NET-UBIEP | Network for
Use BIM to Increase
Energy Performance

DELIVERABLE: D11-D2.2

Report on Roles of Target Groups in the Building Life Cycle and their role in NZEB implementation

Version: 1.5 FINAL
Date: 16/4/2020

WP-Leader: ISSO – STICHTING INSTITUUT VOOR STUDIE EN STIMULERING VAN ONDERZOEK OP HET GEBIED VAN GEBOUWINSTALLATIES

Author(s): All the partners

Network for Using BIM to Increase the Energy Performance

Grant Agreement Number: 754016
Net-UBIEP H2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement *No.754016*

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The present deliverable will be update during the project in order to align the outcome to the market needs as well as to other BIM related projects realized within Horizon 2020 program.

The updated version of the deliverable will be only available in the website of the project www.net-ubiep.eu.

Some deliverables could also be translated in partners national languages and could be find in the respective national web pages. Click on the flags to open the correspondence pages:

International web page

Italian web page

Croatian web page

Slovak web page

Spanish web page

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Estonian web page

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Summary

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1. Deliverable details

Document Reference #:	D11 – D2.2
Title:	Report on Roles of Target Groups in the Building Life Cycle and their role in NZEB implementation
Version Number:	1.5
Preparation Date:	September 2017 – October 2019, final version April 16, 2020
Delivery Date:	April 16, 2020
Author(s):	All the partners
Contributors:	All partners
Work Package	2 – IDENTIFICATION OF REQUIREMENTS
Type of deliverable	Document/Report
Format	Printed and Electronic
Dissemination Level:	PU – Public

2. Brief Description

This report describes the identification of the target groups and their role in BIM. Each role of each actor is identified in the construction workflow and focused on energy aspects. Four types of actors are considered in this task as having a relevant role in the building sector: Public Administrations, Professionals (Architects-Engineers),Technician (Installers-Maintainers),Tenants/Owners/Building Administrators.

For understanding the role of each actor in the different building life cycle phases, each partner is asked to inventory the role, tasks and competences for each actor.

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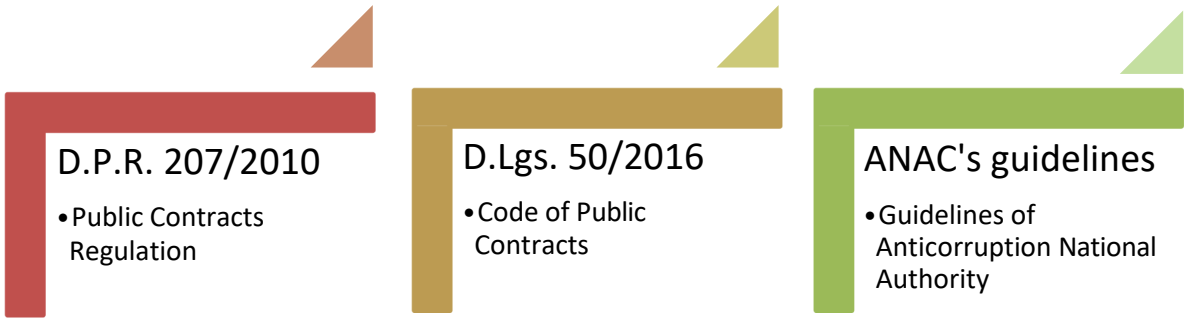
3. The building life cycle and the roles, tasks and competences of target groups in it

3.1 Italian Situation

Contributed by	Italy
Author	Clauido Rosso - Anna Moreno
Contact	rosso@gruppocs.com - anna.moreno@enea.it
Source	D.P.R. 207/2010 D.Lgs. 50/2016 ANAC's guidelines

➢ **General overview of the Building Life Cycle**

In Italy, there are two main decrees in which the phases of the Building Life Cycle are mentioned. At this it is possible to add the ANAC's guidelines.



Graph.01 Italian national law

Considering these decrees, seven phases (plus an additional starting phase) are individuated:

Phases	0. Organization	
Sub Phases	Quantification and identification of needs	Planning

In the initial phase, there are:

- quantification and identification of needs and requirements from the commitment side;
- planning of the activities made by Public Administration every three years to define how much of the budget will be dedicated for each project

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In the phase 1, there are:

Phases	1. Start of the design		
Sub Phases	Definition of DPP (Preliminary Production Document)	Assignment to the level of criticality	Services conference (only in particular cases)

- definition of DPP (Preliminary Production Document)
- assignment to the level of criticality
- services conference

Phases	2. Design						
Sub Phases	Technical and economical feasibility project	Check and validation of the basic design	Definitive Design	Check and validation of the definitive design	Executive Design	Check and validation of the executive design	Approval of the Public Administration

In the phase 2, there are:

- technical and economic feasibility project, which includes the basic design
- check and validation of the basic design made by internal controls body
- definitive design
- check and validation of the definitive design made by internal controls body
- executive design
- check and validation of the executive design made by internal controls body
- approval of the Public Administration

Phases	3. Commitment to Engineering Services		
Sub Phases	Call for Proposal	Assignment of construction works	Contract Stipulation

In the phase 3, there are:

- call for proposal (for public construction works) or collection of three different estimates (for private construction works)
- assignment of construction works
- contract stipulation

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Phases	4. Realization			
Sub Phases	Plan and set-up the construction site	Work in progress and changes	Updating of BIM Model	Finish of construction works

The phase 4 is not regulated by Italian Legislation but, from different experiences, it is possible to find:

- plan and set-up of the construction site
- work in progress and changes
- updating of BIM Model made by BIM Coordinator
- finish of construction works

Phases	5. Test and Control			
Sub Phases	Ongoing Testing	Static test	Technical-functional test of the systems	Update of data in 7D BIM Model

In the phase 5, there are:

- ongoing tests
- static tests
- dynamic tests (technical and functional test of the systems of the building)
- update of data in 7D BIM Model made by BIM Coordinator

Phases	6. Management and Maintenance				
Sub Phases	Management and control	Systems operation	Plan of maintenance using 7D BIM Model	Ordinary Maintenance	Extraordinary Maintenance

In the phase 6, there are:

- management and control
- systems operation
- plan of maintenance using 7D BIM Model made by Facility Manager
- ordinary maintenance (for change of components)
- extraordinary maintenance (for malfunctions, obsolescence, technological progress)

Phases	7. End of Life		
Sub Phases	Recycling and reuse	Extrapolation of environmental data using BIM Model	Demolition and recycling of components

In the phase 7, there are:

- recycling and reuse
- extrapolation of environmental data using BIM Model by Environmental Engineer
- demolition and recycling of components

Table.01 Seven phases construction process

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- **Role of the Public Administration in the BLC**

  In Italy, the Public Administration is the authority who disciplines, supervises and approves the main activities of the Building Life Cycle, controlling the respect of national regulatory and legislative requirements and supervising contracts between privates. If the commitment is public, the authority quantifies and identifies needs at the beginning and stipulates contracts with professionals and technicians after the call for proposal. In the end of the cycle it supervises the way to recycle and dispose waste.

- **Role of the Public Administration when focusing on energy aspects**

  Focusing on the energy aspects, the Public Administration is the entity who pilots the new constructions in the NZEB implementations, controlling the respect of national regulatory and legislative requirements in the field of energy performances for the constructions and the materials used.

- **Tasks and Competencies of the Public Administration in the BLC**

  Its tasks (and consequent competences) in the Building Life Cycle are:

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Phase: Organization	Tasks	Competences
	• Plan of the activities every three years to define how much of the budget will be dedicate to each project	• Competencies in new regulations and European standards

Phase: Design	Tasks	Competences
	• Approve the technical design in accordance with the national regulatory and legislative requirements for energy performance (including laws for RES) • Approve the project documents in accordance with the national regulatory and legislative requirements for used materials	• Competencies to establish energetic focus, developing goals in support of the national regulation • Legislative and regulatory competencies in building energy performance • Legislative and regulatory competencies in the usage of different construction materials and their environmental impacts • Competencies connected to the managing of an Information System and the interpretation of BIM projects • Competencies in stipulating new EPC (Engineering, Procurement and Construction) contracts related to BIM implementation

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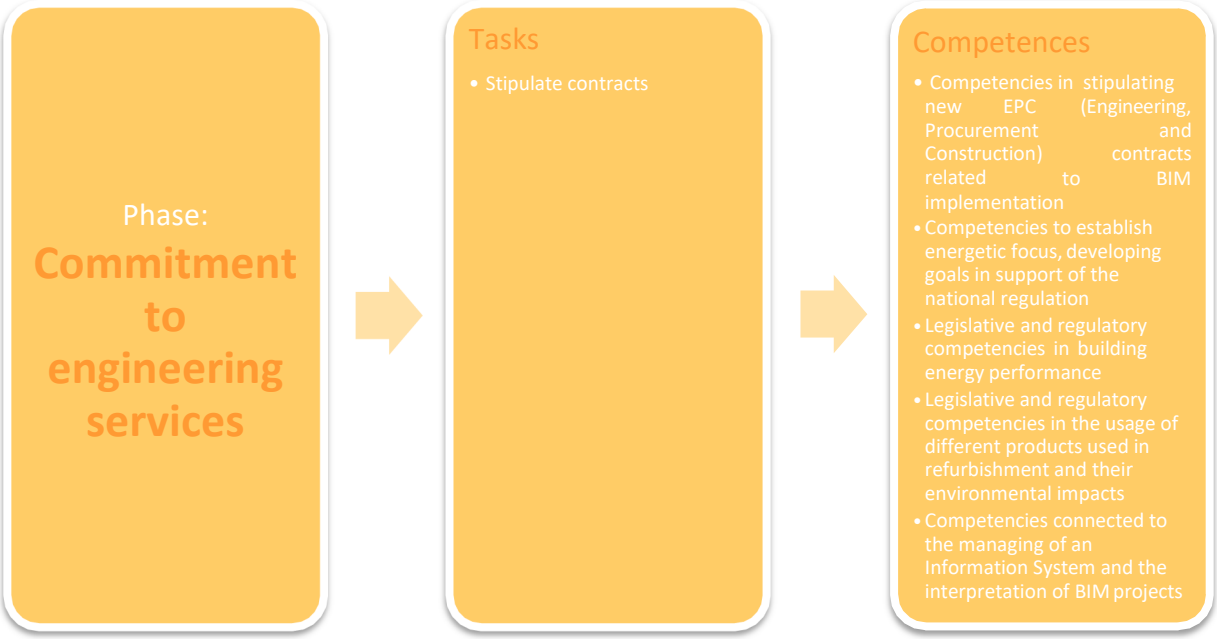

