



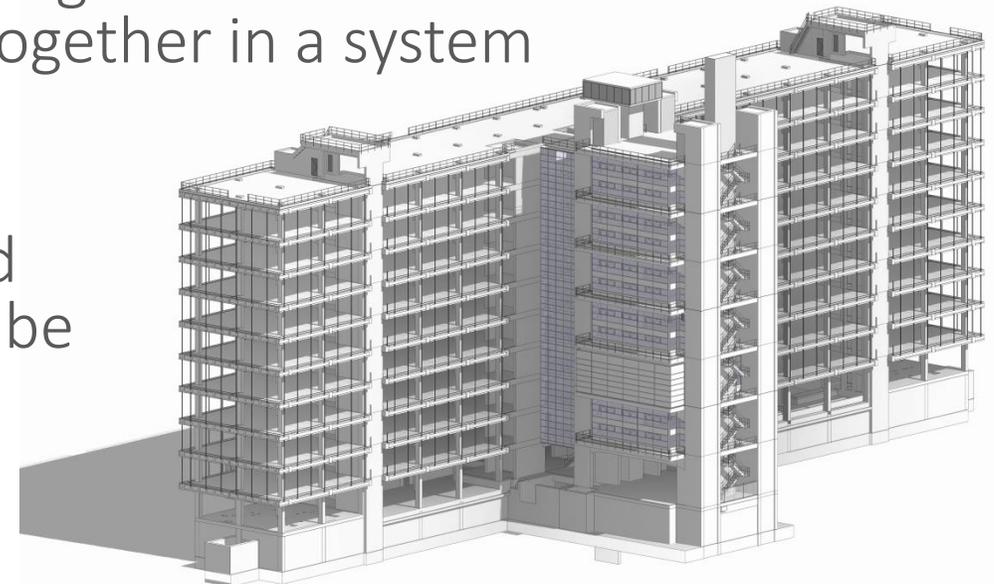
2019 August 05-09, 2019
Berlin, Germany

Exploitation of a sustainable Concept for renovation projects

Christoph Bindal-Gutsche
Technical University Berlin
christoph.gutsche@tu-berlin.de



- 35% of the buildings in the EU are over 50 years old (European Commission)
- Renovation of buildings stock is the most viable solution to reduce energy consumption and CO₂ emission (Nägeli et al. 2018, p. 444)
- The energy use of buildings depends to a significant extent on how the various elements of a building work together in a system (Harvey, 2009, p. 140)
- Renovation strategies are required to find existing energy saving products, that can be installed to achieve energy efficient renovation

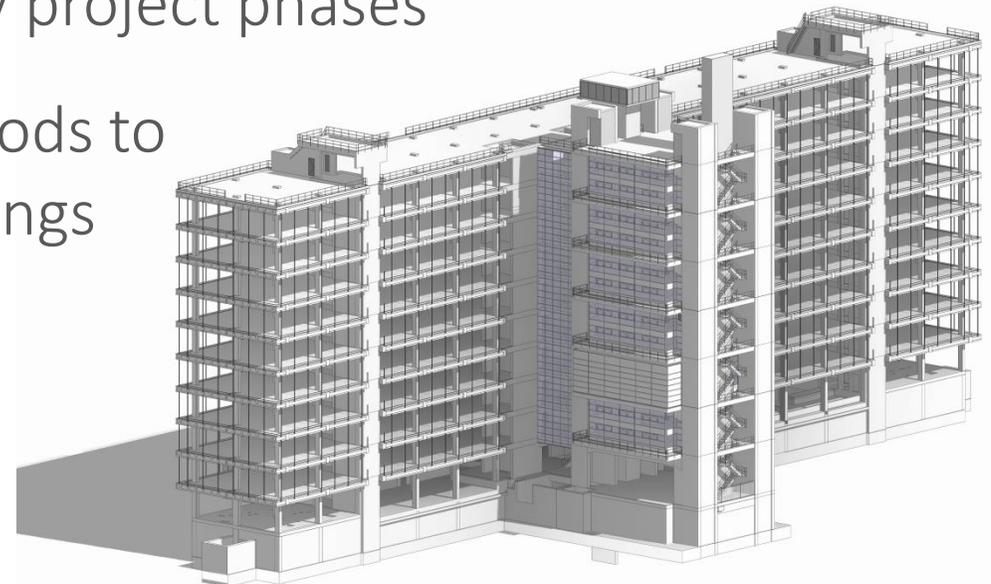


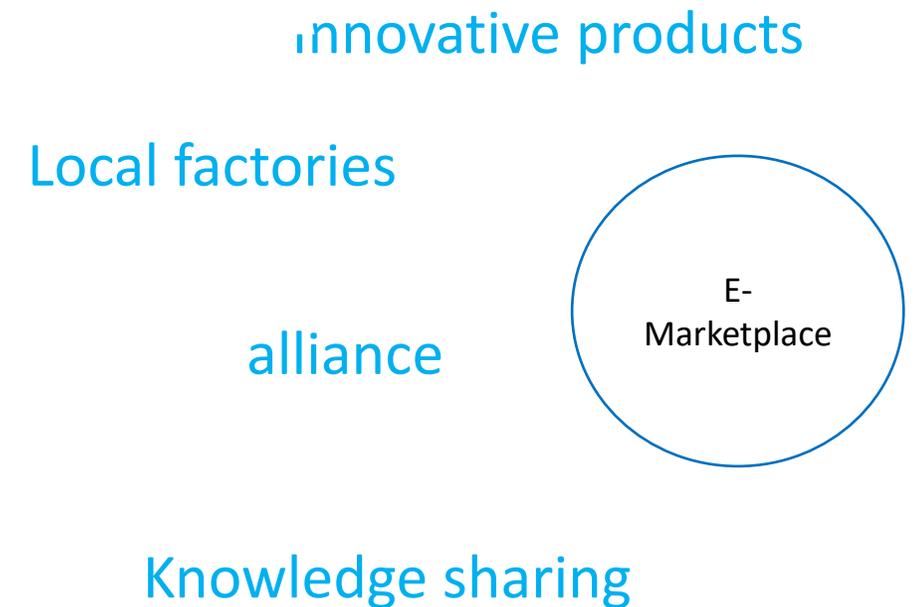
European research:

Holisteec - aim to improve the overall process efficiency, cooperation and conflict resolution of all participants

eeEmbedded - knowledge-based templates, which enable energy simulations already in the early project phases

Design4Energy - aim to develop methods to simulate future energy values of buildings





European climate targets \neq Building renovation situation

Agenda

P2Endure Project
Description

- 
- _____
 - _____
 - _____
 - _____



P2ENDURE Plug-and-Play Product and Process Innovation for Energy-efficient Building Deep Renovation



Starting date: 1 September 2016
Ending date: 30 August 2020
Total cost: EUR 5,318,599.93
Coordinated in: The Netherlands
Call for proposal: H2020-EE-2016-PPP
Funding scheme: Innovation action
Topic: Collaborative local deep renovation platform

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P2Endure promotes **evidence-based innovative solutions** for deep renovation based on prefabricated **Plug-and-Play** systems in combination with on-site robotic 3D-printing and BIM, demonstrated and monitored at 11 real and 2 virtual projects in 4 geoclusters with EU-wide replication potential.



16 (8 SME, 5 IND, 2 HES/RES, 1 PUB)



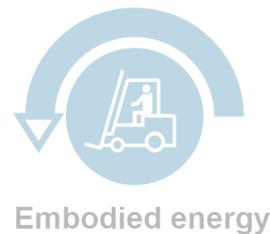
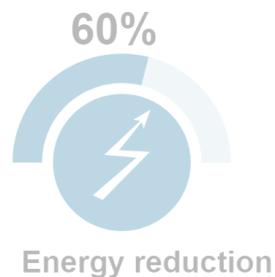
P2Endure Solution

P2Endure will resolve the barriers for wide-scale implementation of innovative solutions:

- Energy
- Financial
- Indoor Quality

By

- **Processes** (4M –modular processes)
- Innovative **Plug-and-Play** systems / products
- Supporting **Information and Communication Technology Tools**



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Propose to develop a detailed technical plan and economic feasibility report for deep renovation

Propose to develop the deep renovation design ready for execution

Starting point for the renovation design

Propose to monitor and guarantee the high quality execution of construction works

Monitor the indoor environmental quality and energy performance

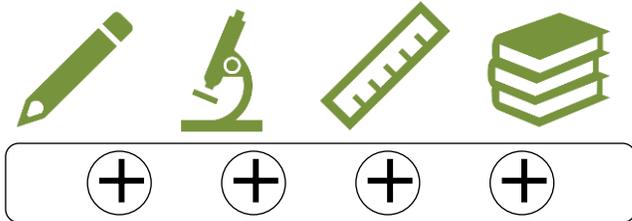


Execute deep renovation activities

Propose to improve test and implement PnP prefab components for deep renovation



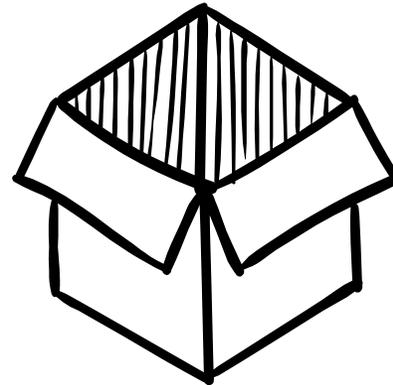
...but you don't know how to integrate it into the market?
Use the P2Endure e-Marketplace:
You have a renovation project or product?



