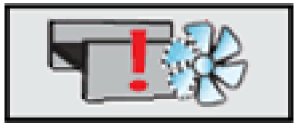
Analysis 1/2

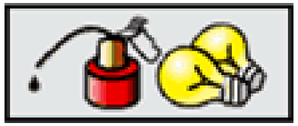

Quantity
Cost estimation
Spaces
Rent management
LCC
LCA
Visualisation
4D scheduling
Lighting
Fire
Safety
Acoustics
Procurement

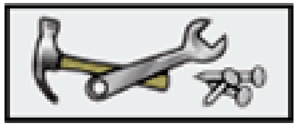
Analysis 2/2


Indoor environment

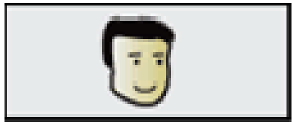

Thermal flow

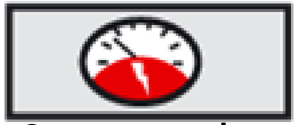

Clash checking


Upkeep

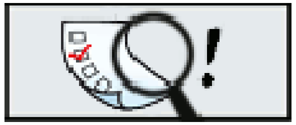

Maintenance

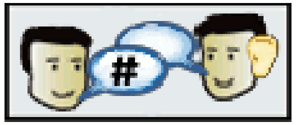

Cleaning

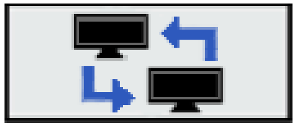

Use


Consumption


Energy matching


Assessment

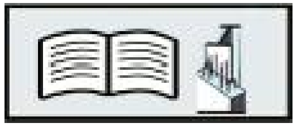

Collaboration

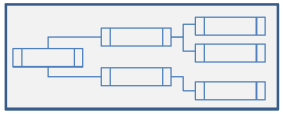

Data sharing


Decision

Model based on...


Registers


Component catalogue data


Attribute level data

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For further information please contact

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Presentations (power point slides with hyperlinks) are shared on request.

Open source development efforts for any testing of the Facilitator (or part of it) is highly appreciated.

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