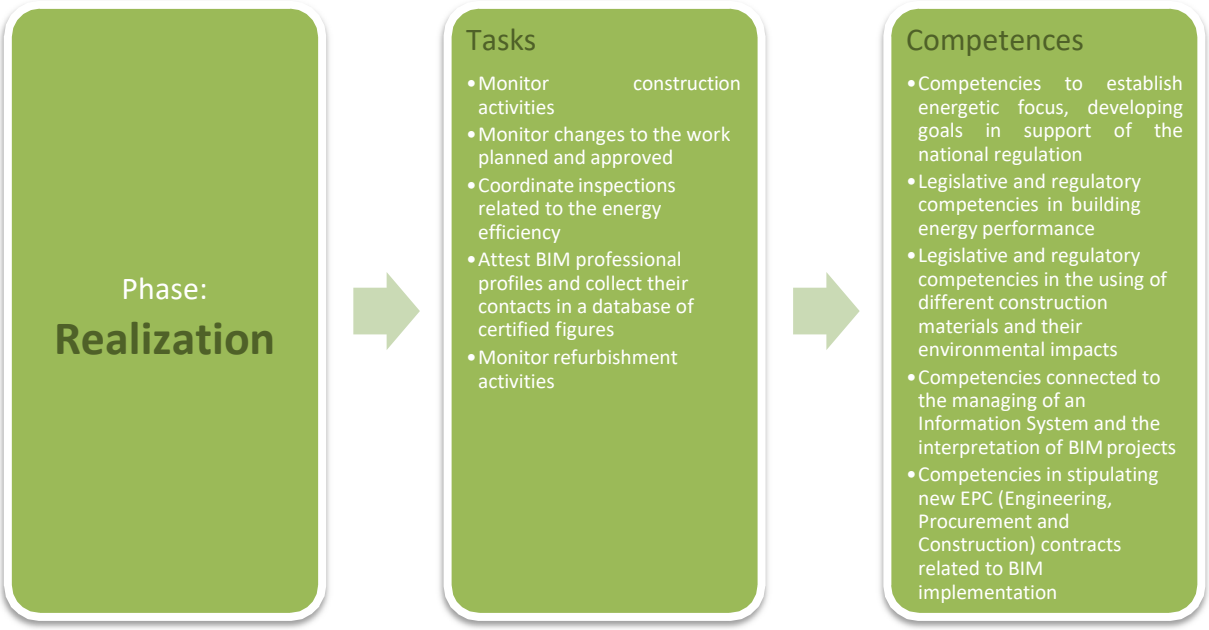

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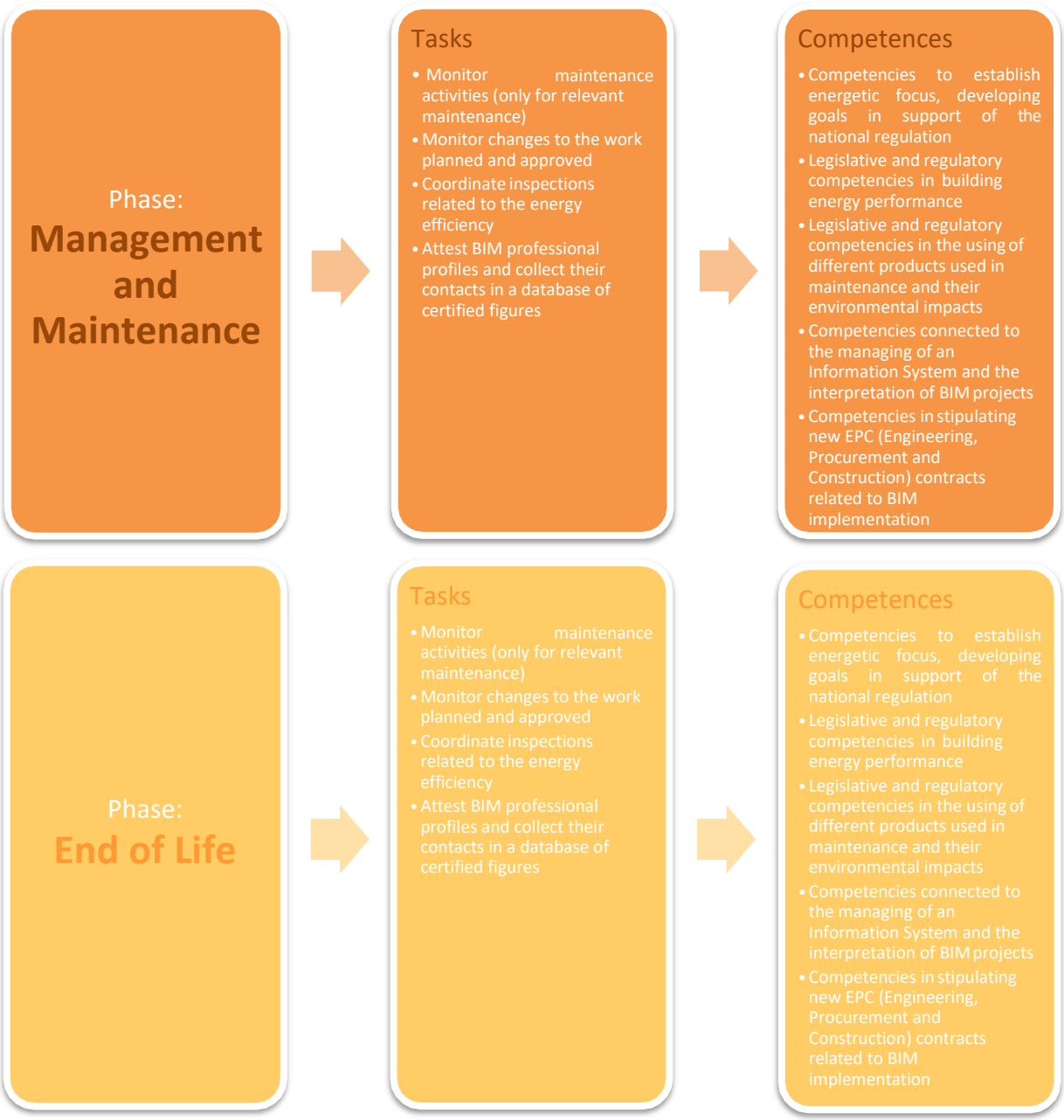

Graph.02 Building Life Cycle for PA

- **Role of the Professionals in the BLC**

  "Professional" includes Architects and Engineers who are in charge to quantify and identify needs of the customers, in the first stages of the Building Life Cycle, and design building features. In addition, during the construction works, they are responsible to test and control works conducted by blue-collar workers.

- **Role of the Professionals when focusing on energy aspects**

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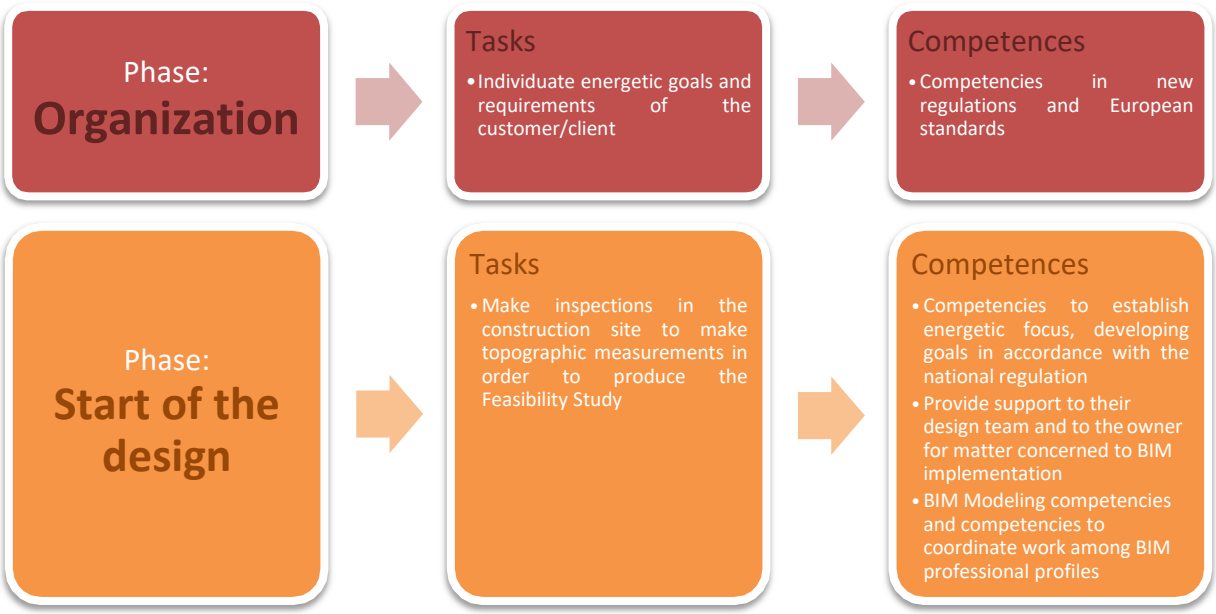
Professionals interested in Energy Efficiency try to pilot construction works in NZEB implementation, controlling that each law and best practice is respected.

➢ **Tasks and Competencies of Professionals in the BLC**



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Phase:
Design

Tasks

- Realize energetic models and simulations to individuate the solution which performed in the best way
- Realize Energetic and Technical Documentations and define specifications to respect laws on environmental impacts
- Individuate optimal technical/energetic solutions to satisfy the building requirements
- Estimate total budget, total time at completion and total resources needed to fulfill starting energetic goals
- Plan energy refurbishment works and their monitoring and controls
- Schedule energy construction works for the refurbishment and their monitoring and controls
- Monitor and control the energy performance of the systems for the refurbishment (enlightenment, heating, fire escape…) realizing schemes and diagrams
- Test that the refurbishment work carried out is in accordance with the energy performance of the project and that it is suitable for the use
- Does technical inspections related to the energy efficiency in the refurbishment

Competences

- Competencies to establish energetic focus, developing goals in accordance with the national regulation
- Provide support to their design team and to the owner for matter concerned to BIM implementation
- BIM Modeling competencies and competencies to coordinate work among BIM professional profiles
- Competencies in system engineering and their energetic consumption
- Competencies in system engineering, their energetic consumption and the energy efficiency
- Competencies in matter of the differences between components and their environmental impacts

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Phase: Commitment to Engineering Services	Tasks	Competences
	• Stipulate contracts	• Competencies in stipulating new EPC (Engineering, Procurement and Construction) contracts related to BIM implementation • Competencies to establish energetic focus, developing goals in support of the national regulation • Legislative and regulatory competencies in building energy performance • Legislative and regulatory competencies in the using of different products used in refurbishment and their environmental impacts • Competencies connected to the managing of an Information System and the interpretation of BIM projects

Phase: Realization	Tasks	Competences
	• Plan energy construction works and their monitoring and controls • Schedule energy construction works and their monitoring and controls • Monitor and control the energy performance of the systems (enlightenment, heating, fire escape…) realizing schemes and diagrams • Test that the work carried out is in accordance with the energy performance of the project and that it is suitable for the use • Does technical inspections related to the energy efficiency	• Competencies to establish energetic focus, developing goals in accordance with the national regulation • Provide support to their design team and to the owner for matter concerned to BIM implementation • BIM Modeling competencies and competencies to coordinate work amoung BIM professional profiles • Competencies in system engineering and their energetic consumption • Competencies in system engineering, their energetic consumption and on the energy efficiency • Competencies in matter of the differences between components and their environmental impacts

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Phase:	Tasks	Competences
Test and Control	• Plan test and control and their monitoring • Monitor and control the energy performance of the systems (enlightenment, heating, fire escape…) realizing schemes and diagrams • Test that the work carried out is in accordance with the energy performance of the project and that it is suitable for the use • Does technical inspections related to the energy efficiency	• Competencies to establish energetic focus, developing goals in accordance with the national regulation • Provide support to technicians and owner for matter concerned to BIM implementation • Competencies in system engineering and their energetic consumption • Competencies in matter of the differences between components and their environmental impacts • Competencies in system engineering, their energetic consumption and on the energy efficiency
Management and Maintenance	• Plan energy maintenance works and their monitoring and controls • Schedule energy construction works and their monitoring and controls • Monitor and control the energy performance of the systems (enlightenment, heating, fire escape…) realizing schemes and diagrams • Test that the work carried out is in accordance with the energy performance of the project and that it is suitable for the use • Does technical inspections related to the energy efficiency • Does external audit to guarantee a continuous high- performing maintenance	• Competencies to establish energetic focus, developing goals in accordance with the national regulation • Provide support to their design team and to the owner for matter concerned to BIM implementation • BIM Modeling competencies and competencies to coordinate work among BIM professional profiles • Competencies in system engineering and their energetic consumption • Competencies in system engineering, their energetic consumption and on the energy efficiency • Competencies in matter of the differences between components and their environmental impacts

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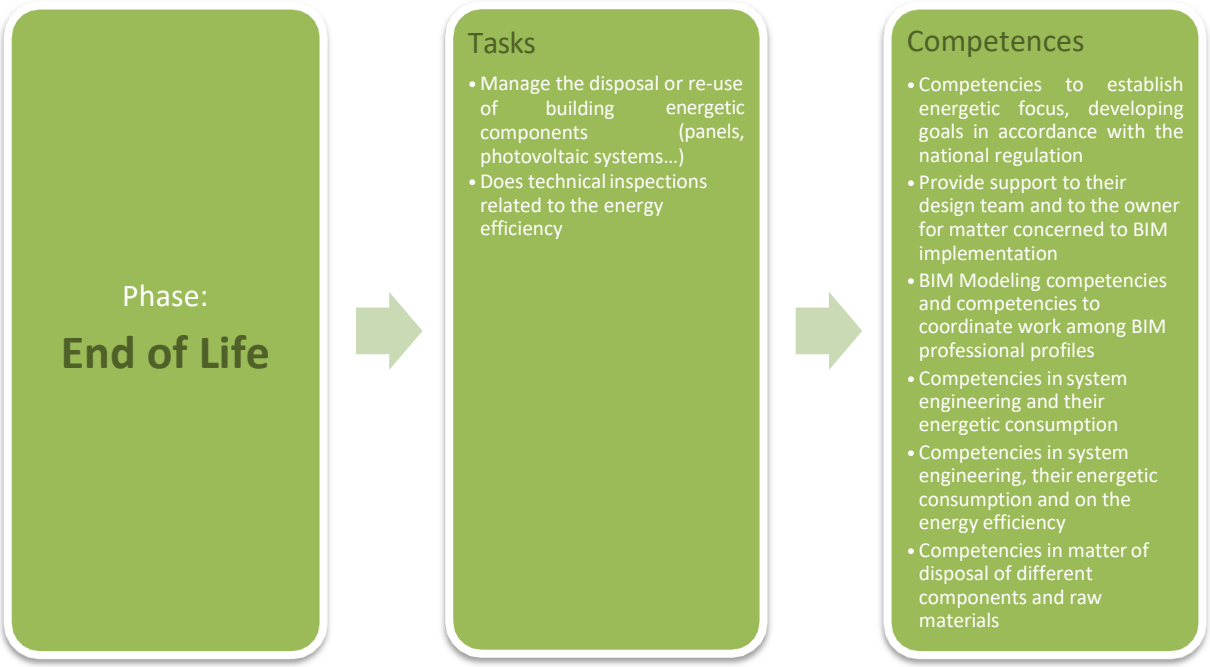


Graph.03 Building Life Cycle for Professional

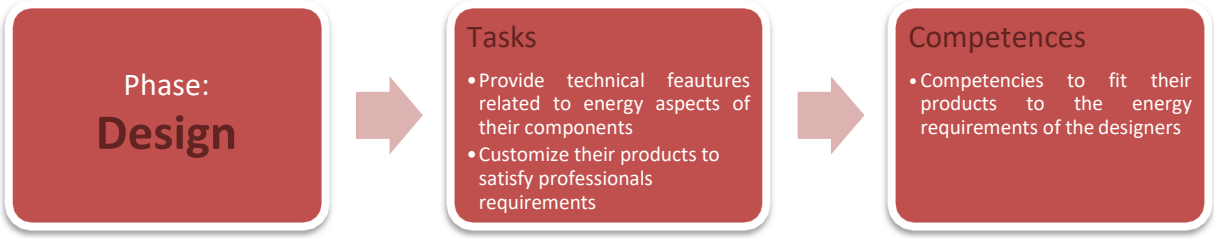
- **Role of the Technicians in the BLC**

  In this Target Group are included supplier of raw materials and components, workers, installers and demolition companies.

- **Role of the Technicians when focusing on energy aspects**

  The enterprises of technical works are less interested in implementing an innovative construction strategy but, if the other target groups are involved in BIM implementation, they are tempted to adapt their way of work to the changes.