P2Endure e-Marketplace Out-of-the-box solution

Marketplace for renovation products

Simulation platform to provide clear and comprehensible information to compare energy saving options



Supports process of planning, buying, and making

In a local district market

For real estate developers, designers, building owners
and construction companies



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localhost:8080

P2ENDURE E-MARKETPLACE

Welcome to the P2Endure E-Marketplace

Smart window, Prefab HVAC system, Fermacell Panel, ROBOT AT WORK, Heatpump

Start Simulation

Present results

Costs

Process Subtotal [kWh]: 12710kWh - 1830Euro
 Total Energy Use [kWh]: 13503kWh - 1944Euro

Energy Use Summary

Electricity

Process Subtotal [kWh], Total Energy Use [kWh]

Site and Source Energy

Total Site Energy

Total Energy [kWh], Energy Per Total Building Area [kWh/m2], Energy Per Total Building Area [kWh/m2]

End Uses

Heating

Electricity [kWh], Natural Gas, Adipic Acid, District Cooling, District Heating, Water

Time Not Comfortable (ASHRAE_55-2004)

Total Site Energy

Winter Clothes [hr], Summer Clothes [hr], Energy Per Total Building Area [kWh/m2]

Winter C, Summer Clothes [hr]

Impressum: The P2Endure E-Marketplace is under developing by Technical University Berlin.
 Contact: Email: e-market@tu-berlin.com Phone: 000-000-00 Address: Guttay Meyer Allee 18, Berlin



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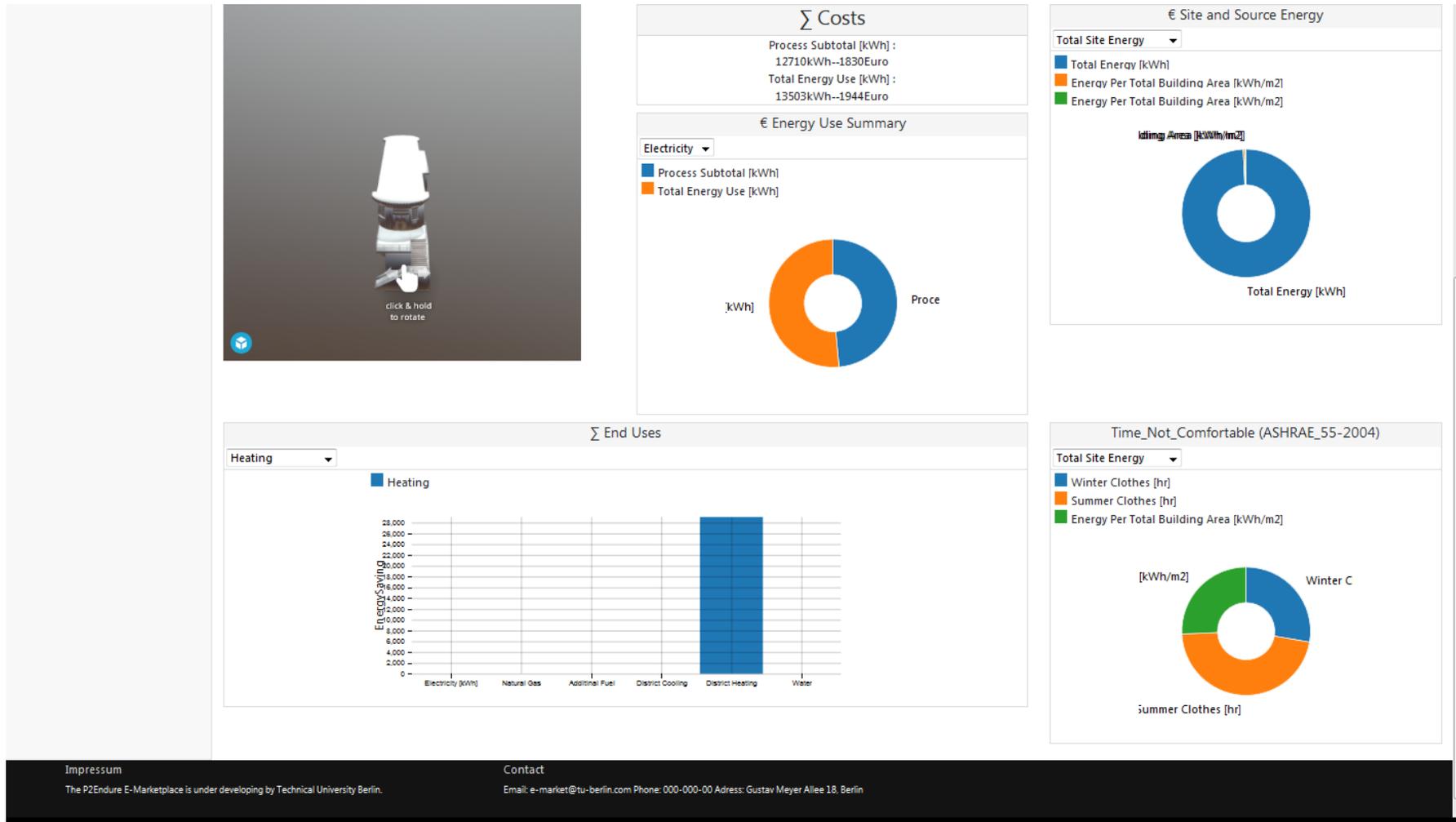
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The screenshot shows a web browser window displaying the P2Endure E-Marketplace. The browser address bar shows 'localhost:8080'. The page title is 'P2ENDURE E-MARKETPLACE'. The main content area features a welcome message: 'Welcome to the P2Endure E-Marketplace' with an 'Info' link. Below this, there are five product cards: 'Smart window', 'Prefab HVAC system', 'Fermacell Panel', 'ROBOT AT WORK On-side facade', and 'Heatpump'. Each card includes a 'More' link and a small square icon. A 'Submit' button is located below the product cards. On the left side, there is a sidebar with a search bar and navigation links for 'Dashboard', 'Charts', and 'Table'. At the bottom left, there is a file upload area with a 'Durchsuchen...' button and the text 'Keine Datei ausgewählt.', and a 'Start Simulation' button. The top right of the page has navigation links for 'Home', 'About', 'Services', and 'Contact'.



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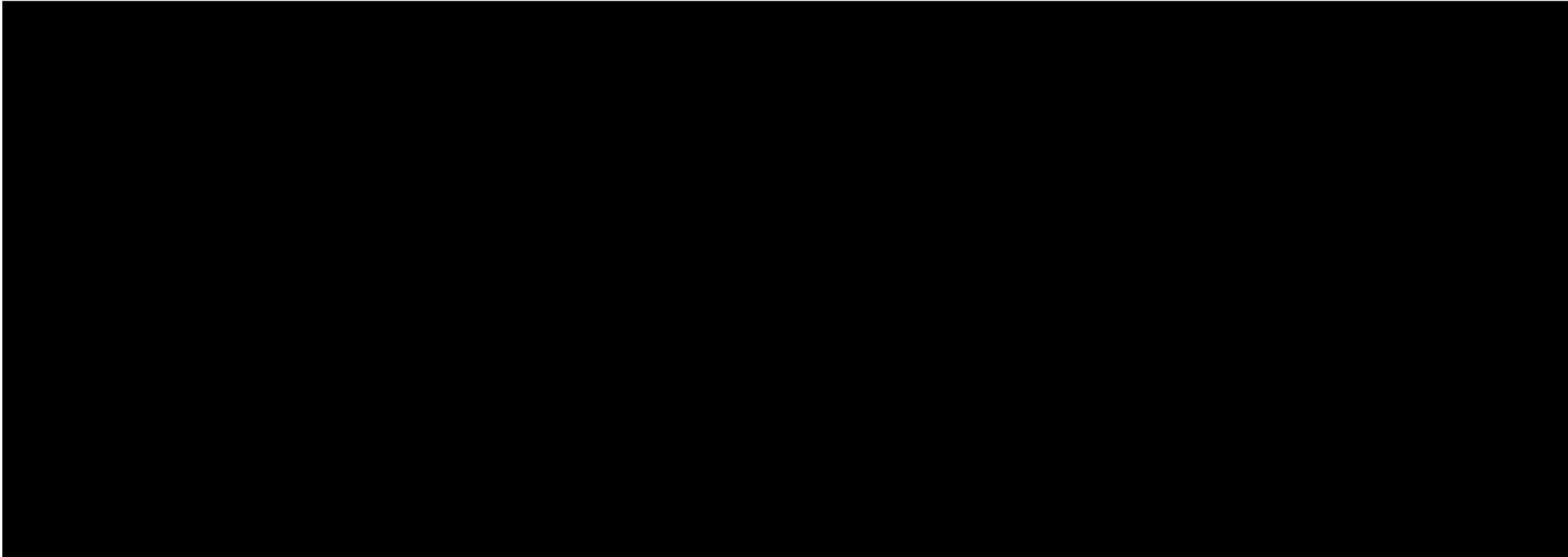


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smart window More

Prelab HVAC system More

Fermacell Panel More

On-side facade More

Heatpump More

Submit

WORK

Durchsuchen... Warszawa_primary_validated.idf

Start Simulation

Σ Costs

Process Subtotal (kWh) : 13140.08kWh--1892Euro

Total Energy Use (kWh) : 187786.48kWh--27041Euro

€ Site and Source Energy

Total Site Energy

Total Energy (kWh)

Energy Per Total Building Area (kWh/m²)

Energy Per Total Building Area (kWh/m²)

Building Area (kWh/m²)

Total Energy (kWh)