- **Tasks and Competencies of the Technicians in the BLC**



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Phase:
Realization

Tasks

- Set up the building site in accordance to increase the energy performance during the construction phase and verify their access
- Responsible for the procurement of construction materials and for the realization of the building in accordance with energetic instructions
- Provide a list of spare parts and an handbook for the use (and their updating) for the future maintenance of the building which fit with energy performance requirements
- Realize the refurbishment in accordance with energetic instructions
- Test the energy performance of the systems (enlightenment, heating, fire escape…) realizing schemes and diagrams

Competences

- Competencies in the way to reach high Energy Performances
- Basic competencies in system engineering

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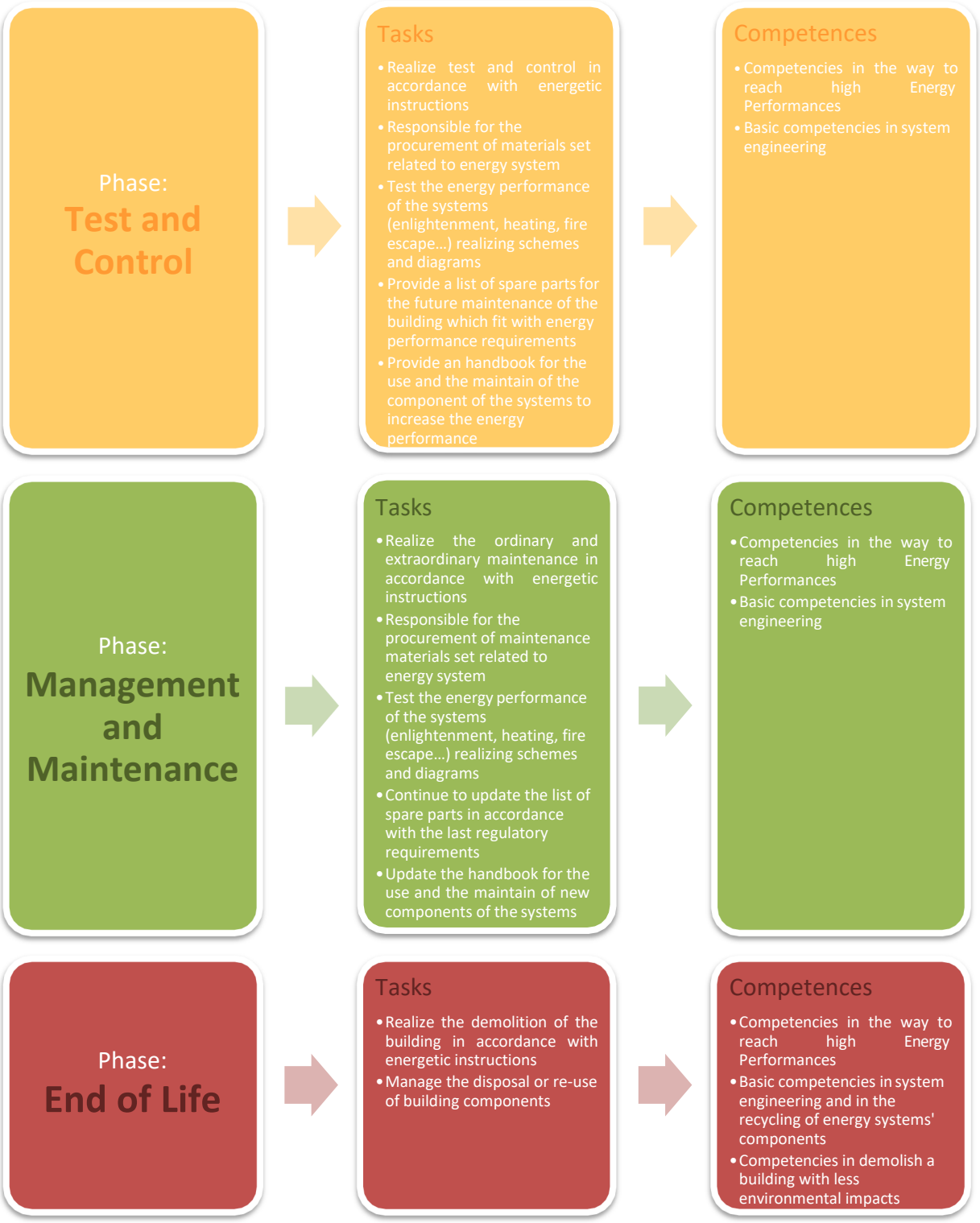

Graph.04 Building Life Cycle for Technicians

D4.1 Report on roles of Target Groups in the Building Life Cycle and their role in NZEB implementation

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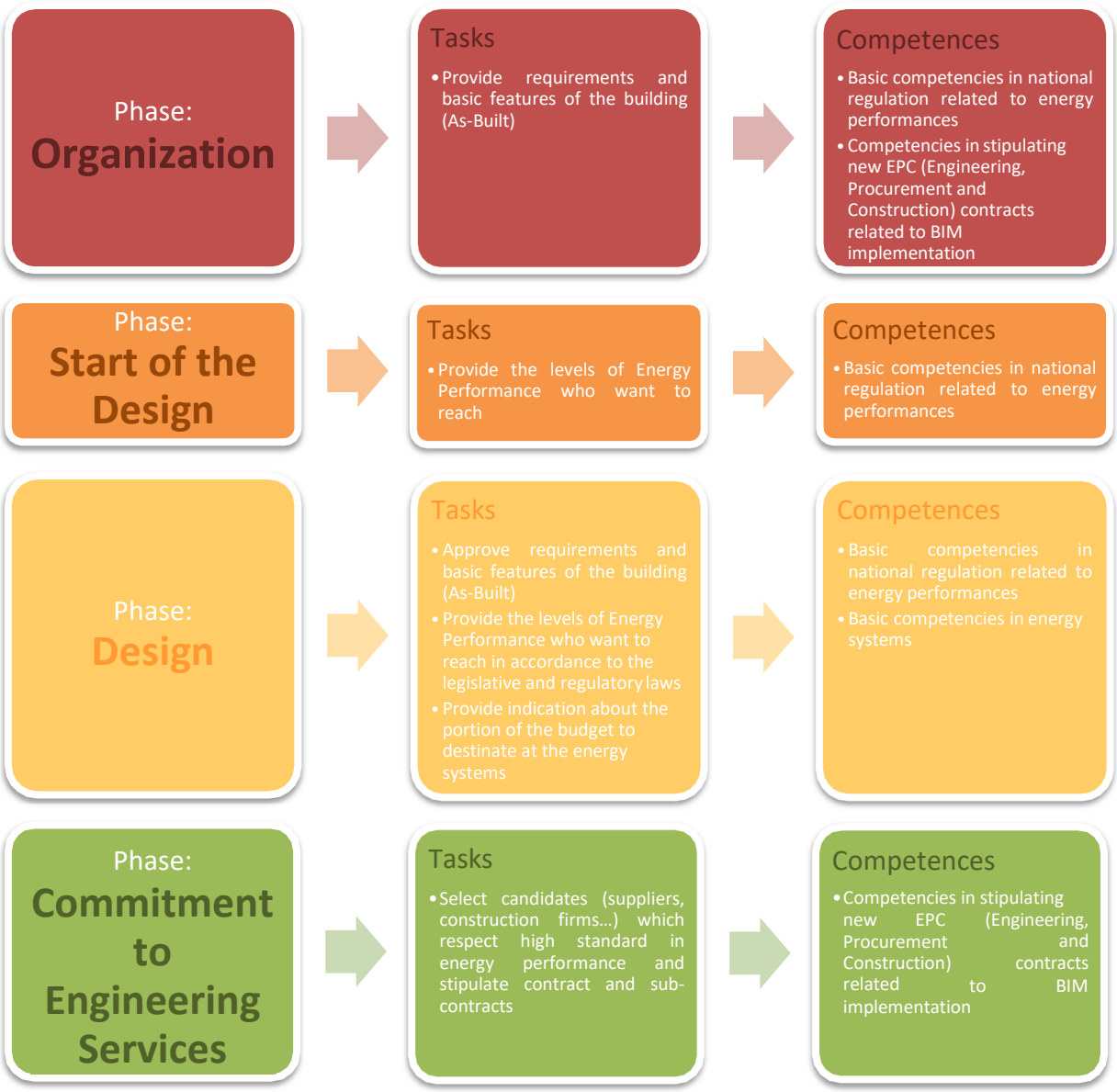
- **Role of the Tenants/Owners in the BLC**

  Tenants and Owners are the commitment part who want to invest in private buildings or who works for the management of public buildings.

- **Role of the Tenants/Owners when focusing on energy aspects**

  Tenants and Owners are the commitment part who want to invest in private buildings or who works for the management of public buildings.

Tasks and Competencies of the Tenants/Owners in the BLC



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Graph.05 Building Life Cycle for Tenants/Owners

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Spanish Situation

Contributed by	Fundación Laboral de la Construcción (FLC)
Author	Silvia Santos
Contact	ssantos@fundacionlaboral.org
Source	'Código Técnico de Edificación' (Technical Code on Edification) Act 38/1999 on Ordenation of the Edification (LOE)

➢ General overview of the Building Life Cycle

In Spain, the following table shows the main stages and sub-stages applied to the BLC, although it is not possible to find one single and common diagram, since the life cycle usually depends on the author. The following integrates the most usual ones:

Phase 1	Phase 2		Phase 3			Phase 4	Phase 5	Phase 6
Conceptual idea	Feasibility analysis		Design-planning			Execution	Use & maintenance	Demoliton
	Technical feasibility	Financial feasibility	Technical specifications	Economic specifications	Contractual specifications			

Table.01 Construction process phases

The main reference to be applied is the current 'Código Técnico de Edificación' (Technical Code on Edification), which encompasses the set of main regulations applied to the construction industry in Spain, according to the Act 38/1999 on Ordination of the Edification (LOE).

This document integrates the stages of *Project, Building, Maintenance and Conservation*. Its compliance is compulsory for all the new buildings, whereas for those needing to be modified or refurbished obligation depends on the nature of the intervention to be done.

➢ Role of the Public Administration in the BLC

The Public Administration is the competent authority who makes the final approval and permission of the project deign, in line with the regulations in force. They will deal with any of the aspects that a building project may affect: environment, occupational health and safety for workers, energy, waste, etc.

➢ Role of the Public Administration when focusing on energy aspects

Energy is one of the aspects that is being regulated. In Spain, the Energy Performance of Buildings Directive (EPBD) is transposed through different documents:

- Basic document on energy savings of the Technical Code on Edification;
- Regulation on Thermal Installation on Buildings;
- Sustainable Economy Act
- R.D. 235/2013 on Basic procedure for the certification of the energy efficiency of the buildings.

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➢ **Tasks and Competencies of the Public Administration in the BLC**

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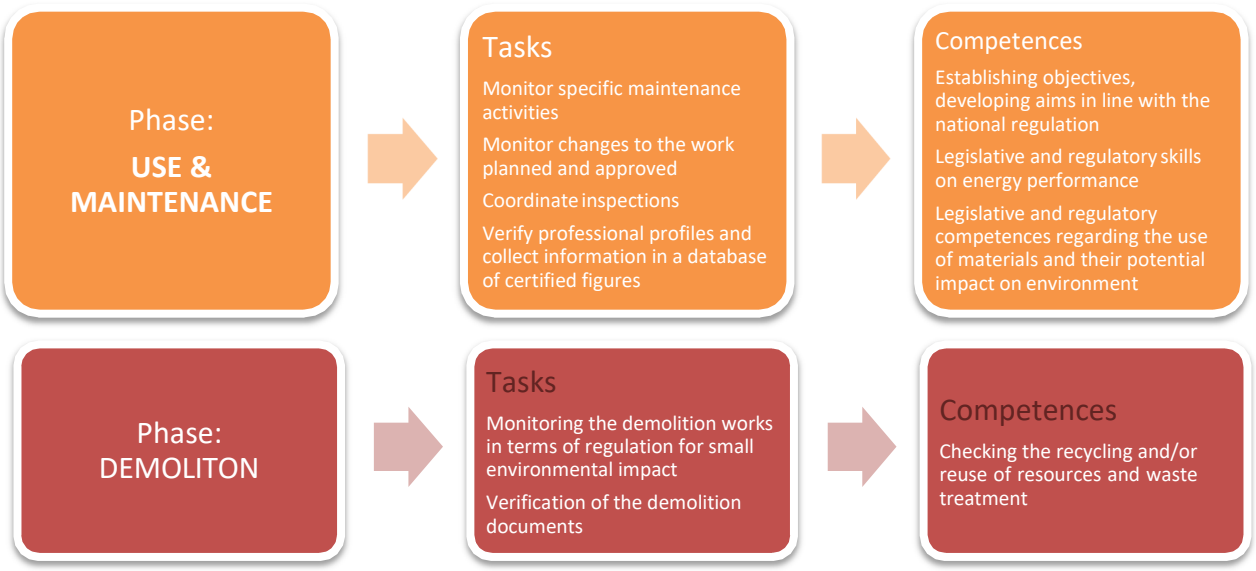

graph.01 Building Life Cycle for PA

- **Role of the Professionals in the BLC**

  In the first stages of the BLC, Architects, Engineers, Project Managers, Consultants, etc. are in charge of drafting the necessary documentation and analyzing all those needs and requirements by the competent authorities, customers, users, contractors, building managers/maintainers, and of designing according to these needs and requirements. Furthermore, they will need to test and carry out a monitoring of each activity performed by other workers, especially operators. After the construction works, these Professionals will be also in charge of the maintenance activities and will deal with refurbishment projects when necessary or even for demolition.

- **Role of the Professionals when focusing on energy aspects**

  Professionals will act as consultants for all those topics related to energy efficiency for new buildings and as energy auditors for existing buildings.

Tasks and Competencies of the Professionals in the BLC

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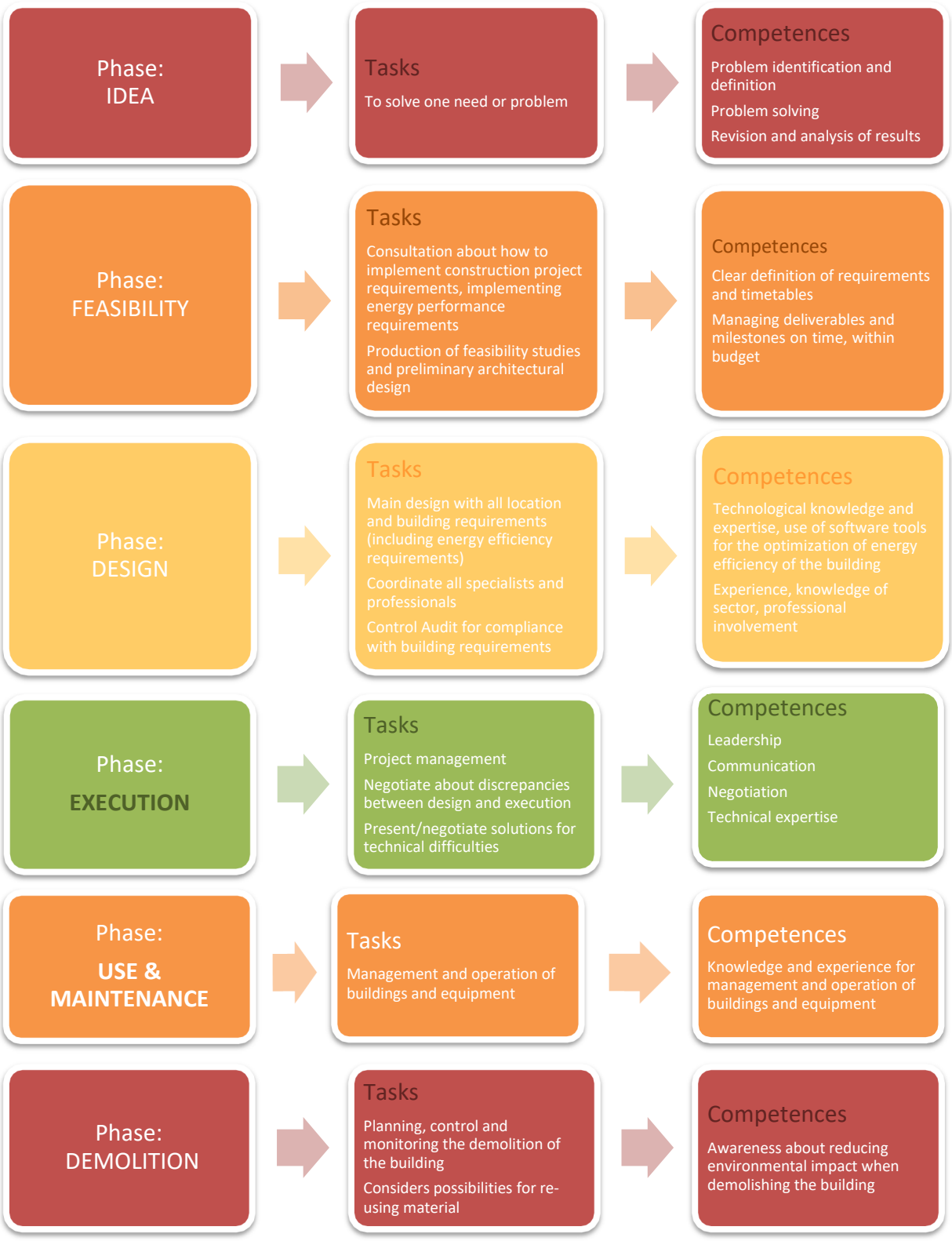

graph.02 Building Life Cycle for Professional

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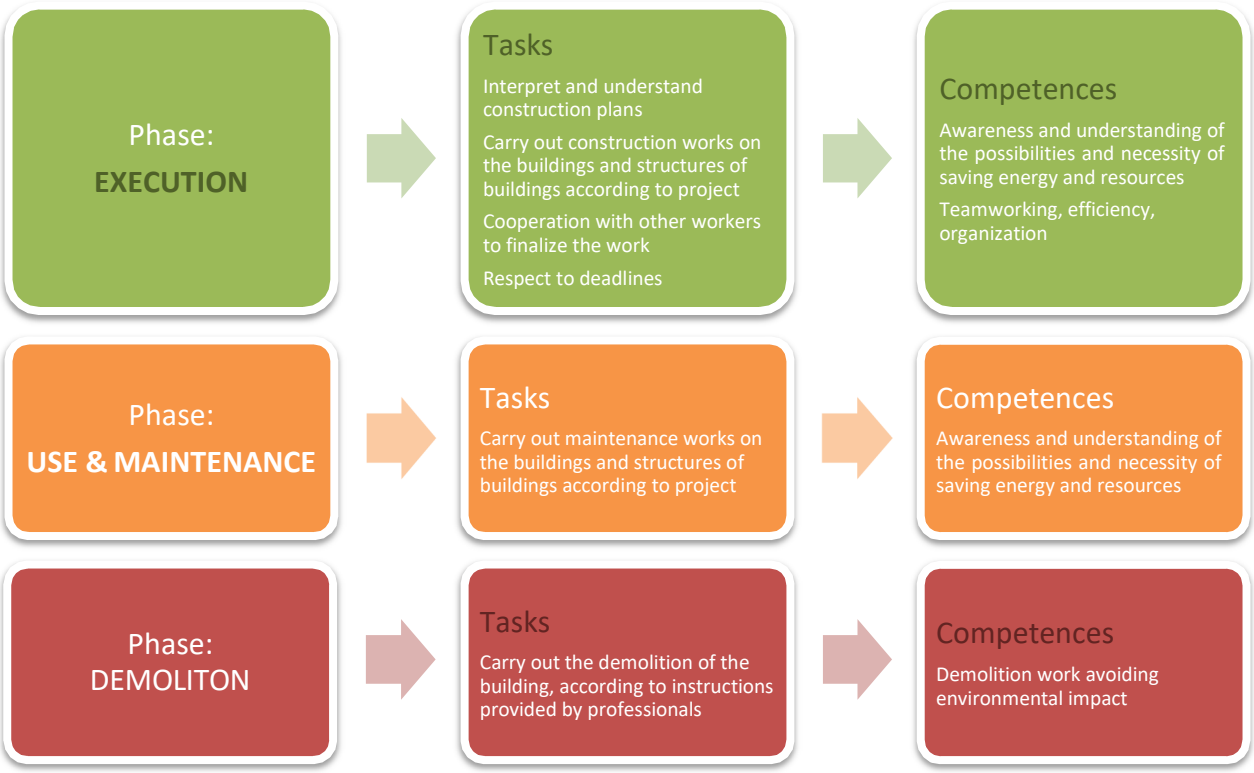
- **Role of the Technicians in the BLC**

In this Target Group are included suppliers of materials and components, blue-collar workers and operators, maintainers, installers and demolition companies, being responsible for the execution and delivery of final work.

- **Role of the Technicians when focusing on energy aspects**

The technicians work on the building thermal and RES envelope and for this reason they need a certain certification (gas installers, for instance). Certified construction workers and installers install systems related to energy efficiency.

- **Tasks and Competencies of the Technicians in the BLC**



graph.03 Building Life Cycle for Technicians

- **Role of the Tenants/Owners in the BLC**

These are the persons who start the stages of the Building Life Cycle. They could be public entitiens or private parties.

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- **Role of the Tenants/Owners when focusing on energy aspects**
  Owners/Tenants will indicate what are the requirements of the new building in terms of energy aspects (energy efficiency, renewable energy systems…), always taking into account the budget and the legislation. They may subcontract different roles to ensure the compliance of the requirements. Also, they will use the building with the energy aspects in mind.

- **Tasks and Competencies of the Tenants/Owners in the BLC**

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graph.04 Building Life Cycle for Owners

3.2 Slovak Situation

Contributed by	ViaEU - Slovakia UVS - Slovakia
Author	Frantisek Doktor Zuzka Kyrinovičová
Contact	doktorfr@icloud.com kyrinovicova@uvs.sk
Source	Act on spatial planning and building codex (Building Act) No 50/1976 Coll. And all relevant amendments, Energy Efficiency Act No 321/2017 Coll. and their following regulations, Energy Performance of Buildings Act No 555/2005 Coll. and relevant amendments (last one in 2017, No 144/2017 Coll.), Construction project tasks and activities which are common practice

- **General overview of the Building Life Cycle**

List of phases:

- Initiation
- Conceptual design/main design
- Build
- Exploitation/maintain/operate
- End of life/recycling/reuse

- **Role of the Public Administration in the BLC**

Initiation
- Enforces the acts / Representative of regulatory body (public authority)
- Set (some) physical area requirements for certain locations or physical areas in country / region / city

Conceptual design/main design
- Enforces the acts / Representative of regulatory body (public authority)
- Checks the compliance of the building design with the acts and regulations in force

Build
- Enforces the acts / Representative of regulatory body (public authority)
- Checks the compliance of the finished building with the design and acts and regulations in force.

Exploitation/maintain/operate
- Enforces the acts/ Representative of regulatory body (public authority)
- Checks the issuance and validity of Energy performance certificate and/or inspection reports on technical systems according to the acts and regulations in force. Checks the compliance of possible refurbishments with the acts and regulations in force. Regulates the ownership and other property rights.

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End of life/recycling/reuse
- Enforces the acts / Representative of regulatory body (public authority)
- Checks the compliance of the deconstruction design with the acts and regulation in force. Checks the recycling and/or reuse of resources and waste treatment.

- **Role of the Public Administration when focusing on energy aspects**

Initiation
- Enforces the act / Representative of regulatory bodies (public authority, importance of authorities which defines energy efficiency requirements, shape and size of the building)
- Defining the possibilities and mandatory use of RES, defining the requirements for the use of different energy sources in future building.

Conceptual design/main design
- Enforces the act / Representative of regulatory bodies (public authority, importance of authorities which defines energy efficiency requirements)
- Checks the requirements regarding the energy efficiency of the design, compliance of the design (architectural, civil engineering, mechanical and electrical engineering, fire safety)

Build
- Enforces the act / Representative of regulatory bodies (public authority, importance of authorities which defines energy efficiency requirements). Decides on the possibility of connection to the grid of RES
- Checks the fulfillment of designed properties of buildings regarding the quality of conducted works and installed materials and systems regarding energy efficiency, i.e. building envelope airtightness requirements, etc.

Exploitation/maintain/operate
- Enforces the act / Representative of regulatory bodies (public authority, importance of authorities which defines energy efficiency requirements)
- Checks the issuance and validity of Energy performance certificate and/or inspection reports on technical systems according to the acts and regulations in force. Checks the compliance of possible refurbishments with the acts and regulations in force.

End of life/recycling/reuse
- Enforces the act / Representative of regulatory bodies (public authority, importance of authorities which defines energy efficiency requirements)
- Detachment of the existing building from the existing energy infrastructure. Checks the recycling and/or reuse of resources and waste treatment.

- **Tasks and Competencies of the Public Administration in the BLC**

Its tasks (and consequent competences) in the Building Life Cycle are:

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Phase:	Tasks	Competences
Initiation	• Defines spatial planning requirements in country / region / city • Issues spatial planning requirements for specific locations when requested • Issue location information's when requested	• Self-assessment, systems/organizational analysis, stakeholder analysis • Problem definition, problem solving, review and analysis of results • Technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis managemeng • Expertise, experiance, knowledge of sector, familiarity of work, professional involvement • Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution
Conceptual design/main design	• Defines and issues spatial planning requirements • Defines and issues special construction requirements (including energy efficiency and RES requirements) • Checks compliance of the design (technical documentation) (for conceptual design) • Issues zoning decision • Checks compliance of the design (technical documentation) (for main design) • Issues Building permit	• Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution • Self-assessment, systems/organizational analysis, stakeholder analysis • Problem definition, problem solving, review and analysis of results • Technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management • Expertise, experience, knowledge of sector, familiarity of work, professional involvement

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Phase:	Tasks	Competences
Build	• Establish technical inspection commission • Runs the database and performs validity check of the issued energy performance certificate • Runs the database and performs validity check of the issued report on technical system inspection • Issue Final Inspection Decision • Runs database of Energy auditors (building performance and technical system performance) • Runs register of certified RES installers • Runs an building inspection, health and safety inspection, fire inspection, etc.	• Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution • Self-assessment, systems/organizational analysis, stakeholder analysis • Problem definition, problem solving, review and analysis of results • Technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management • Expertise, experience, knowledge of sector, familiarity of work, professional involvement
Phase: **Exploitation/ maintain/ operate**	• Registration in terrier registry (Cadastre/land register) • Defines requirements for building energy refurbishment	• Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution • Self-assessment, systems/organizational analysis, stakeholder analysis • Problem definition, problem solving, review and analysis of results • Technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis managemeng • Expertise, experiance, knowledge of sector, familiarity of work, professional involvement

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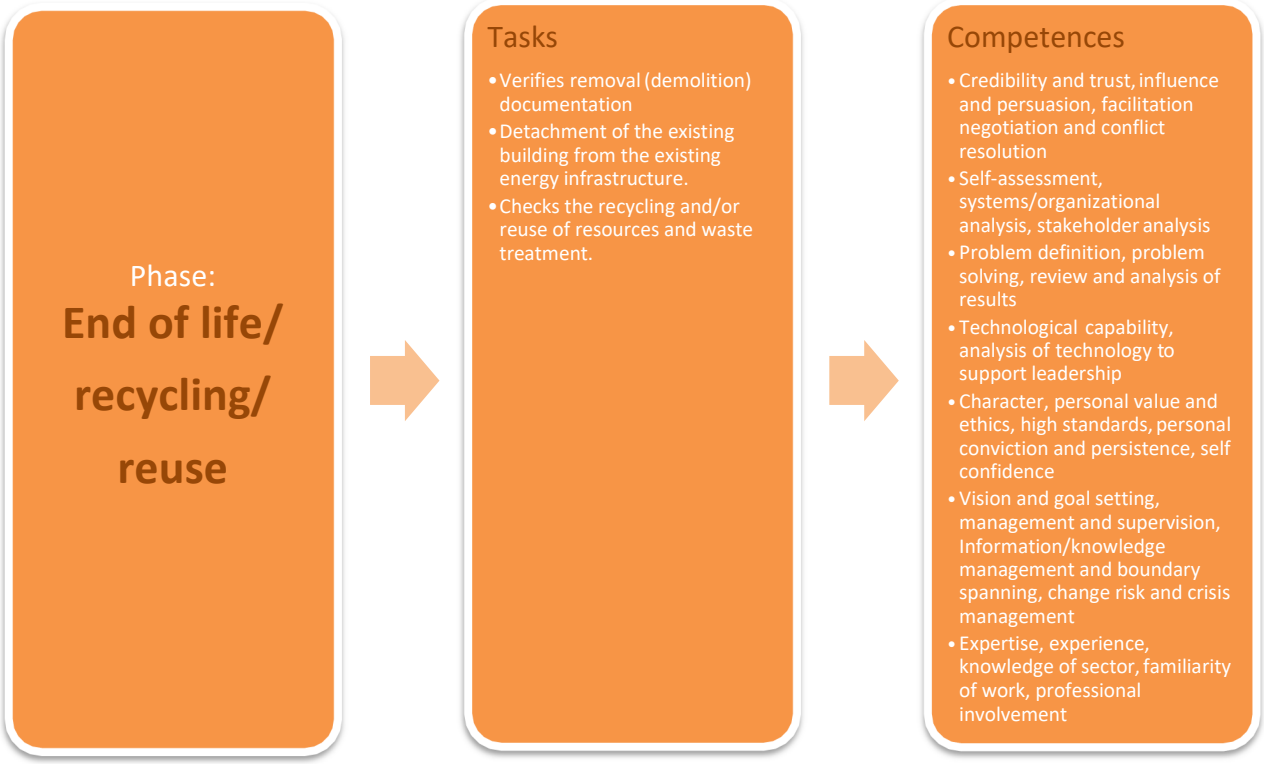

graph.01 Building Life Cycle for PA

➢ Role of the Professionals in the BLC

Initiation
- Consultant to Owner (Project manager or Consultant)
- In charge of production of design technical documentation (Architect - leading designer)

Conceptual design/main design
- In charge of production of design technical documentation / designs (Architect - leading designer)
- Auditor for design technical documentation

Build
- Supervisor on behalf of the Owner
- Building site manager, Energy Auditor