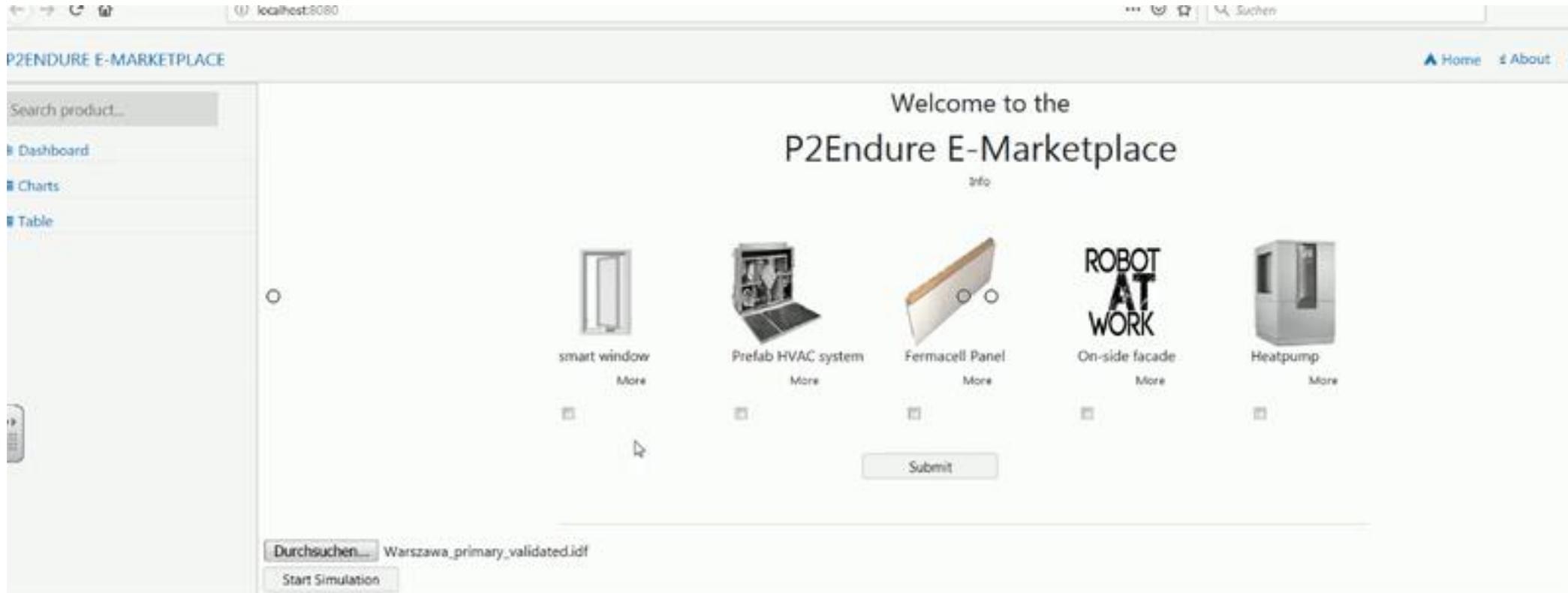
€ Energy Use Summary

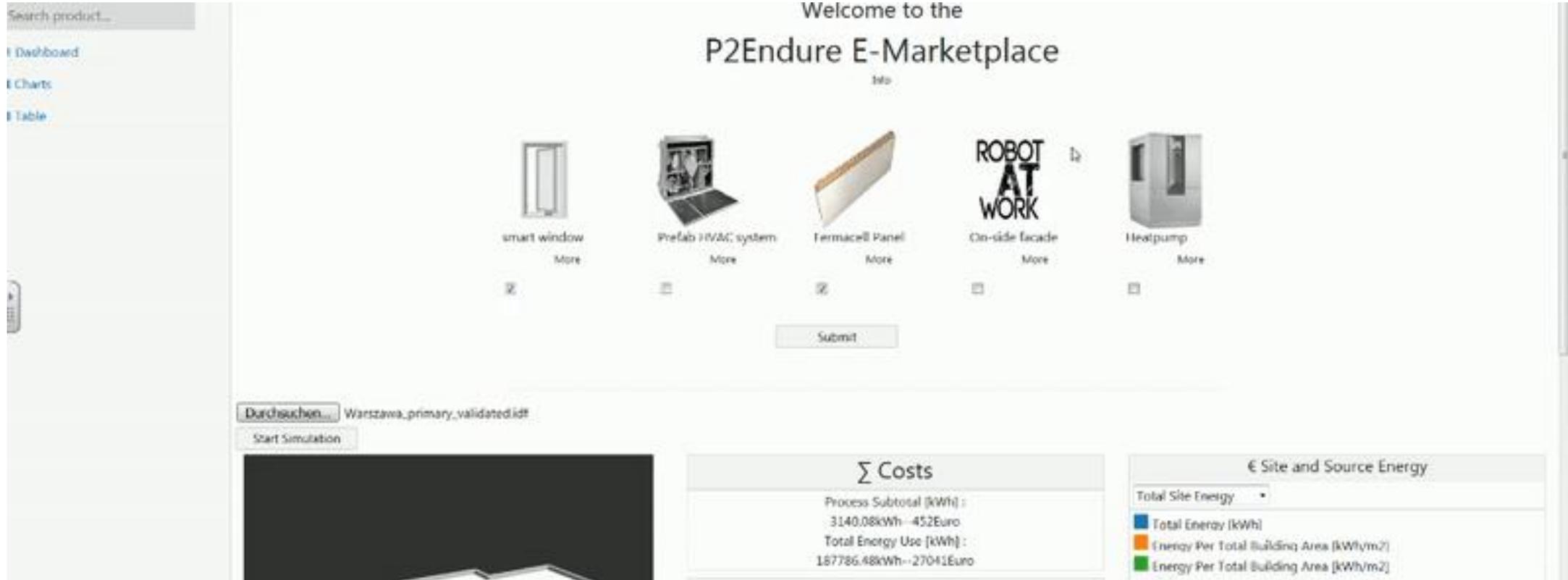
Additional

Process Subtotal (kWh)

Total Energy Use (kWh)







Welcome to the
P2Endure E-Marketplace

Info

smart window More

Prefab HVAC system More

Fermacell Panel More

ROBOT AT WORK On-side facade More

Heatpump More

Submit

Durchsuchen... Warszawa_primary_validated.idf

Start Simulation

Σ Costs

Process Subtotal [kWh] :	3140.08kWh - 452Euro
Total Energy Use [kWh] :	167786.48kWh - 27041Euro

€ Site and Source Energy

Total Site Energy

- Total Energy [kWh]
- Energy Per Total Building Area [kWh/m²]
- Energy Per Total Building Area [kWh/m²]

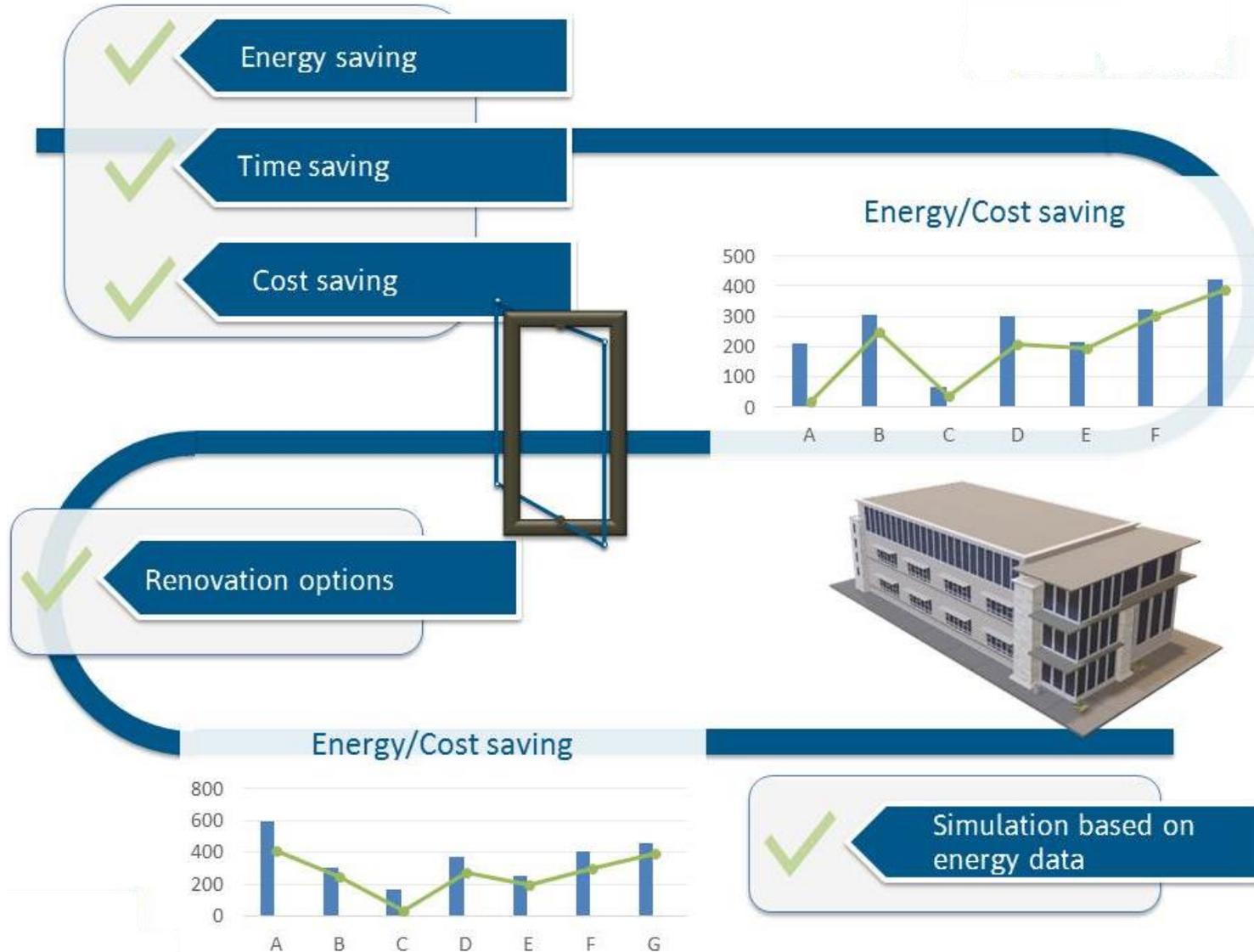


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Innovative Plug-and-Play solutions

Components for building envelopes

- Light weighted Plug-and-Play façade panels
- Plug-and-Play façade elements
- **Smart Energy Efficient windows**
- Rooftop retrofitting / Extension module

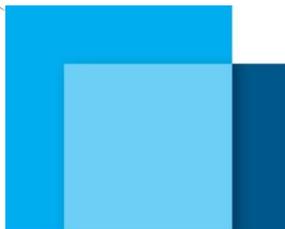
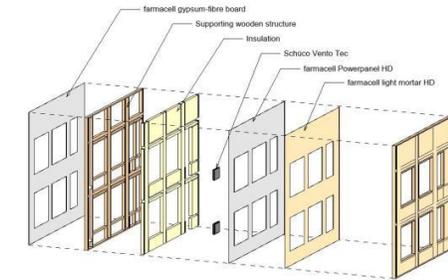
Technical systems

- Plug-and-Play bathroom unit
- Plug-and-Play HVAC systems
- **IndoorEnvironmentQuality control systems**
- Connection to energy grid and RES production

On-site 3D technologies

- 3D scanning (geomatics) - laser and photogrammetry
- **On-site 3D printing and robotics**

ICT Tools for deep renovation





SCAN 3D
3D SCANNING & REVERSE ENGINEERING



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Plug-and Play product and process innovation for Energy-efficient building deep renovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 723391.