Exploitation/maintain/operate
- Performing maintenance works (Contractor, Craftsman), design and execution of energy refurbishment projects
- Energy Auditor

End of life/recycling/reuses

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- Consultant to Owner
- In charge of production of technical documentation for demolition of existing building

➢ Role of the Professionals when focusing on energy aspects

Initiation
- Consultant to Owner regarding the issues related to energy efficiency (Project manager or consultant). Consultant regarding energy refurbishment.
- In charge of production of design technical documentation (Architect or Civil engineer - leading designer)

Conceptual design/main design
- In charge of production of some project technical documentation / designs (Architect - leading designer, architectural design, energy efficiency and building physics, mechanical engineering design, electrical engineering design, fire protection design)
- Auditor of the technical documentation

Build
- Supervisor (Main supervisor and supervisors for specific integral parts of construction works. Building site manager. Performs all prescribed (necessary test) on the finished building, i.e. blower door, thermography, etc.
- Energy Auditor for new build

Exploitation/maintain/operate
- Performing maintenance works on building envelope and technical systems (Contractor, Craftsman). Design and execution of energy refurbishment projects
- Energy Auditor for existing building

End of life/recycling/reuses
- Consultant to Owner
- In charge of production of technical documentation

➢ Tasks and Competencies of the Professionals in the BLC

Its tasks (and consequent competences) in the Building Life Cycle are:

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Phase:

Initiation

Tasks

- Consult owner about how to implement construction project requirements
- Consult owner about how to implement energy performance requirements
- Production of preliminary architectural design
- Production of prefeasibility study and/or other similar documentation

Competences

- Leadership, negotiation, communication,
- Essential project management skills, project management tools and techniques, stakeholder analysis
- Overview in specific application/industry knowledge, Life cycle management
- "Strategic in approach: understands and addresses inter-dependencies and real issues
- Clear definition of requirements (tested by real customer requirements) and timetables
- Experience managing to deliverables and milestones: on time/within budget/meeting business needs
- Ability to manage troubled teams/projects and bring them to success
- Proven experience with projects of similar size and scope
- Organized and efficient in work processes"
- Analytical thinking, teamwork, problem definition, problem solving, review and analysis of results

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Phase:

Conceptual design/main design

Tasks

- Production of conceptual design compliant with all location and building requirements (including energy efficiency requirements)
- Production of main design compliant with all location and building requirements (including ee requirements)
- Coordinate all specialists / professionals (which delivers separate parts of building designs, i.e. mechanical engineering part of building design, civil engineering part of building design...)
- Auditing when there is need to control compliance with essential requirements for building

Competences

- technological capability, analysis of technology to support leadership
- Character, personal value and ethics, high standards, personal conviction and persistence, self confidence
- Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management
- Expertise, experience, knowledge of sector, familiarity of work, professional involvement; the use of software tools for the optimization of energy efficiency of the building (architectural, civil engineering, mechanical and electrical engineering)
- Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution

Phase:

Build

Tasks

- Construction of building following design technical documentation (architecture, civil engineering, mechanical engineering, electrical engineering)
- Supervises all building activities (controlling compliance with project technical documentation)
- Issuing report on technical specification of building
- Technical inspection of the building
- Issuing report on energy performance / efficiency of building
- Perform all prescribed (necessary test) on the finished building, i.e. blower door, thermography, etc.

Competences

- technological capability, analysis of technology to support leadership
- Character, personal value and ethics, high standards, personal conviction and persistence, self confidence
- Vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management
- Expertise, experience, knowledge of sector, familiarity of work, professional involvement; the use of software tools for the optimization of energy efficiency of the building (architectural, civil engineering, mechanical and electrical engineering)
- Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution

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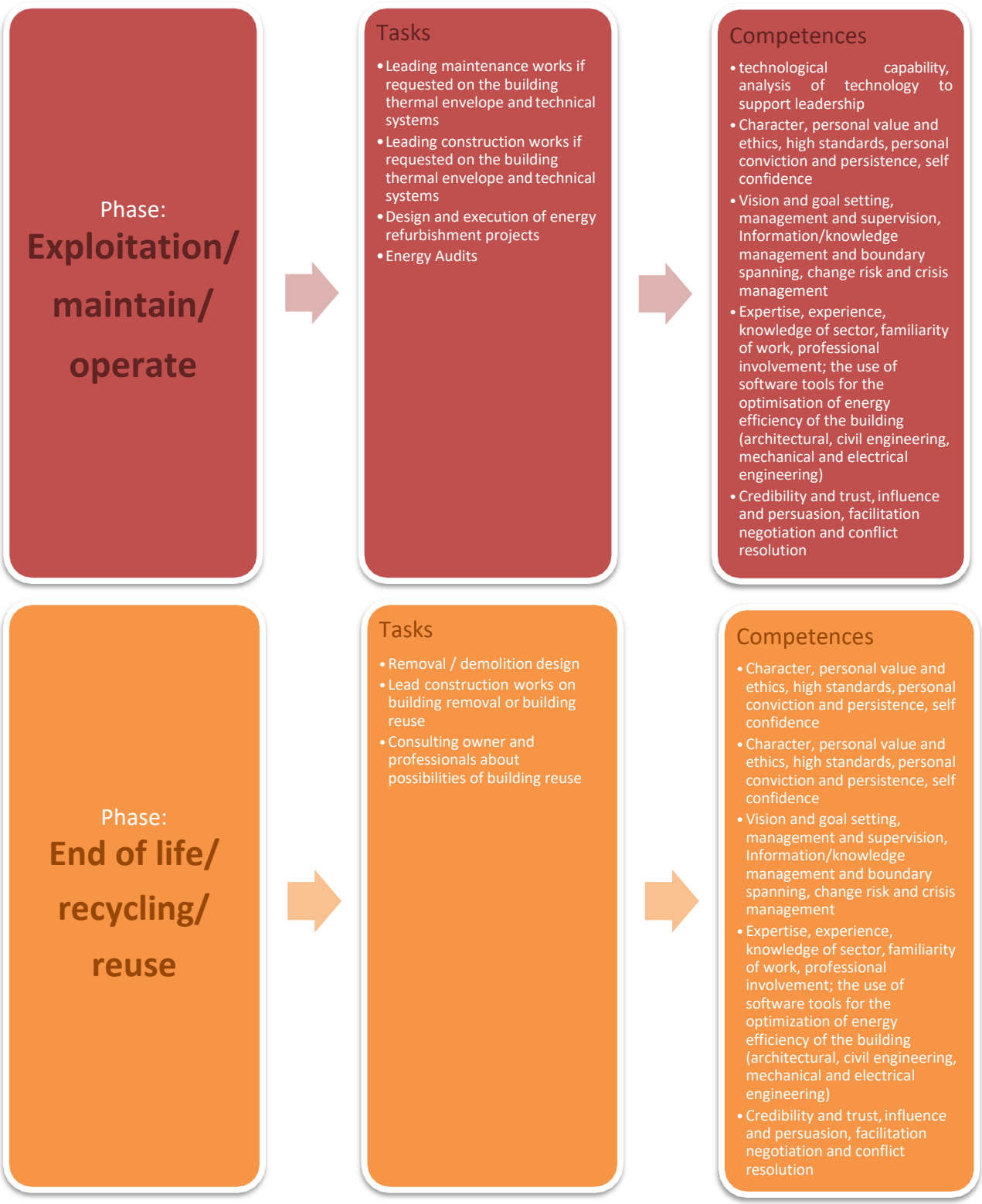

graph.02 Building Life Cycle for Professional

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Role of the Technicians in the BLC

Build
- Craftsmen, on-site workers and installers (HVAC, RES, TEE)
- Installing materials and systems on the building envelope, HVAC, automation and control, lighting as well as RES.

Exploitation/maintain/operate
- Craftsmen, on-site workers and installers (HVAC, RES, TEE)
- Maintaining and installing materials and systems on the building envelope, HVAC, automation and control, lighting as well as RES.

End of life/recycling/reuse
- Craftsmen, on-site workers and installers (HVAC, RES, TEE)

Role of the Technicians when focusing on energy aspects

Build
- Work on the building thermal envelope and install HVAC systems, automation and control as well as lighting, RES, etc.
- Certified RES installers (mandatory from the implementation of nZEB). Certified construction workers which install systems related to energy efficiency. Certified installers of gas burners.

Exploitation/maintain/operate
- Maintain the building thermal envelope, and HVAC and automation systems and lighting as well as installation of new systems, RES, etc.
- Certified RES installers (mandatory from the implementation of nZEB). Certified construction workers which install systems related to energy efficiency. Certified installers of gas burners.

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➢ Tasks and Competencies of the Technicians in the BLC

Phase:

Build

Tasks

- Understanding of designs and implementation / construction / installation of all designed materials and equipment
- Collaboration with other workers and installers to deliver building (and its special parts) as required - Cross crafting
- Taking care of all required procedures to construct / install materials and technical systems properly
- ensure proper operations of technical systems and RES

Competences

- Character, personal value and ethics, high standards, personal conviction and persistence, self confidence
- Expertise, experience, knowledge of sector, familiarity of work, professional involvement; the use of software tools
- Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution
- "Understands and addresses inter-dependencies and real issues
- -Clear definition of requirements and timetables
- - Experience managing to deliverables and milestones: on time/within budget/meeting business needs
- - Proven experience with projects of similar size and scope
- - Organized and efficient in work processes"
- Teamwork, problem definition, problem solving

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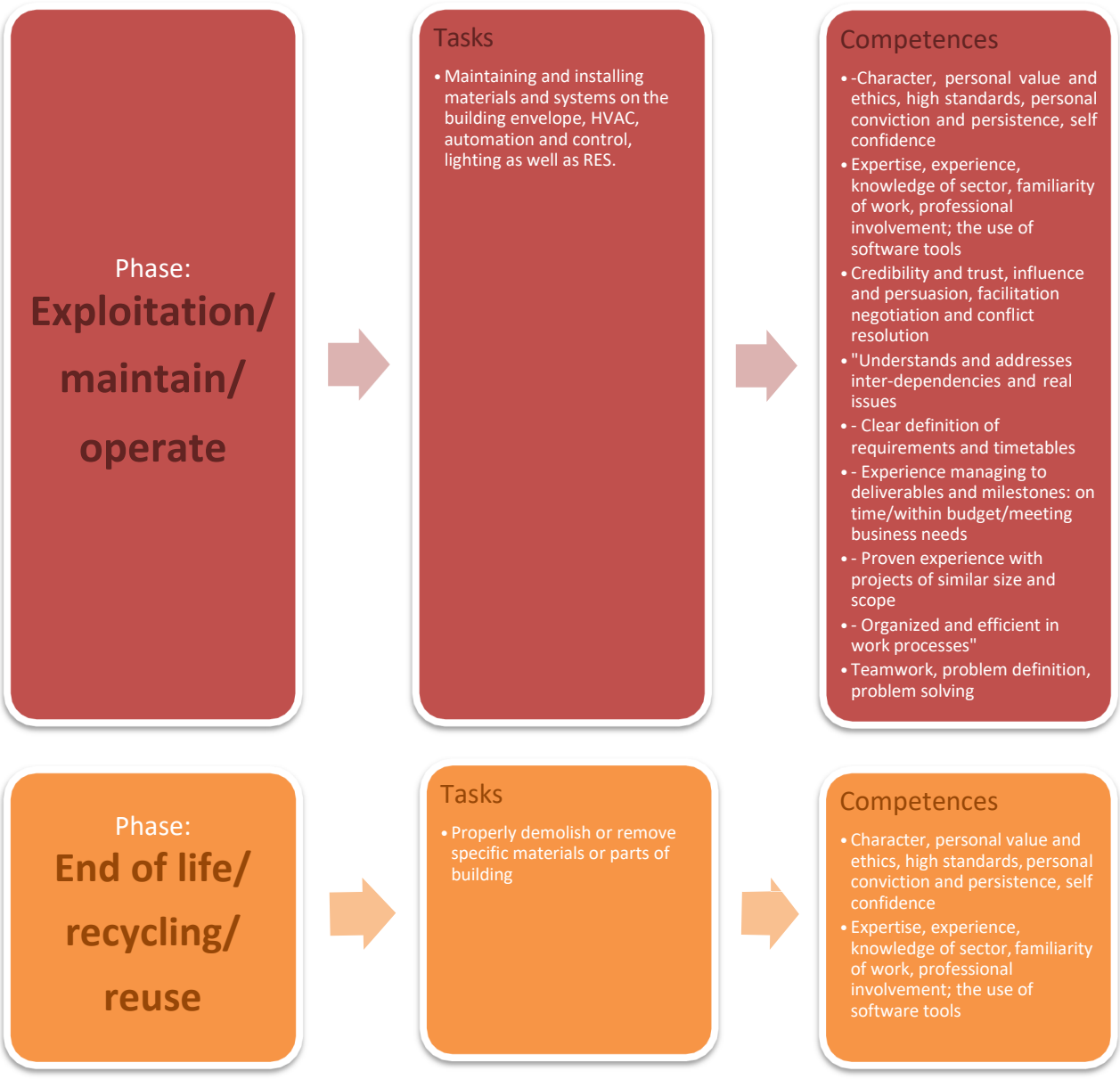

graph.03 Building Life Cycle for Technicians

➢ Role of the Tenants/Owners in the BLC

Initiation

- Owner - initiator and investor, taking all needed actions to start with the project

Conceptual design/main design

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- Owner - initiator and investor, taking all needed actions to start with the design

Build
- Owner - initiator and investor, taking all needed actions to start with the construction

Exploitation/maintain/operate
- Owner / Tenant / User / Building administrator
- Maintenance of the building

End of life/ recycling/reuse
- Owner / Tenant / User / Building administrator

➢ Role of the Tenants/Owners when focusing on energy aspects

Initiation
- Setting project requirements and a wish list regarding energy efficiency and RES

Conceptual design/main design
- Decision on the project budget, and the direction of the design (RES, nZEB, sustainable materials, etc.)
- List of requirements regarding the shape and size of the building, definition of spaces, orientations etc.

Build
- Supervisor in the name of investor checks the compliance of the works with the design and legislation in force

Exploitation/maintain/operate
- Owner / Tenant / user / Building administrator. Enable the energy refurbishment process of existing buildings, and installation of RES
- Enable the renewal of energy performance certificate and inspection of technical systems, maintenance of the building and ensuring the safe operation of technical systems

End of life/ recycling/reuse
- Owner / Tenant / User / Building administrator

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Tasks and Competencies of the Tenants/Owners in the BLC

Phase	Tasks	Competences
Initiation	• Initiate production of (or produce) prefeasibility study and other pre-project documentation • Hire all necessary project participants (i.e. Architect - leading designer…) and consult important stakeholders • Coordinate all project actions • Ensure fairness and quality of tender process for designers	• -
Conceptual design/ main design	• Hire all necessary project participants and consult important stakeholders • Coordinate all project actions • Authorize all possible project changes (changes of building design) • Collaborate with leading architect and make final decision about conceptual and main design • Ensure fairness and quality of tender process for contractors	• -
Build	• Hire all necessary project participant (i.e. Main site supervisor, main contractor, authorized energy auditors, authorized companies which provide tests…) and consult important stakeholders • Coordinate all project actions • Collaborate with main contractor and make final decision about possible changes • Ensure all necessary building certificates and permits • Manage final handover to tenants and/or building administrator • Provide energy performance certificate	• -

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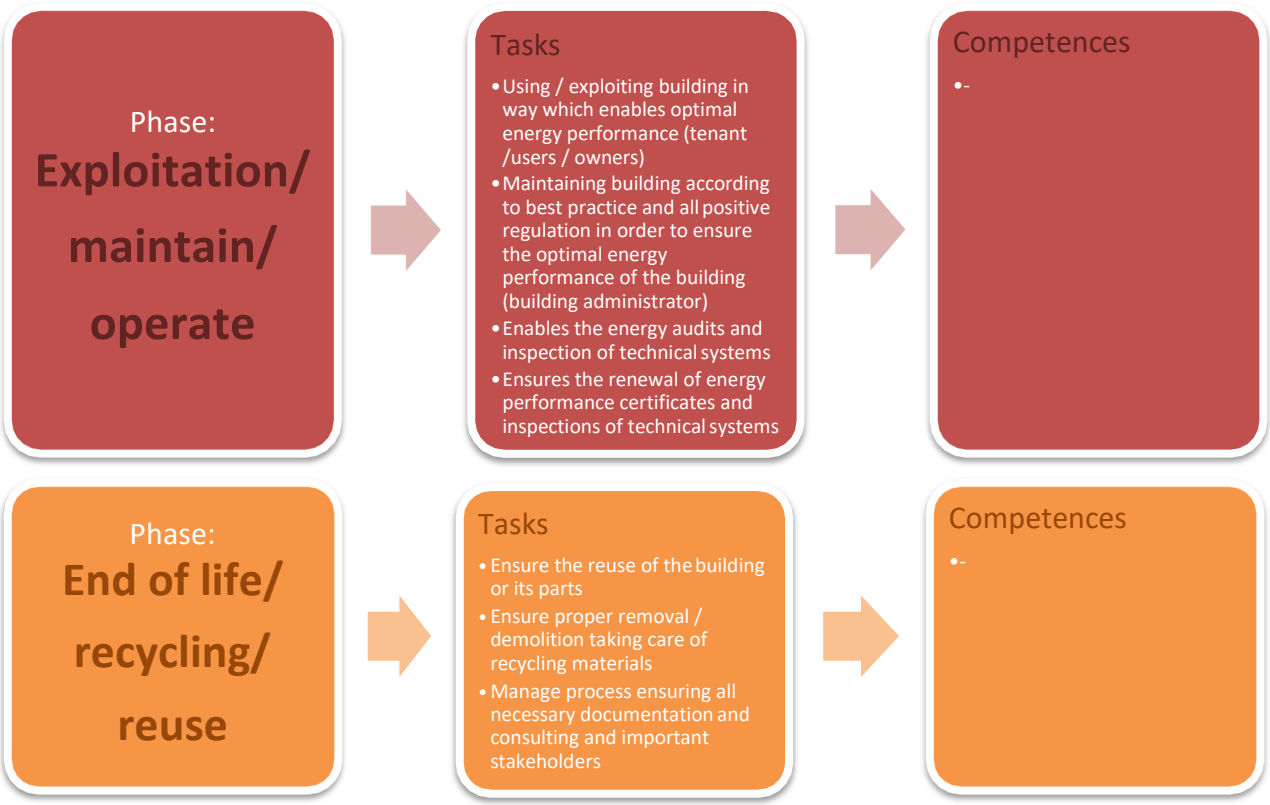

graph.04 Building Life Cycle for Owners

3.3 Lithuanian Situation

Contributed by	Lithuania
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Sources	• Construction Act • Technical regulation of construction STR 1.12.06:2002. • Technical regulation of construction STR 1.04.04:2017. • Technical regulation of construction STR 2.01.02:2016. • Technical regulation of construction STR 1.06.01:2016. • Statybos projekto etapai ir BIM taikymo būdai. VšĮ "Skaitmeninė statyba. Prieiga per interneta: www.skaitmeninestatyba.lt • Aušrinė Verbylaitė. ANALYSIS OF BIM MODEL USES THROUGH BUILDING LIFECYCLE STAGES FOR EMPLOYER'S INFORMATION REQUIREMENTS. Master thesis, 2017.

➢ General overview of the Building Life Cycle

In Lithuania, there are five main legal acts in which the phases of the Building Life Cycle are mentioned:

1. Construction Act (Lietuvos Respublikos Statybos įstatymas, Žin. 1996, Nr. 32-788, i. k. 0961010ISTA00I-1240)

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2. Technical regulation of construction STR 1.12.06:2002 “STATINIO NAUDOJIMO PASKIRTIS IR GYVAVIMO TRUKMĖ” (*Building operation purpose and lifetime*)
3. STR 1.04.04:2017 „Statinio projektavimas, projekto ekspertizė“ (*Building design. Expertize of the design*)
4. STR 2.01.02:2016 “Pastatų energinio naudingumo projektavimas ir sertifikavimas” (*Design and certification of energy performance of buildings*)
5. Technical regulation of construction STR 1.06.01:2016 „STATYBOS DARBAI. STATINIO STATYBOS PRIEŽIŪRA“ (*Construction works. Supervision of construction*)

Different activities on building life cycle, the participants, their roles and obligations regulated by 64 technical regulations of construction. For full list of technical regulations see http://www.am.lt/VI/index.php#a/16982.

Table.01 Lithuanian national law

Currently Building Life Cycle divided to 4 stages: 1. **Planning**; 2. **Design**; 3. **Construction** and 4. **Building Operation**.
Currently, the system is being reorganized to include BIM processes, so the current situation and proposed changes are presented.
Lithuania for BIM projects uses 7 stages approach developed by RIBA adopted to Lithuanian national needs (developed by Public institution "Skaitmenine statyba" (“Digital Construction")):

S0	S1	S2	S3	S4	S5	S6	S7
Feasibility Study	Project program	Concept project	Technical project	Detail project	Construction	Construction closure	Use and maintenance

Table.02 construction process phases

Original documents presented for market could be found:
http://skaitmeninestatyba.lt/bim-dokumentai/246-statybos-projekto-etapai-ir-stadijos-suderintos-su-bim-metodologija
http://skaitmeninestatyba.lt/files/Dokumentai/STATYBOS_PROJEKTO_ETAPAI_IR_STADIJOS.pdf

Considering mentioned main five decrees and rebuilding of system, seven phases are individuated (S0 – S7). Within phases S0 – S7 the sub phases presented using conditional coding (UC – use cases, D - deliverables).

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Explanation of colors used in figures and text to mark the changes planned (**red**), existing processes incorporated in new formed BIM processes (**black**), and optional recommended use cases (**grey**).

Phases	S0. Feasibility	
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments

The phase **S0** is the part of **Planning stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;
- UC1. D1.2. Planning of investments.

Phases	S1. Project Program						
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments	UC2. D2.1. Modeling of existing conditions	UC3. D3.1. Planning of the project phases	UC4. D4.1. Site analysis	UC5. D5.1. Functional, volumetric, and area analysis	UC6. D6.1. Visualization and review of alternative solutions

Phase **S1** is the part of **Planning stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC4. D4.1. Site analysis.
- UC5. D5.1. Functional, volumetric, and area analysis.
- UC6. D6.1. Visualization and review of alternative solutions.

Phases	S2. Conceptual Design											
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments	UC2. D2.1. Modeling of existing conditions	UC3. D3.1. Planning of the project phases	UC4. D4.1. Site analysis	UC5. D5.1. Functional, volumetric, and area analysis	UC6. D6.1. Visualization and review of alternative solutions	UC7. D7.1. Design / Modelling	UC8. D8.1. Engineering calculations and analysis	UC10. D10.1. Sustainability assessment	UC11. D11.1. Structural analysis and design	UC13. D13.1. Engineering system analysis

Phase **S2** is the part of **Design stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;

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- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC4. D4.1. Site analysis.
- UC5. D5.1. Functional, volumetric, and area analysis.
- UC6. D6.1. Visualization and review of alternative solutions.
- UC7. D7.1. Design / Modelling.
- UC8. D8.1. Engineering calculations and analysis.
- UC9. D9.1. Energy analysis (Optional).
- UC10. D10.1. Sustainability assessment.
- UC11. D11.1. Structural analysis and design.
- UC12. D12.1. Lighting Analysis (Optional).
- UC13. D13.1. Engineering system analysis.
- UC14. D14.1. Other cases of analysis (Optional).
- UC15. D15.1. Conformity assessment / project expertise (Optional).

UC9. D9.1., UC12. D12.1., UC14. D14.1., UC15. D15.1. – other recommended use cases (optional).

Phases	S3. Technical Design											
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments	UC2. D2.1. Modelling of existing conditions	UC3. D3.1. Planning of the project phases	UC4. D4.1. Site analysis	UC6. D6.1. Visualization and review of alternative solutions	UC7. D7.1. Design / Modelling	UC8. D8.1. Engineering calculations and analysis	UC10. D10.1. Sustainability assessment	UC11. D11.1. Structural analysis and design	UC13. D13.1. Engineering systems analysis	UC16. D16.1. 3D coordination

Phase **S3** is the part of **Design stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC4. D4.1. Site analysis.
- UC6. D6.1. Visualization and review of alternative solutions.
- UC7. D7.1. Design / Modelling.
- UC8. D8.1. Engineering calculations and analysis.
- UC9. D9.1. Energy analysis (Optional).
- UC10. D10.1. Sustainability assessment.
- UC11. D11.1. Structural analysis and design.
- UC12. D12.1. Lighting Analysis (Optional).
- UC13. D13.1. Engineering system analysis.
- UC14. D14.1. Other cases of analysis (Optional).
- UC15. D15.1. Conformity assessment / project expertise (Optional).

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- UC16. D16.1. 3D coordination.

UC9. D9.1., UC12. D12.1., UC14. D14.1., UC15. D15.1. – other recommended use cases (optional).

Phases	S4. Detailed Design											
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments	UC2. D2.1. Modelling of existing conditions	UC3. D3.1. Planning of the project phases	UC6. D6.1. Visualization and review of alternative solutions	UC7. D7.1. Design / Modelling	UC8. D8.1. Engineering calculations and analysis	UC10. D10.1. Sustainability assessment	UC11. D11.1. Structural analysis and design	UC13. D13.1. Engineering systems analysis	UC16. D16.1. 3D coordination	UC17. D17.1. Building site planning (site masterplan)

Phase S4 is the part of **Design stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC6. D6.1. Visualization and review of alternative solutions.
- UC7. D7.1. Design / Modelling.
- UC8. D8.1. Engineering calculations and analysis.
- UC9. D9.1. Energy analysis (Optional).
- UC10. D10.1. Sustainability assessment.
- UC11. D11.1. Structural analysis and design.
- UC12. D12.1. Lighting Analysis (Optional).
- UC13. D13.1. Engineering system analysis.
- UC14. D14.1. Other cases of analysis (Optional).
- UC15. D15.1. Conformity assessment / project expertise (Optional).
- UC16. D16.1. 3D coordination.
- UC17. D17.1. Building site planning (site masterplan).
- UC18. D18.1. Planning of health and safety measures.
- UC19. D19.1. Structural-technological analysis.
- UC20. D20.1. Simulation of construction technologies (technological schemes) and installation simulation.

UC9. D9.1., UC12. D12.1., UC14. D14.1., UC15. D15.1., UC18. D18.1., UC19. D19.1., UC20. D20.1. – other recommended use cases (optional).

Phases	S5. Construction

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Sub Phases
UC1. D1.1. Technical and economic feasibility study
UC1. D1.2. Planning of investments
UC2. D2.1. Modelling of existing conditions
UC3. D3.1. Planning of the project phases
UC16. D16.1. 3D coordination
UC17. D17.1. Building site planning (site masterplan)
UC21. D21.1. Construction logistics planning
UC22. D22.1. Modelling and management of construction processes
UC24. D24.1. Technical surveillance of construction works
UC25. D25.1. As-built model

Phase **S5** is the part of **Construction stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study.
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC15. D15.1. Conformity assessment / project expertise (Optional)
- UC16. D16.1. 3D coordination.
- UC17. D17.1. Building site planning (site masterplan).
- UC18. D18.1. Planning of health and safety measures.
- UC19. D19.1. Structural-technological analysis.
- UC20. D20.1. Simulation of construction technologies (technological schemes) and installation simulation.
- UC21. D21.1. Construction logistics planning.
- UC22. D22.1. Modelling and management of construction processes.
- UC23. D23.1. Digital manufacturing.
- UC24. D24.1. Technical surveillance of construction works.
- UC25. D25.1. As-built model.

UC15. D15.1., UC18. D18.1., UC19. D19.1., UC20. D20.1., UC23. D23.1. – other recommended use cases (optional).

Phases	S6. Construction completion
Sub Phases	UC1. D1.1. Technical and economic feasibility study UC1. D1.2. Planning of investments UC2. D2.1. Modelling of existing conditions UC3. D3.1. Planning of the project phases UC17. D17.1. Building site planning (site masterplan) UC21. D21.1. Construction logistics planning UC22. D22.1. Modelling and management of construction processes UC24. D24.1. Technical surveillance of construction works UC25. D25.1. As-built model UC26. D26.1. Data model

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Phase **S6** is the part of **Construction stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study;
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC17. D17.1. Building site planning (site masterplan)/
- UC18. D18.1. Planning of health and safety measures.
- UC19. D19.1. Structural-technological analysis.
- UC20. D20.1. Simulation of construction technologies (technological schemes) and installation simulation.
- UC21. D21.1. Construction logistics planning.
- UC22. D22.1. Modelling and management of construction processes.
- UC23. D23.1. Digital manufacturing.
- UC24. D24.1. Technical surveillance of construction works.
- UC25. D25.1. As-built model.
- UC26. D26.1. Data model.