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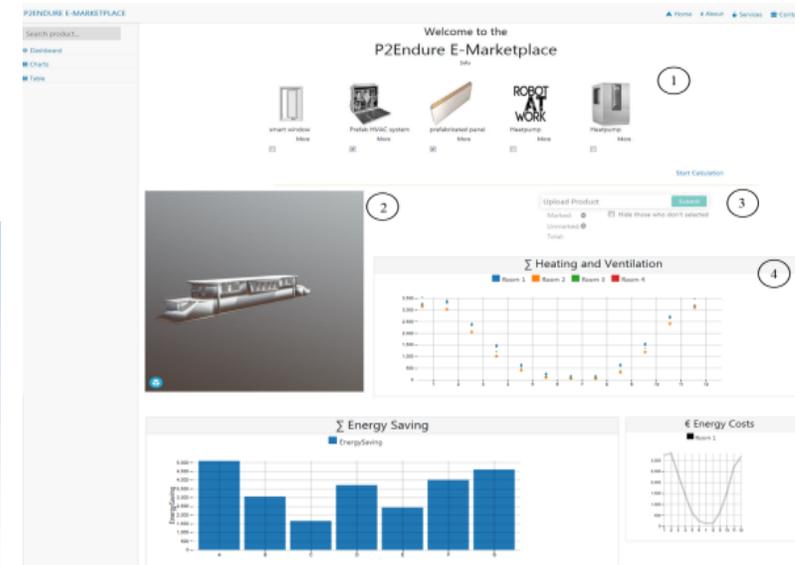
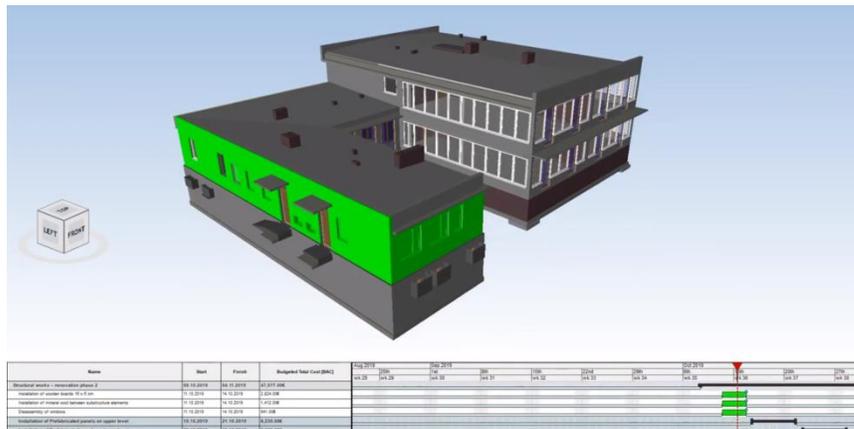
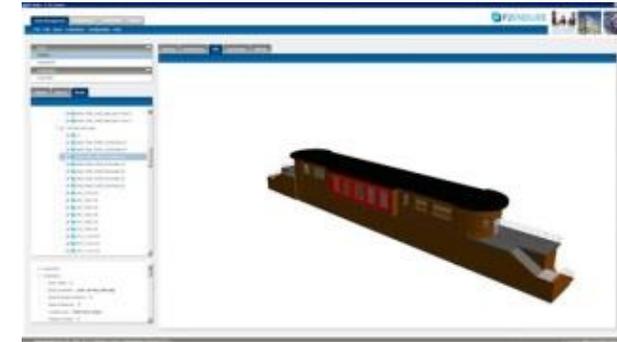


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Supporting ICT Tools

BIM based

- Building Condition Assessment
- LCC and asset management
- Energy monitoring (parametric modeller)
- 4D (time) and 5D (costs) analysis

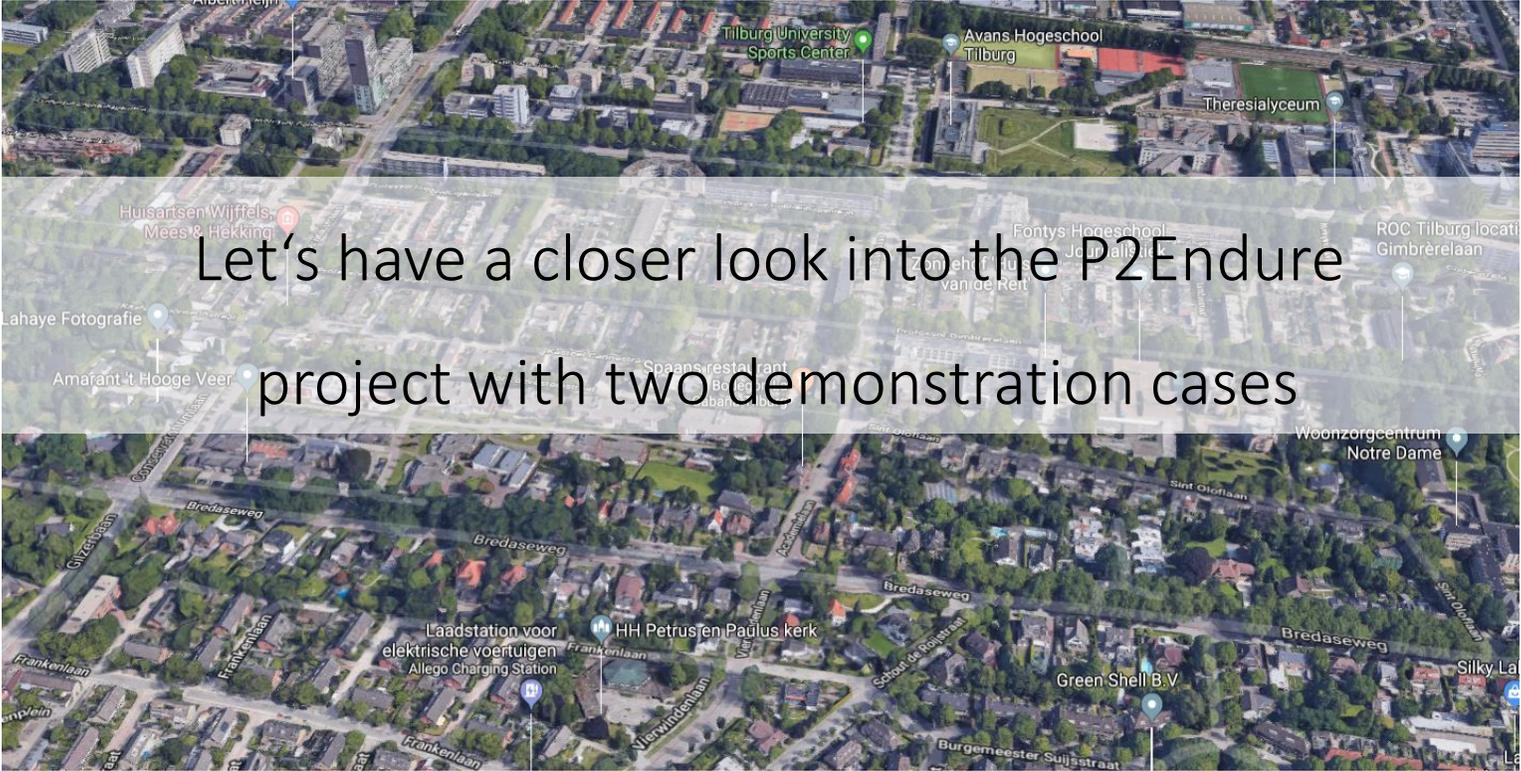


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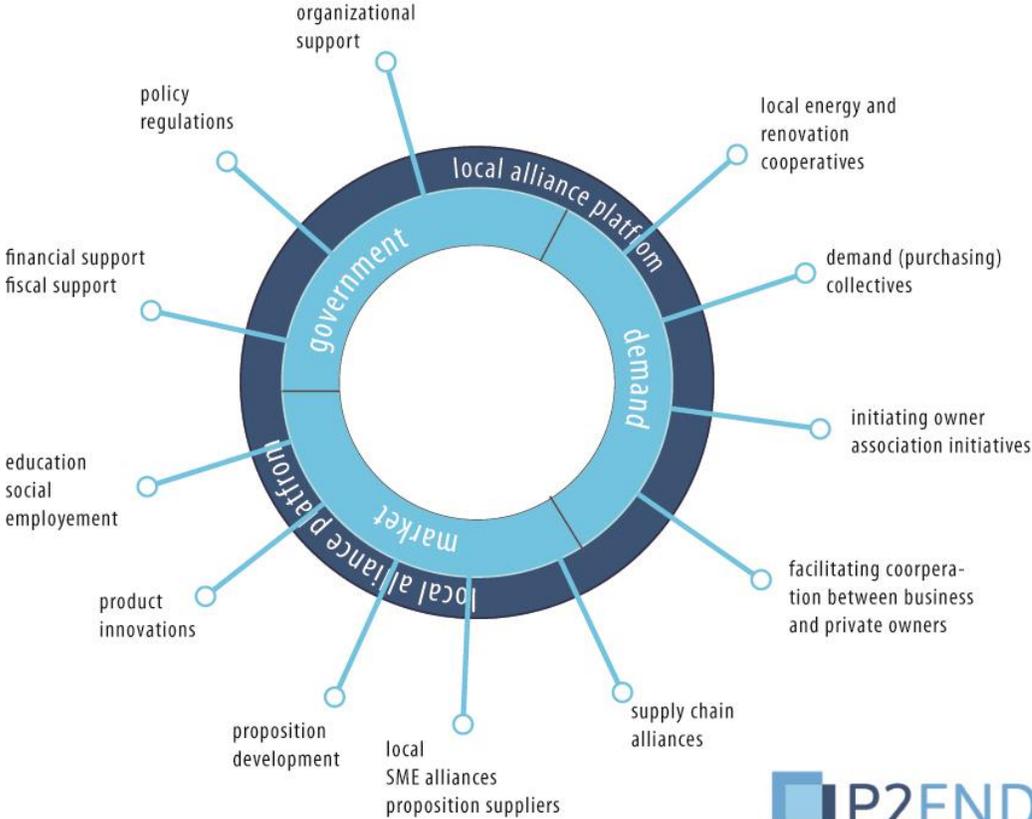
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Testing of district alliance approach in Tilburg (NL)



Case studies of district renovation scenarios: Tilburg

Mapping



Areal picture of the district 'de Reit' with different building typologies

5280 inhabitants on a surface of 1,43 km²

This comprises of

- 6 multi-family privately owned
- 4 storey housing complexes
- 10 multi-storey social housing complexes
- 4 storey high, portico disclosure
- 3 multi-storey social housing complexes
- 7 storey high, gallery disclosure
- 41 patio dwellings
- 58 row houses

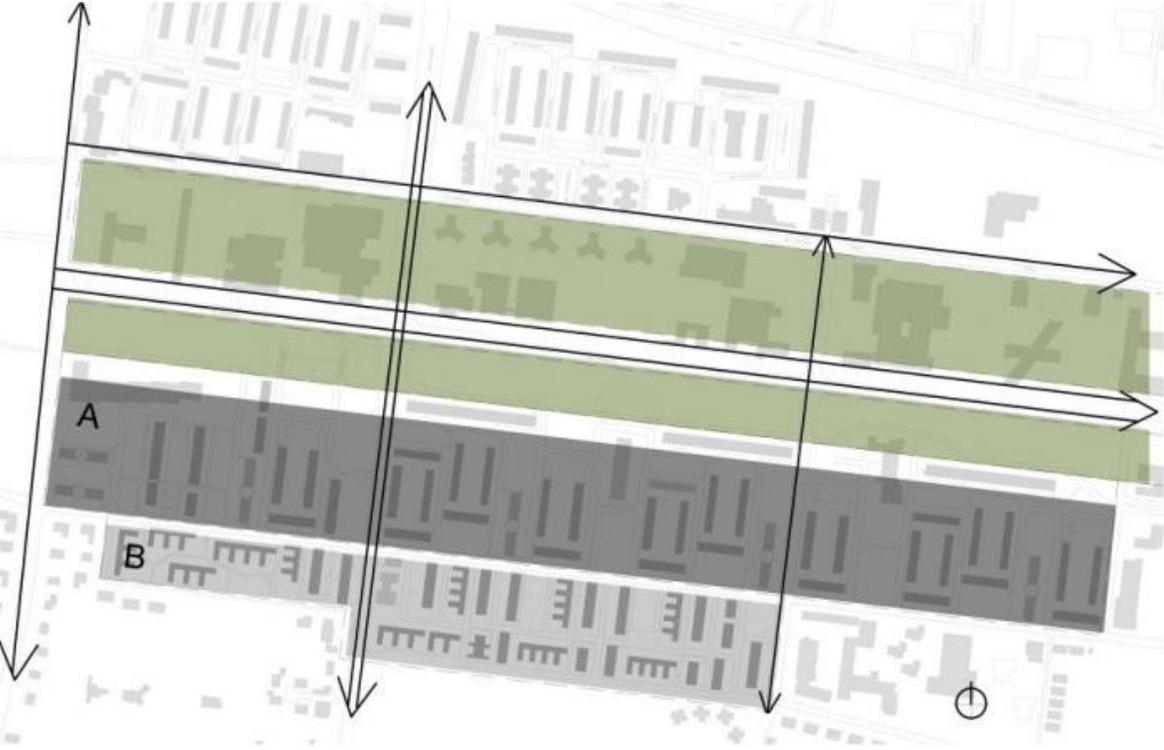
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Mapping



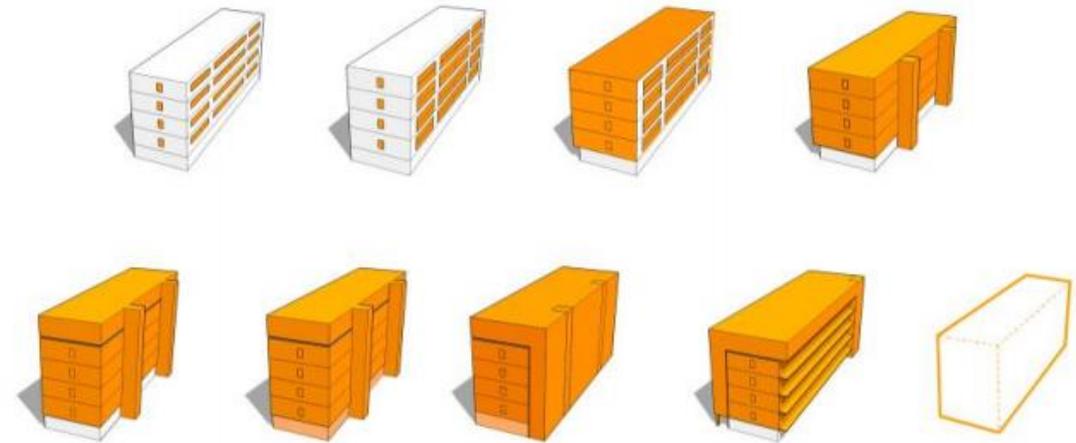
Circulation and zoning district 'de Reit'



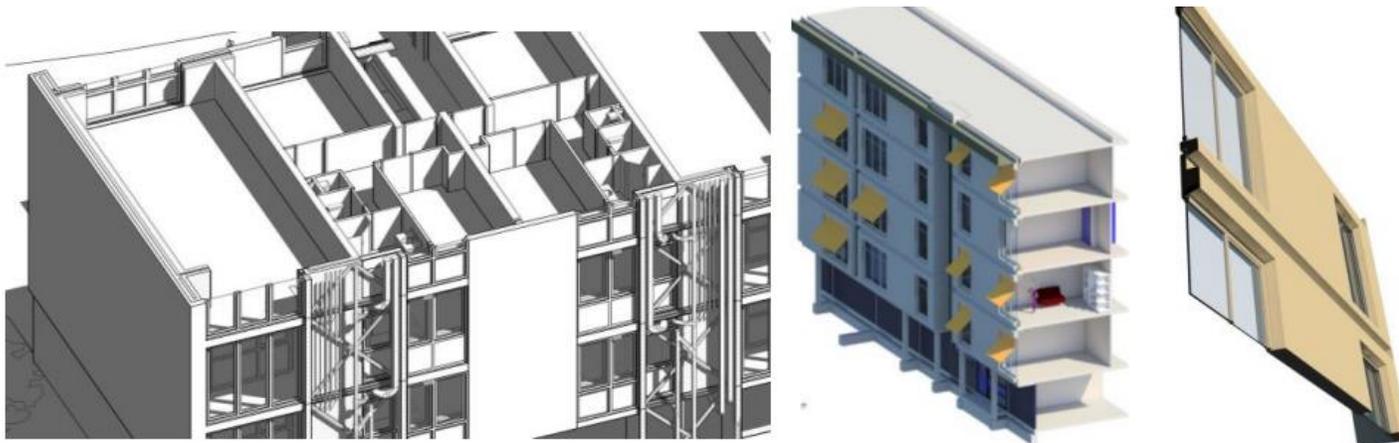
Energy labelling district 'de Reit'

Case studies of district renovation scenarios: Tilburg

Modelling



Different scenario's as part of the proposition for multi-family complexes in zone A



Modelling facade solutions for the multi-family complexes in zone A

Case studies of district renovation scenarios: Tilburg

possible decision result for the renovation of the six different privately owned multifamily complexes

Modelling

compl ex	facade	windows	roof	elevator	ground floor	installations
A	prefab facade	see facade	rooftop addition	yes	entrance improvement + insu.	HVAC comp.
B	prefab facade	see facade	rooftop addition	yes	entrance improvement + insu.	HVAC comp.
C	prefab facade	see facade	none	no	entrance improvement + insu.	HVAC comp.
D	prefab facade	see facade	insulation	no	none	HVAC comp.
E	Inside insulation	New windows	none	no	none	none
F	Inside insulation	New glass	none	no	entrance improvement	none

Case studies of district renovation scenarios: Tilburg

Making



Zone A and B in the district

Case studies of district renovation scenarios: Tilburg

Monitoring:

- monitor and evaluate the functioning of the district approach.
- The collection of these data is done through monitoring the usages and comfort of the inhabitants
- The P2Endure district alliance platform (LCC tools and e-Market) will be able to collect all the data and make them accessible for all the stakeholders in the district.

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Case studies of district renovation scenarios: Korsløgken

Mapping



Korsløgken district



Korsløgken district buildings

Case studies of district renovation scenarios: Korsløggen

Modelling



Milling with the robot (left); Spraying on the finishing layer

Case studies of district renovation scenarios: Korsløkken

Making



^F Temporal storage unit

Case studies of district renovation scenarios: Korsløggen

Making



Temporal storage places projected in the district

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Let's think together

Future Radars

...a backcasting method which uses time travel and a little imagination

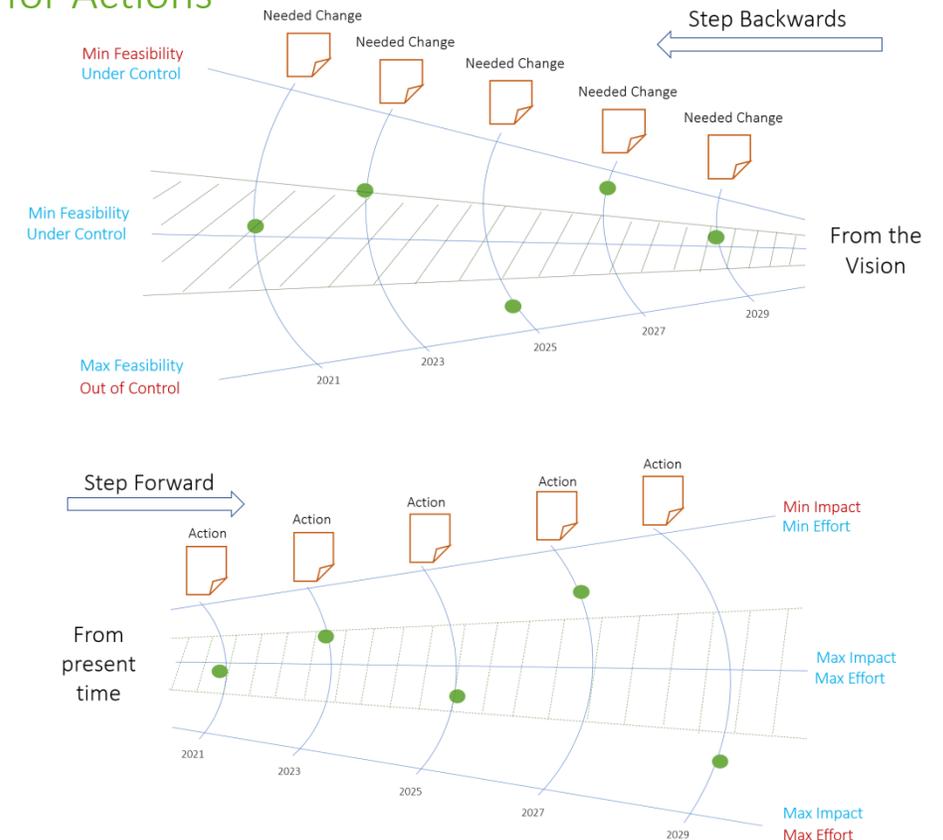
The Future Radar is made up of two parts: **Radar for Changes**, **Radar for Actions**

Step 1: Radar for Changes – Move Backwards

- We move from the Future Time to the present
- Our future vision is on the narrow extreme
- Goal: Move back from the Future Vision and identify the changes, which are necessary to achieve the envisioned future

Step 2: Radar for Actions – Move Forward

- Put yourself in the present and move forward
- Identify those actions, that can lead to the changes
- Brainstorm 10 Minutes individually as many actions as you can think of
- Discuss the suitable actions afterwards in your team



Future Radars

The CURRENT STATE

- No effective incentives to renovate old, energy-consuming buildings

The CHALLENGE

- How can we start a deep renovation movement at local district?