UC18. D18.1., UC19. D19.1., UC20. D20.1., UC23. D23.1. – other recommended use cases (optional).

Phases	S7. Operation and Maintenance									
Sub Phases	UC1. D1.1. Technical and economic feasibility study	UC1. D1.2. Planning of investments	UC2. D2.1. Modelling of existing conditions	UC3. D3.1. Planning of the project phases	UC26. D26.1. Data model	UC27. D27.1. Planning of building maintenance	UC30. D30.1. Asset management			

Phase **S7** is the part of **Building Operation stage** and includes following sub phases:

- UC1. D1.1. Technical and economic feasibility study.
- UC1. D1.2. Planning of investments.
- UC2. D2.1. Modelling of existing conditions.
- UC3. D3.1. Planning of the project phases.
- UC26. D26.1. Data model.
- UC27. D27.1. Planning of building maintenance.
- UC28. D28.1. Building (engineering) systems analysis.
- UC29. D29.1. Energy analysis.
- UC30. D30.1. Asset management.
- UC31. D31.1. Space Management and Monitoring.
- UC32. D32.1. Sustainability monitoring and analysis.
- UC33. D33.1. Accident Prevention.

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UC28. D28.1., UC29. D29.1., UC31. D31.1., UC32. D32.1., UC33. D33.1. – other recommended use cases (optional).

Table.03 construction process seven phases details

➢ Role of the Public Administration in the BLC

Lithuania:

Public administration institutions carry out public management related to the construction sector at all stages of the building life cycle.

State Territorial Planning and Construction Inspectorate under the Ministry of Environment of the Republic of Lithuania participates in the forming of the policy on the state supervision of territorial planning and construction as well as the use of the buildings, controls and coordinates its implementation:

- carries out state supervision of territorial planning and controls the projecting of the buildings;
- carries out and coordinates state supervision of construction;
- methodically manages public administration entities carrying out the supervision of the use of buildings;
- verify the legality of the construction permit;
- verifies the compliance of the actions of construction actors with the requirements of the legal acts regulating construction;
- verifies the legality of the execution of the construction;
- verifies the construction completion procedures;
- carries out buildings accident investigation;
- performs mandatory instructions to provide the necessary information, documents, and to eliminate the violations of the provision established during the inspections;
- carries out supervision of compliance with the terms of issuance of admissions and special architecture requirements, special requirements for heritage protection and special protected area management, verifies the legality of the conditions of admission and/or special requirements issued;
- examines personal requests, complaints or reports related to the construction process;
- provides counselling and methodological assistance;
- carries out other preventive actions aimed at reducing the number of violations;
- carries out other actions related to the state supervision of construction.

Municipal administrations:

- controls compliance with the protection requirements of all objects including architectural and cultural monuments during construction, development and reconstruction,
- Issues specific architectural requirements, construction permits,
- carries out the supervision of the use of structures,
- performs other functions of construction management.

State Enterprise„Turto bankas“ (Asset Bank):

- implementation of centralized management of the state-owned real estate,
- organization of privatization of shares belonging to the State and municipalities by the right of ownership,
- management, use and disposal of the state-owned real estate transferred under the right of trust,
- organization of public auctions of redundant state-owned property,
- administration of the unified state-owned assets informative online search system,

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- other functions delegated to the enterprise under the efficient legal acts.

Other organizations act as public authorities in the life-cycle of a building:

- National Center for Public Health at the Ministry of Health of The Republic of Lithuania,
- State Labor Inspectorate of the Republic of Lithuania,
- Department of Disabled Affairs under the Ministry of Social Security and Labor,
- Fire and Rescue Department under the Ministry of the Interior of the Republic of Lithuania.

At the pre-design stage, the special requirements for design are issued by (Section 24 (3) of the Construction Act):

- Special requirements for architecture - Administration of Municipality.
- Special requirements for protection and management of protected area - Directorate of Protected Territory.
- Special requirements for Heritage protection - Department of Cultural Heritage under the Ministry of Culture.

At the stage of building design special state authorities in accordance with their competence, set specific requirements for building design and (or) check building projects.

At the construction phase the special state authorities in accordance with the competence verify the construction process and (or) participate in the verification of the completed structure (involved in the procedures of the completion).

At the stage of use, special public administration authorities in scope of their competence carry out supervision of the building use and maintenance.
At the stage of use, public authorities also participate as public building owners, respectively, in the use and maintenance functions.

Legislation authorizes other institutions to participate in public administration of the construction.
Provisions of the National Land Service under the Ministry of Agriculture, 7.19 p. provides that the National Land Service under the Ministry of Agriculture issues certificates of competence for the preparation of land management planning documents, certificates of geodesist, surveyor qualifications, suspends or revokes them.

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➢ Role of the Public Administration when focusing on energy aspects

Lithuania: Focusing on the energy aspects, the Public Administration sets national regulatory requirements in the field of energy performance for construction process and construction participants. The defining of requirements includes the use of different energy sources and the possibility to use RESs for NZEB construction. In addition, the Public Administration checks the issuance and the validity of energy performances' certificates.

➢ Tasks and Competencies of the Public Administration in the BLC

Its tasks and competences in the Building Life Cycle are:

Phase:	Tasks	Competences
S0 Feasibility	• Initiation and organization of preparation of territorial planning documents. • Establishes the requirements for the specialists in the basic technical field of construction. • Prepare technical specifications for design. • Provides records of collected data.	• Competencies in new regulations and european standards
S1 Project program	• Establishes special requirements for the design of a building (including requirements for energy use and production from renewable energy sources). • Prepare investment plans methodologies.	• Vision and goal setting. • Knowledge of energy efficiency and sustainability • Problem definition, problem solving, review and analysis of results • Credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution
S2 Conceptual Design	• Establishes special requirements for the design of a building, (including requirements for energy use and production from renewable energy sources). • Prepares calculation methods. • Prepare project coordination procedures. • To prepare the public procurement procedures. • Prepares the procedure for	• Legislative and regulatory competencies in building energy performance • Competencies connected to the managing of an Information System

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Phase:	Tasks	Competences
S3 Technical (Main) Design	• Establishes special requirements for the design of a building (including requirements for energy use and production from renewable energy sources). • Prepares calculation methods. • Prepare project coordination procedures. • Verifies the compliance of project solutions with requirements. • Issues a building permit.	• Expertise, experience, knowledge of sector, familiarity of work, • *Knowledge of BIM processes* • *BIM technology application skills by area (model viewer and BIM communication program)*
S4 Detailed Design	• Establishes work safety requirements and controls. • Determines the requirements for the use of mechanisms and equipment.	• Expertise, experience, knowledge of sector, familiarity of work,
S5 Construction	• Performs construction supervision, fire, health and safety measures inspection. • Collects data on energy certification of buildings. • Collects data about certified professionals. • Collects data about certified companies. • Collects data about certified workers engaged in construction work and installation of equipment in near zero energy buildings.	• Expertise, experience, knowledge of sector, familiarity of work, • Legislative and regulatory competencies in building energy performance • *Knowledge of BIM processes* • *BIM technology application skills by area (model viewer and BIM communication program, use of the electronic construction logs)*
S6 Construction Completion	• Performs construction supervision, fire, health and safety measures inspection. • Collects data on energy certification of buildings. • Organizes the recognition of the building as suitable for use commissions. • Collects data about buildings recognized as suitable for use.	• Expertise, experience, knowledge of sector, familiarity of work. • *Knowledge of BIM processes* • *BIM technology application skills by area (model viewer and BIM communication program, use of the electronic construction logs)*

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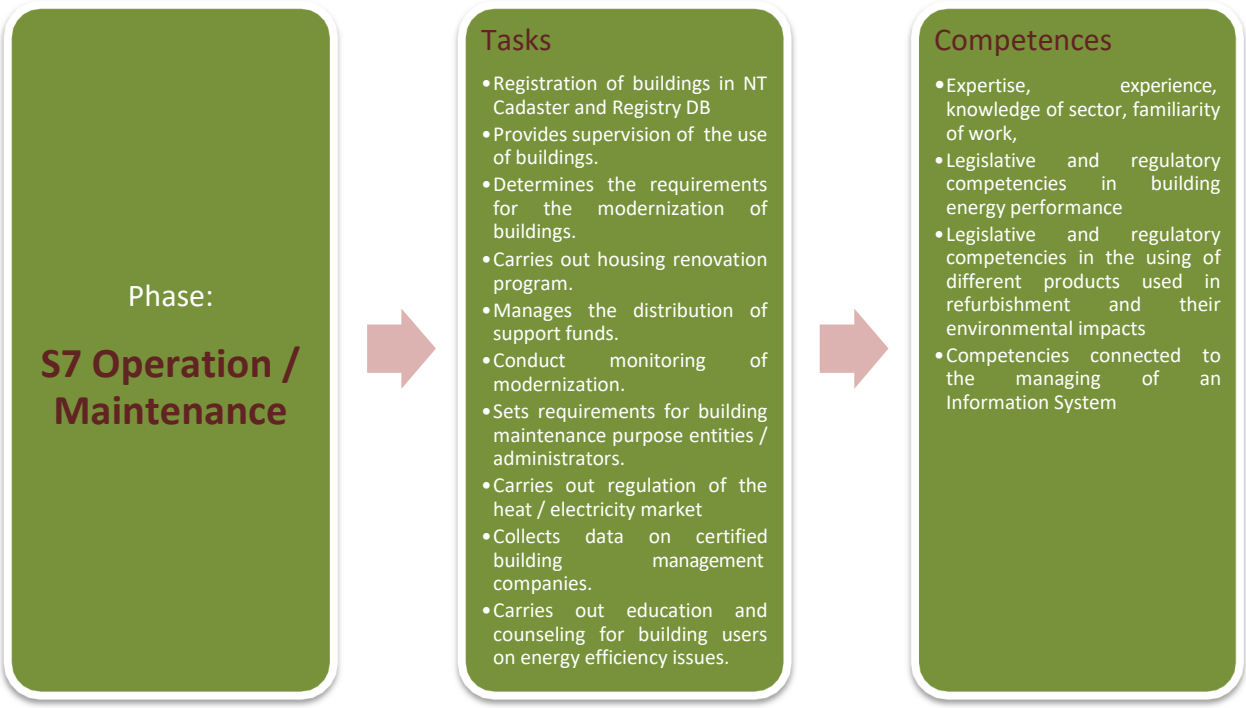

Graph.01 Building life cycle for PA

Role of the Professionals in the BLC

Lithuania: The target group of Professionals includes Architects, MEP Designers, Structural Designers, Project Managers, Construction Site Managers, Construction Technical Supervisors, Surveyors, Facility Managers, *BIM Coordinators*, BIM Managers**, other Specialists, and Experts. This target group is active and have important roles on all stages of Building Life Cycle. They are consultants of Owners (Technical Supervisors, Energy Auditors, Experts), in charge of production of design documentation (Architects, MEP Designers, Structural Designers), main supervisors and supervisors for specific integral parts of construction works (Construction Site Managers), perform maintenance works (Facility Managers, Building Administrators), etc.

** Competences described in documents issued by Public organization "Digital Construction" (www.skaitmeninestatyba.lt)*

Role of the Professionals when focusing on energy aspects

Lithuania: The roles of the Professionals when focusing on energy aspects, participating in all stages of Building Life Cycle, include the energy audits, energy modelling, design solutions, construction works of airtight and thermal resistant building envelope, installment of HVAC systems, and RES systems. Professionals need certain certification to organize construction works and installments not only in NZEBs, but in all types of buildings.

Tasks and Competencies of the Professionals in the BLC

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Phase:	Tasks	Competences
S0 Feasibility **S1 Project program**	• Prepares feasibility study. • Performs the necessary tests (geological, energy audits). • Prepares other pre-project documentation.	• Competencies in national regulation including those related to construction and energy performance • Competences in Contract preparation. • *Knowledge of BIM processes.* • *BIM technology application skills by area (scanning, photogrammetry, GIS, ect.)* • Basics of Sustainable Development and Energy Efficiency knowledge • ICT knowledge • General competences (teamwork, problem definition, problem solving, etc.)
S2 Conceptual Design	• *Develops BEP (BIM Execution Plan).* • *Set up CDE (Common Data Environment).* • Performs the necessary tests (geological, energy audits). • *Prepares conceptual BIM model.* • Performs preliminary eco-efficiency assessment. • Performs preliminary economical calculations. • Lighting performance preliminary assessment. • Performs preliminary energy modelling. • Prepares conceptual design project. • Provides conceptual design project for owner acceptance.	• Expertise in knowledge area, experience, knowledge of sector, familiarity of work, professional involvement. • Use of software tools for the optimization of energy efficiency of the building. • *Knowledge of BIM processes.* • *BIM technology application skills by area (BIM collaboration, BIM modelling, vizualizations, virtual reality, economical evaluations, etc.)* • Basics of Sustainable Development and Energy Efficiency knowledge • General competences (teamwork, problem definition, problem solving, etc.)

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Phase:

S6 Construction Completion

Tasks

- Evaluate the quality of the construction works and / or the installed building systems, perform mandatory tests.
- Perform measurements related to energy efficiency.
- To prepare operating instructions for systems, parts replacement recommendations.
- Issues report on energy performance.
- Performs all necessary tests.
- Issues As-Built documentation.
- Performs final handover to local authorities, owner and tenants.