The VISION

- Wide scale, transferable processes for energy- and cost-efficient renovation

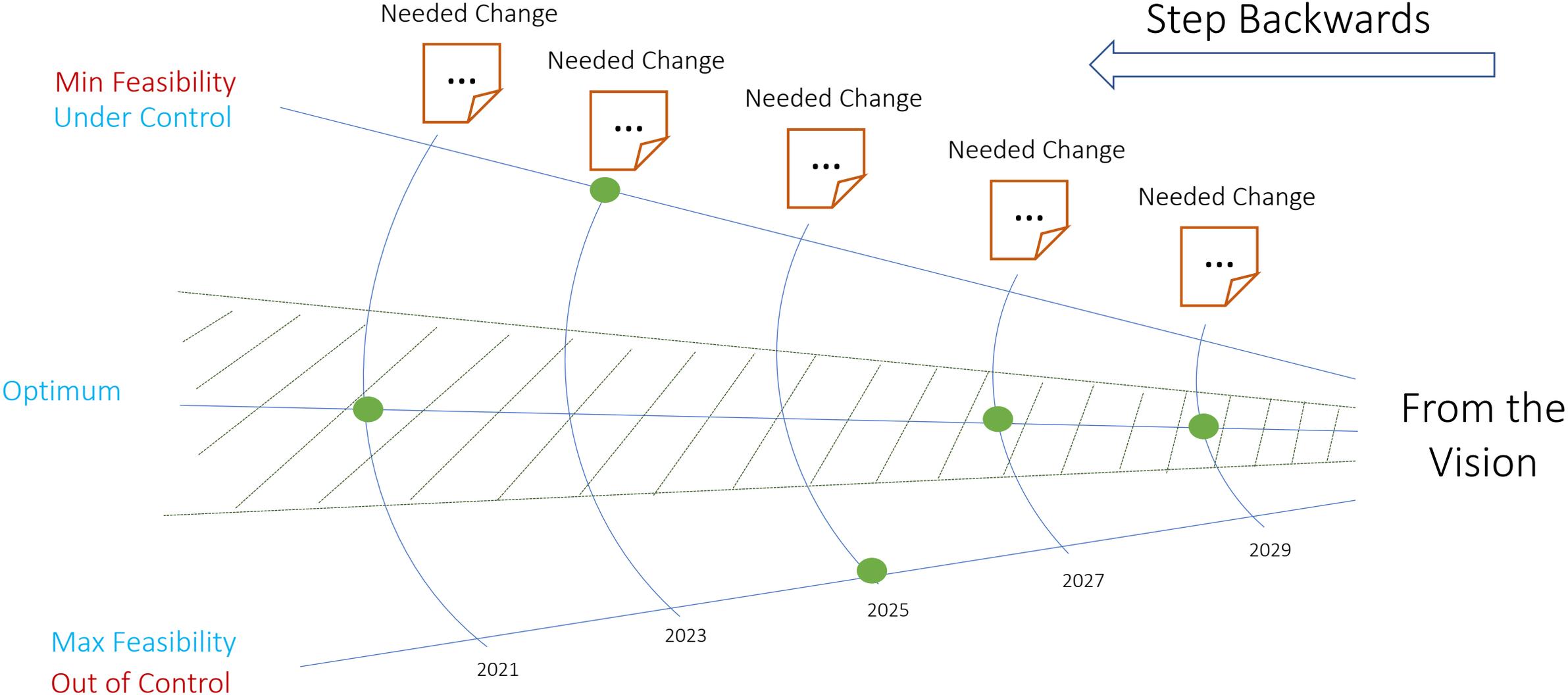
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Future Radars



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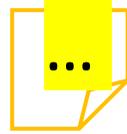
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Future Radars

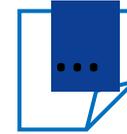
Specific renovation consortium in every municipality



We need the definition of best practice



We need a funding for local renovation



Step Backwards

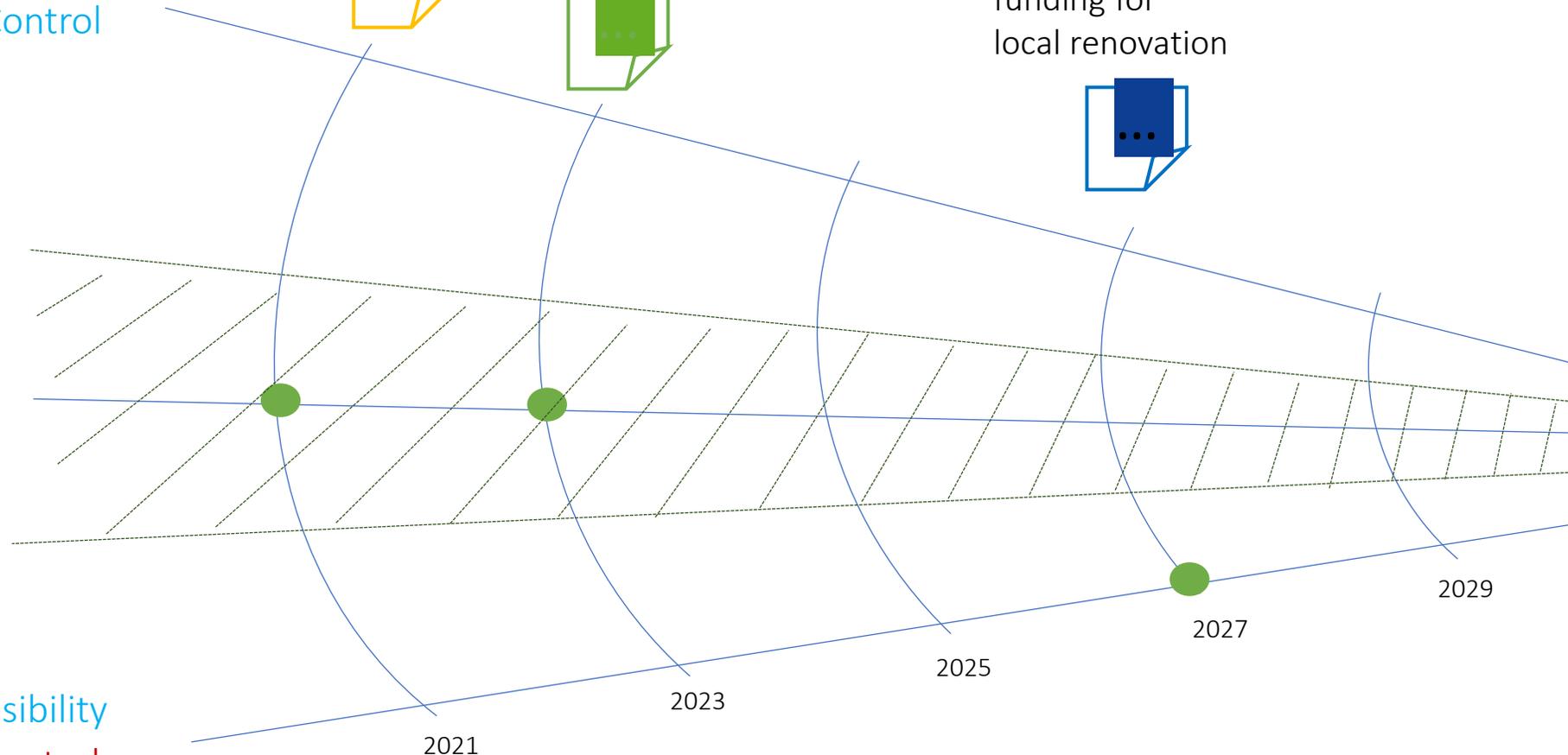


From the Vision

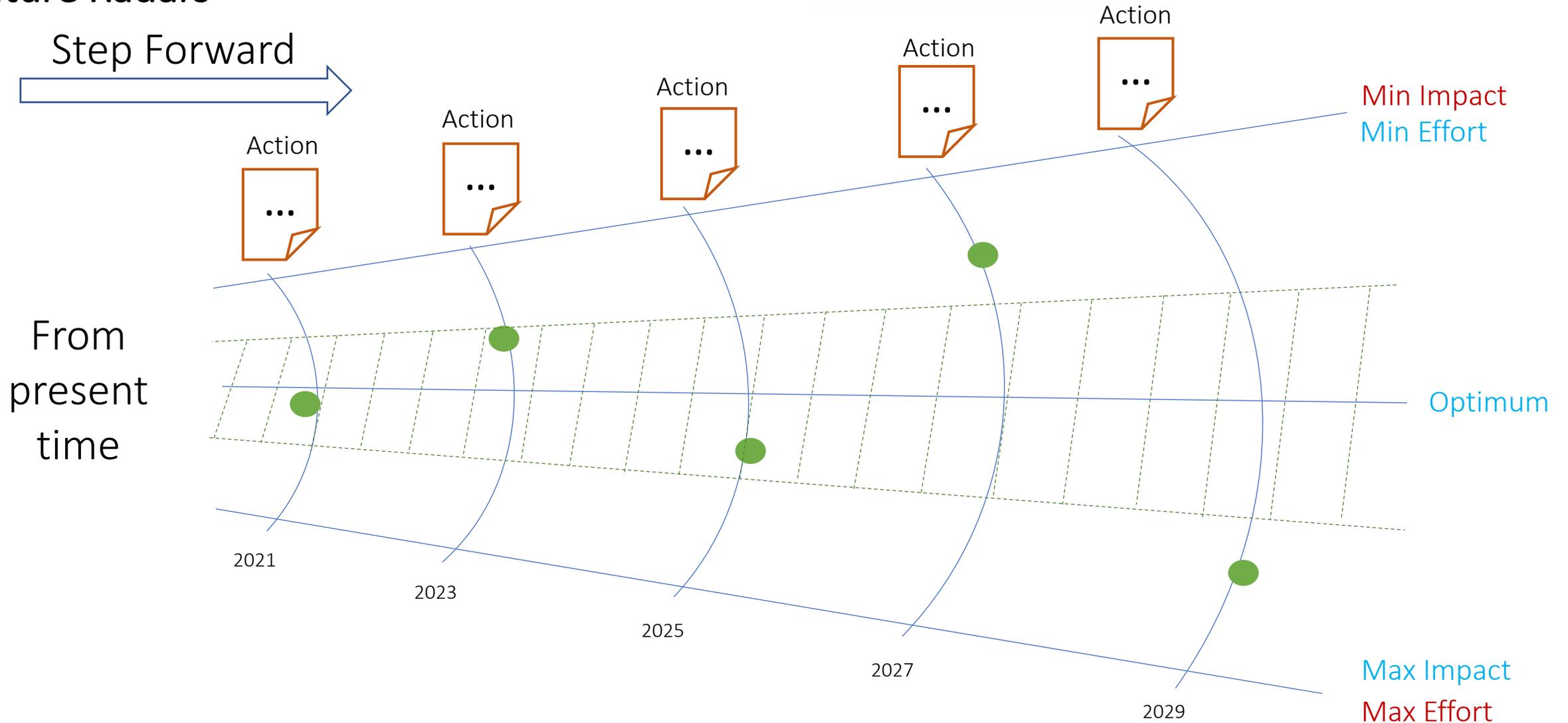
Min Feasibility
Under Control

Optimum

Max Feasibility
Out of Control



Future Radars



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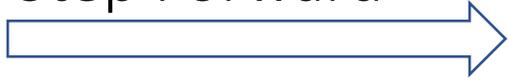
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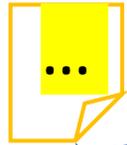
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Future Radars

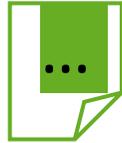
Step Forward



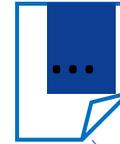
Set up
Initiate tender for
consortium



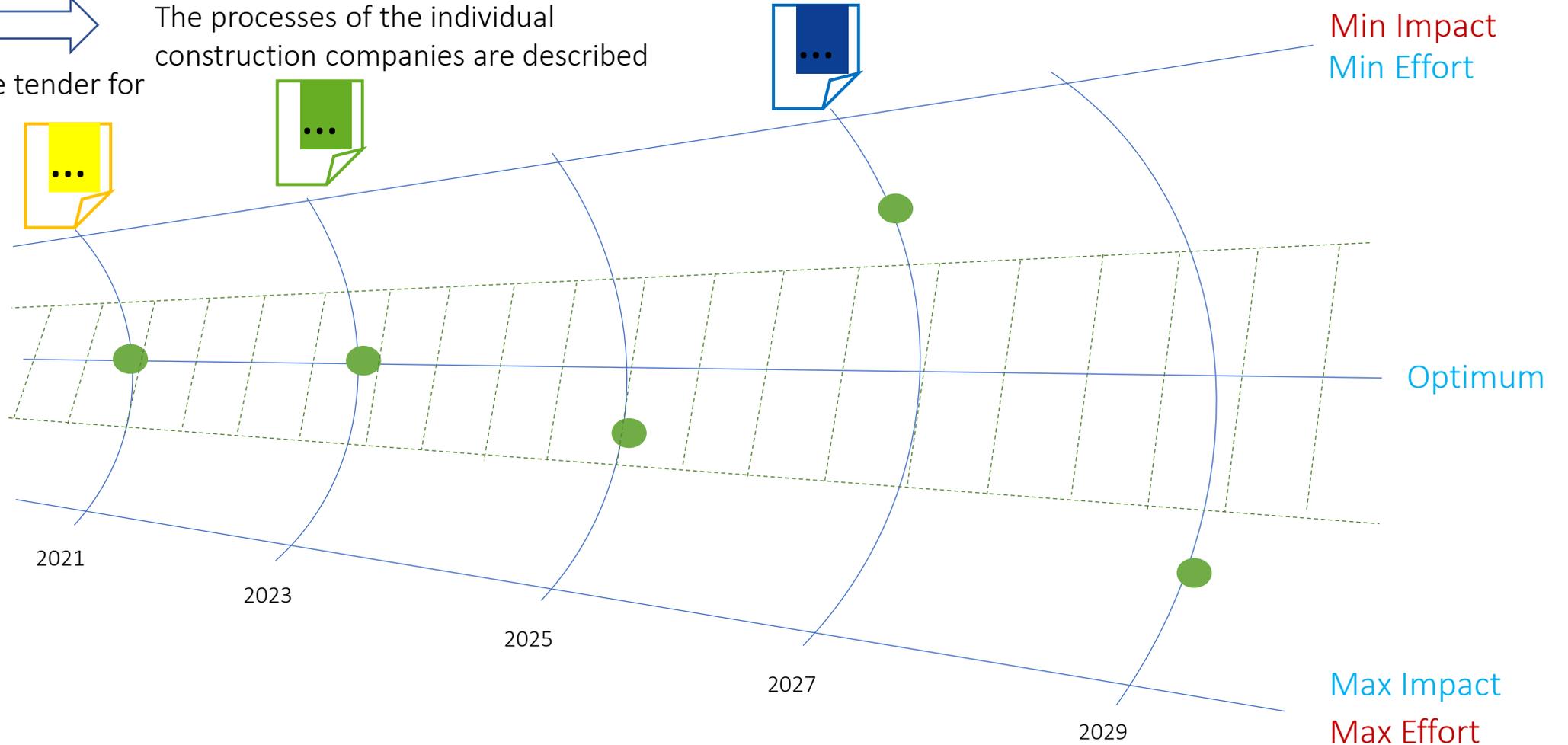
The processes of the individual construction companies are described



Municipality supports regional renovations with specific funds



From present time



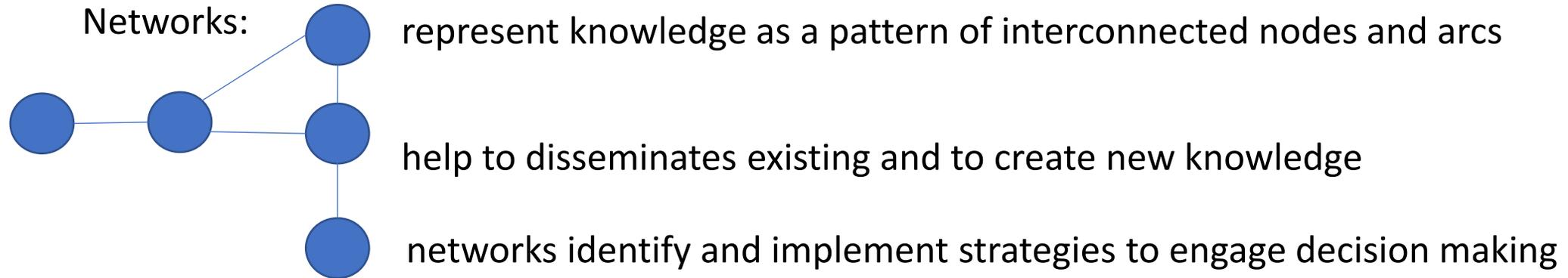
Actions to be done:

Radar for Changes

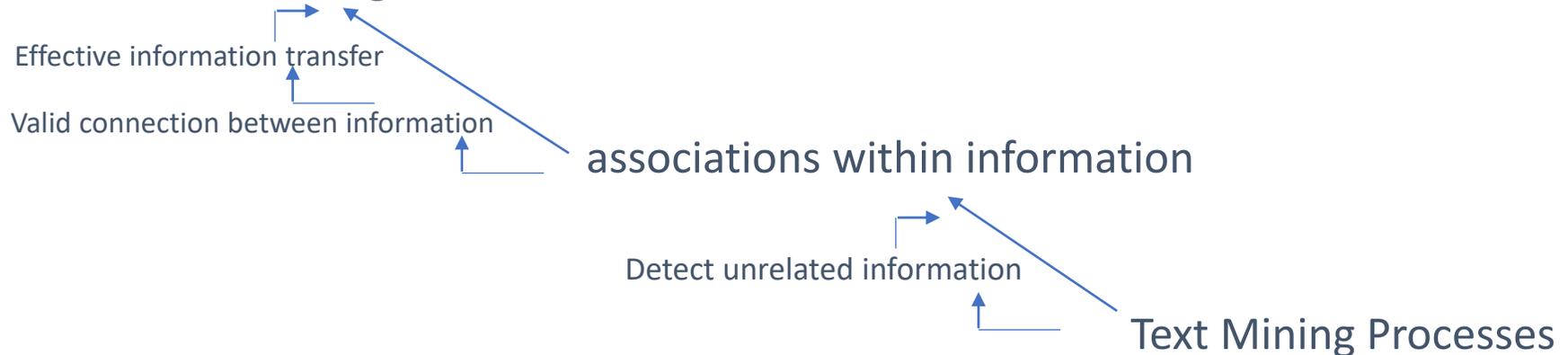
1. Spend 10 Minutes to brainstorm as many changes as you can imagine by yourself (think about social, process, technical and financial changes) and write them down
 1. Every Idea on a new sticky note
 2. Yellow for social; green for process; red for technical, blue for financial changes
2. Discuss ideas and place them in a chronological way along the time slide (20 Minutes)
3. Evaluate each idea according feasibility and controllable and make dots on the radar lines. Put ideal situations on the centre line

Radar for Actions

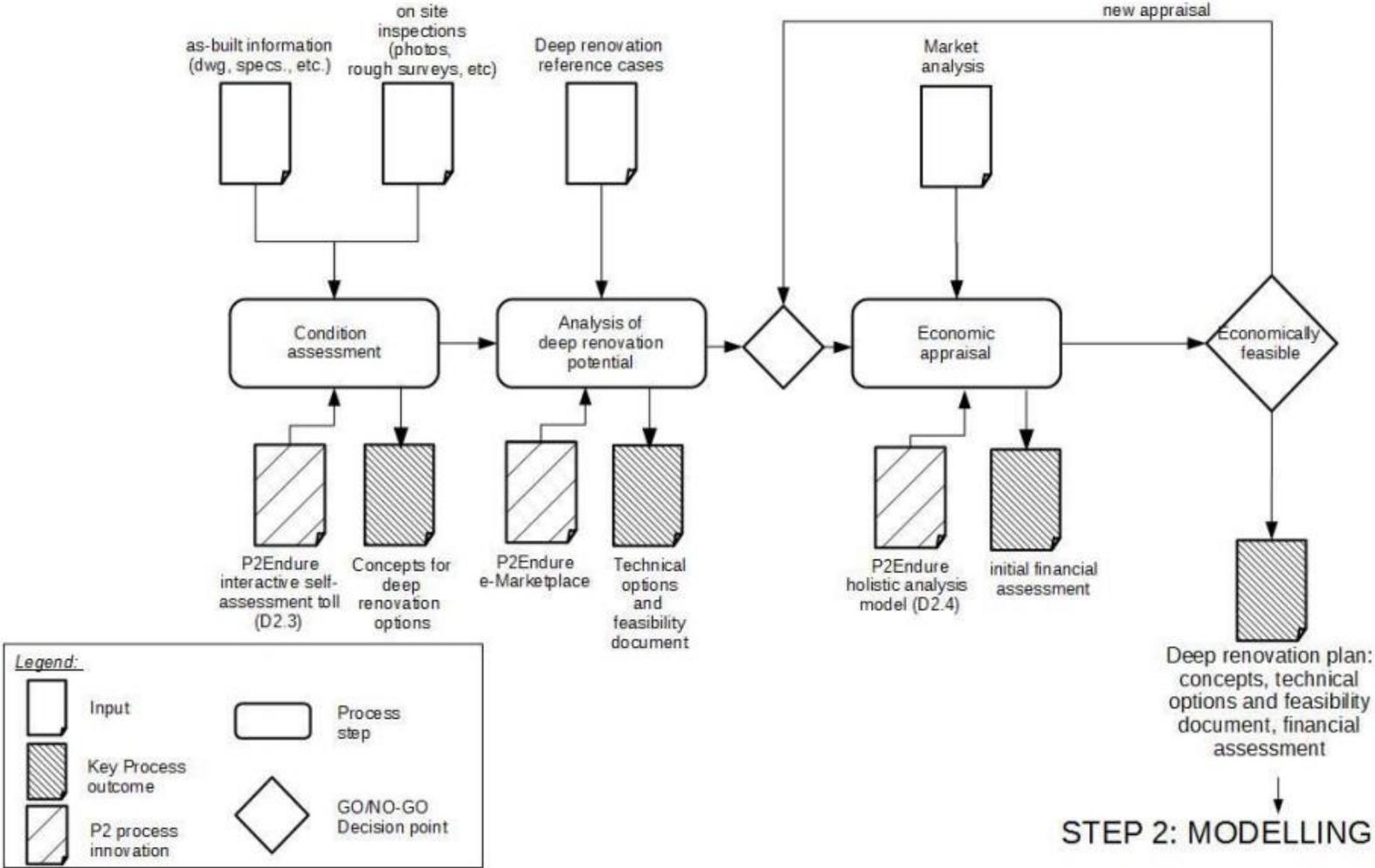
4. Spend 10 Minutes to brainstorm as many actions as you can imagine, which can lead to the changes and write them down
 1. Every Idea on a new sticky note
 2. Yellow for social; green for process; red for technical, blue for financial actions
5. Discuss ideas and place them in a chronological way along the time slide (20 Minutes)
6. Evaluate each idea according feasibility and controllable and make dots on the radar lines. Put ideal situations on the centre line



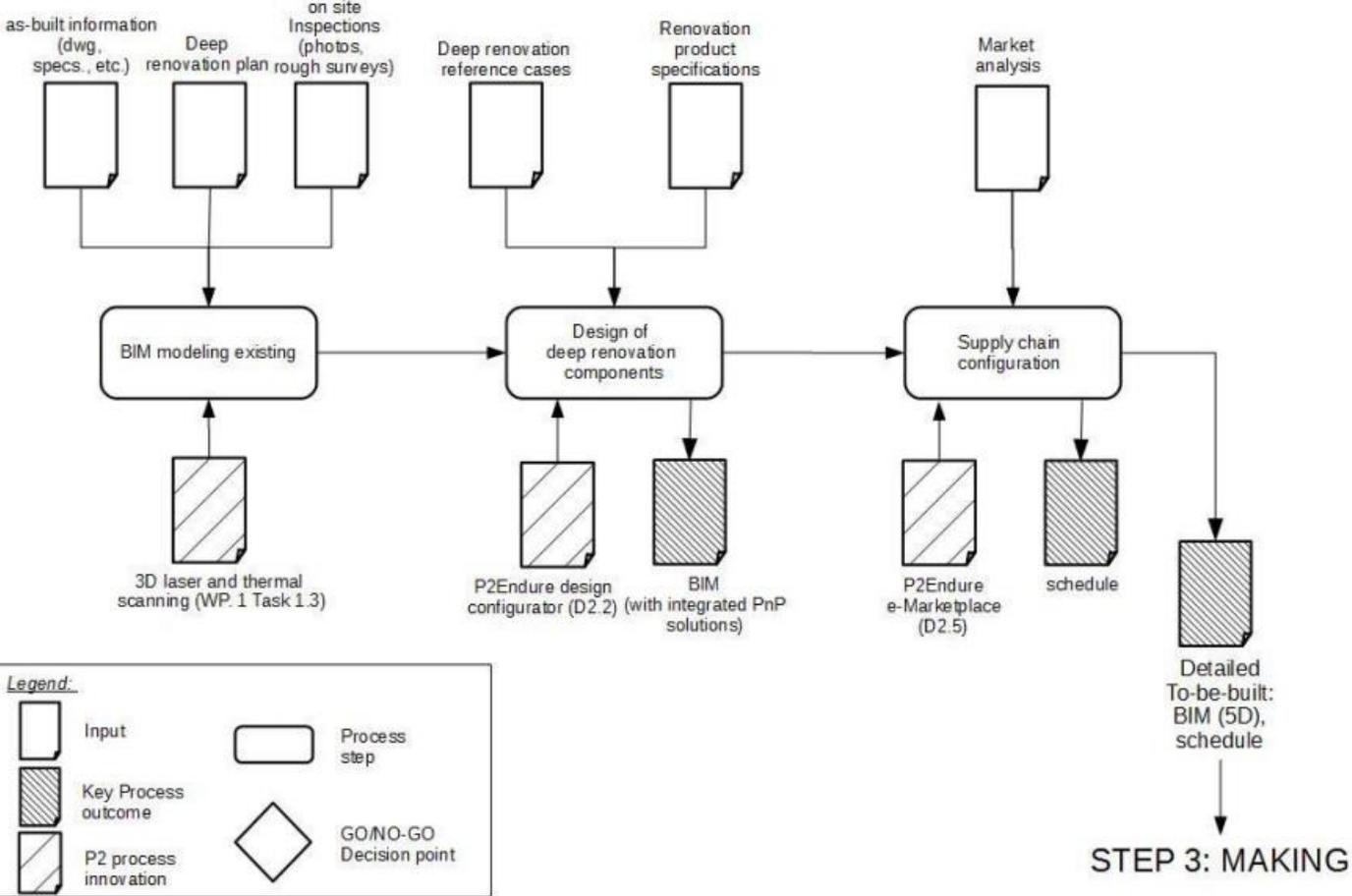
Powerful Knowledge Networks



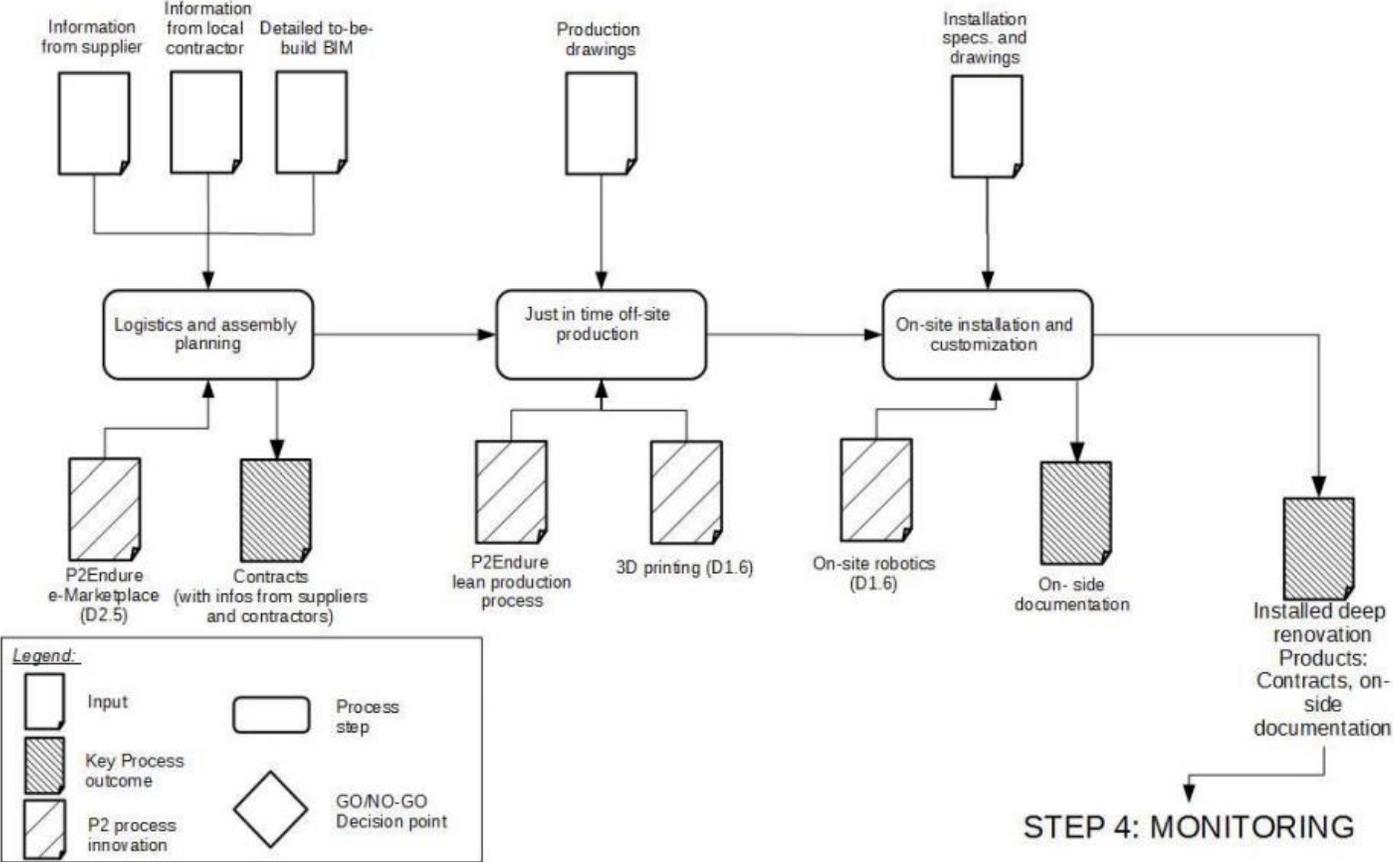
STEP 1: MAPPING



STEP 2: MODELLING



STEP 3: MAKING



STEP 4: MONITORING