Competences

- Expertise in knowledge area, experience, knowledge of sector, familiarity of work, professional involvement.
- *Knowledge of BIM processes.*
- *BIM technology application skills by area (BIM collaboration, BIM 4D, change management, quality control, vizualizations, virtual reality, economical calculations, scanning, photogrammetry, etc.)*
- Basics of Sustainable Development and Energy Efficiency knowledge
- General competences (teamwork, problem definition, problem solving, etc.)
- Public procurement competences (if required)
- Competences in Contract preparation

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Phase:	Tasks	Competences
S3 Technical (Main) Design	• *Adjustment of BEP (BIM Execution Plan).* • *Adjustment of CDE (Common Data Environment).* • *Prepares BIM model.* • Performs the necessary tests (geological, energy audits). • Performs modelling of engineering systems. • Performs economical calculations. • *Performs other calculations agreed in BEP.* • Prepares building technical documentation. • Coordinates technical design project preparation. • Performs the expertize of technical design project. • Coordinates project with local authorities (if assigned by client).	• Expertise in knowledge area, experience, knowledge of sector, familiarity of work, professional involvement. • Use of software tools for the optimization of energy efficiency of the building and other simulations. • *Knowledge of BIM processes* • *BIM technology application skills by area (BIM collaboration, BIM modelling, change management, quality control, vizualizations, virtual reality, economical evaluations, etc.)* • Basics of Sustainable Development and Energy Efficiency knowledge • General competences (teamwork, problem definition, problem solving, etc.) • Public procurement competences (if required) • Competences in Contract preparation
S4 Detailed Design	• *Adjustment of BEP (BIM Execution Plan).* • *Adjustment of CDE (Common Data Environment).* • *Detailed BIM model (agreed in BEP).* • Prepares detailed project documentation (including technology and organization parts). • Performs the additional expertise of detailed design project (if needed). • Provides information for procurement and organization of construction.	• Expertise in knowledge area, experience, knowledge of sector, familiarity of work, professional involvement. • *Knowledge of BIM processes* • *BIM technology application skills by area (BIM collaboration, BIM modelling, change management, quality control, vizualizations, virtual reality, economical calculations, etc.)* • Basics of Sustainable Development and Energy Efficiency knowledge. • General competences (teamwork, problem definition, problem solving, etc.) • Public procurement competences (if required) • Competences in Contract preparation

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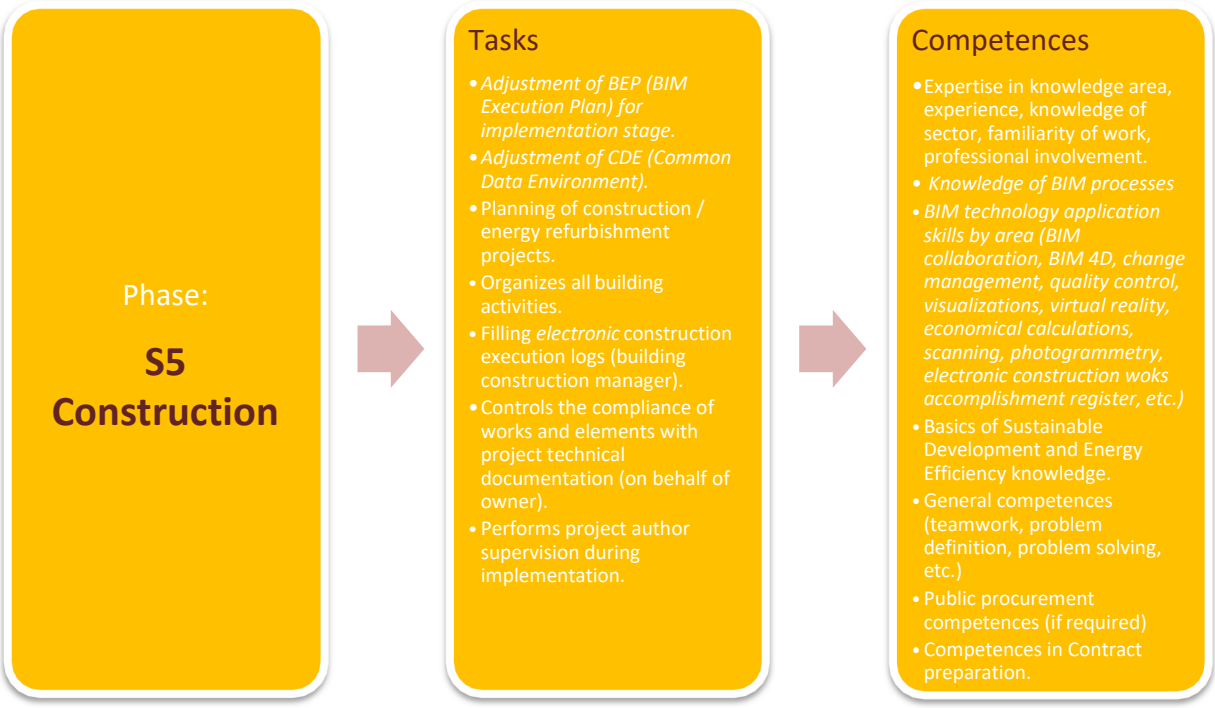

Graph.01 Building life cycle for Professional

➢ Role of the Technicians in the BLC

Lithuania: The target group of Technicians includes blue-collar workers, installers, suppliers of materials and components. This target group is active mainly during **Construction** and **Building Operation**, and doesn't have specific role in **Planning** and **Design Stages** except suppliers of materials and components, who can have some influence during Design stage, specifically, in terms of the technologies, prices and availability of products on market.

➢ Role of the Technicians when focusing on energy aspects

Lithuania: The roles of the Technicians when focusing on energy aspects include the construction works of airtight and thermal resistant building envelope, installment of HVAC systems, and RES systems. Technicians (workers and installers) may need certain certification to perform construction works and installments in NZEBs. So far, certification of NZEB workers and installers is voluntary in Lithuania (started by Lithuanian Builders Association (as manager of certification scheme) within ENERGOTRAIN project).

➢ Tasks and Competencies of the Technicians in the BLC

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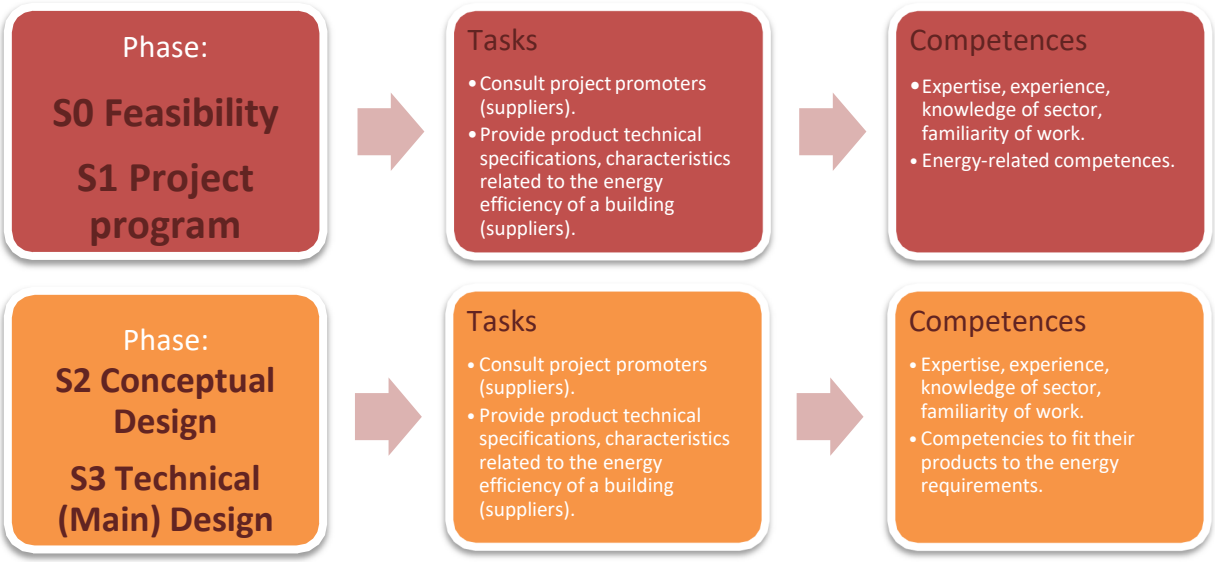

Graph.02 Building life cycle for Technicians

➢ Role of the Tenants/Owners in the BLC

Owners acting as Investors set up project requirements, take all needed actions to start Design and Construction/Refurbishment, hire the technical supervisors for control of the compliance of the works with the design and valid legislation. During Building Operation, they organize the maintenance of building and inspection of systems. At the end of BLC they initiate building refurbishment or demolition. Tenants have no specific roles, however, Owners take into account their needs and expectations regarding the indoor comfort parameters and quality of inner spaces.

➢ Role of the Tenants/Owners when focusing on energy aspects

Owners set up requirements for building in terms of energy efficiency (no less that required in regulations), choose the materials and make decisions on energy systems to be installed in building. Owners analyze the alternative modernization measures and select the set that ensures the required energy performance, is affordable and sustainable. During Construction they check the compliance of the works with the design and valid legislation and accept works done. In case of new Construction (after), in case of Refurbishment (before and after) they initiate energy performance certification of building. During Building Operation Owners/Building Administrators organize the maintenance of building.

➢ Tasks and Competencies of the Tenants/Owners in the BLC

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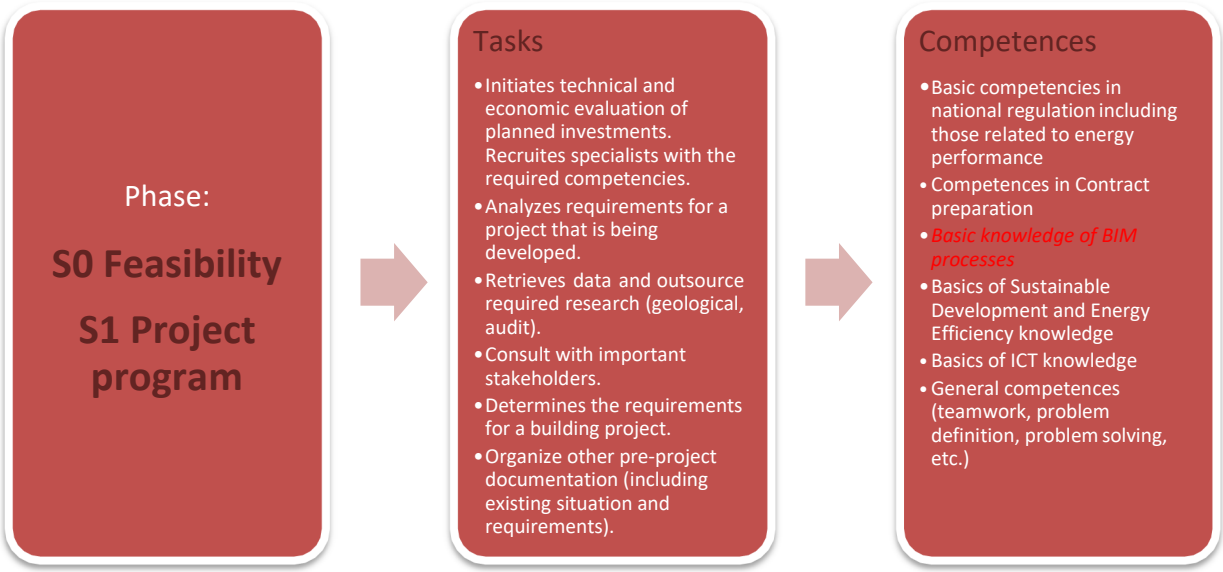

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Phase:	Tasks	Competences
S2 Conceptual Design	• Prepares task for technical design *(EIR - Employee Information Requirements, AIR - Asset Information Requirements).* • Selects the project promoter. • participates in preparation of project concept. • Authorizes the prepared project concept.	• Basic competencies in national regulation including those related to energy performance • Competences in Contract preparation • *Basic knowledge of BIM processes* • *Basics of application of BIM technologies* • Basics of Sustainable Development and Energy Efficiency knowledge • Basics of ICT knowledge • Public procurement competences (if required) • General competences (teamwork, problem definition, problem solving, etc.)
S3 Technical (Main) Design	• *According to the need adjusts EIR.* • Participates in the preparation of technical design project. • Verifies prepared technical design project. • Orders the expertise of technical design project. • Getting the permission for construction. • Authorizes all possible project changes.	• Basic competencies in national regulation including those related to energy performances • Competences in Contract preparation • *Basic knowledge of BIM processes* • *Basics of application of BIM technologies* • Basics of Sustainable Development and Energy Efficiency knowledge • Basics of ICT knowledge • Public procurement competences (if required) • General competences (teamwork, problem definition, problem solving, etc.)
S4 Detailed Design	• Orders the preparation of detailed design project. • Inspects the prepared detailed design project. • Verifies the prepared detailed design project. • Authorizes all possible project changes. • Coordinates all project actions.	• Competences in Contract preparation • *Basic knowledge of BIM processes* • *Basics of application of BIM technologies* • Basics of Sustainable Development and Energy Efficiency knowledge • Basics of ICT knowledge • Public procurement competences (if required) • General competences (teamwork, problem definition, problem solving, etc.)

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Phase:

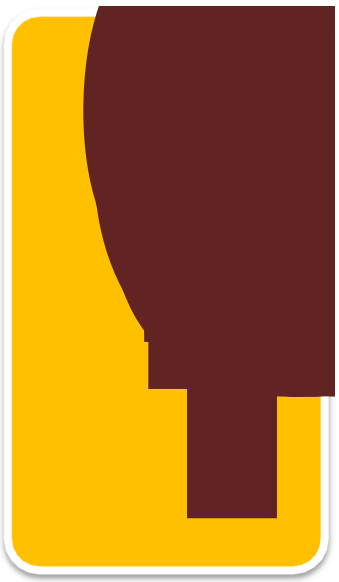
S5 Construction

Tasks

- *Develops EIR for construction phase.*
- Submit a Technical Project to the contractor
- Set up construction works registration journal (*preferred electronic version*)
- Ensures all necessary permits for construction (e.g. connections to infrastructure networks).
- Organizes tenders for construction works and supply. Signs contracts.
- Organizes technical supervision for monitoring the status of construction/ refurbishment/ demolition works.
- Authorizes all possible project changes.
- Organizes project author supervision during implementation.
- Accept completed works.

Competences

- Basic competencies in national regulation
- Competences in Contract preparation
- *Basic knowledge of BIM processes*
- *Basics of application of BIM technologies*
- Basics of Sustainable Development and Energy Efficiency knowledge
- Basics of ICT knowledge
- Public procurement competences (if required)
- General competences (teamwork, problem definition, problem solving, etc.)



Tasks

- Authorizes As-Built drawings
- Plan and control tests in accordance with energetic instructions.
- Collaborates with main contractor.
- Provides energy performance certificate.
- Accepts building handover docs from main contractor.
- Organize construction completion procedures.
- Organizes building cadastral surveying.
- Registers the building's property units at the register office.
- Manages final handover to tenants.

Competences

- Basic competencies in national regulation
- Competences in Contract preparation
- *Basic knowledge of BIM processes*
- *Basics of application of BIM technologies*
- Basics of Sustainable Development and Energy Efficiency knowledge
- Basics of ICT knowledge
- Public procurement competences (if required)
- General competences (teamwork, problem definition, problem solving, etc.)

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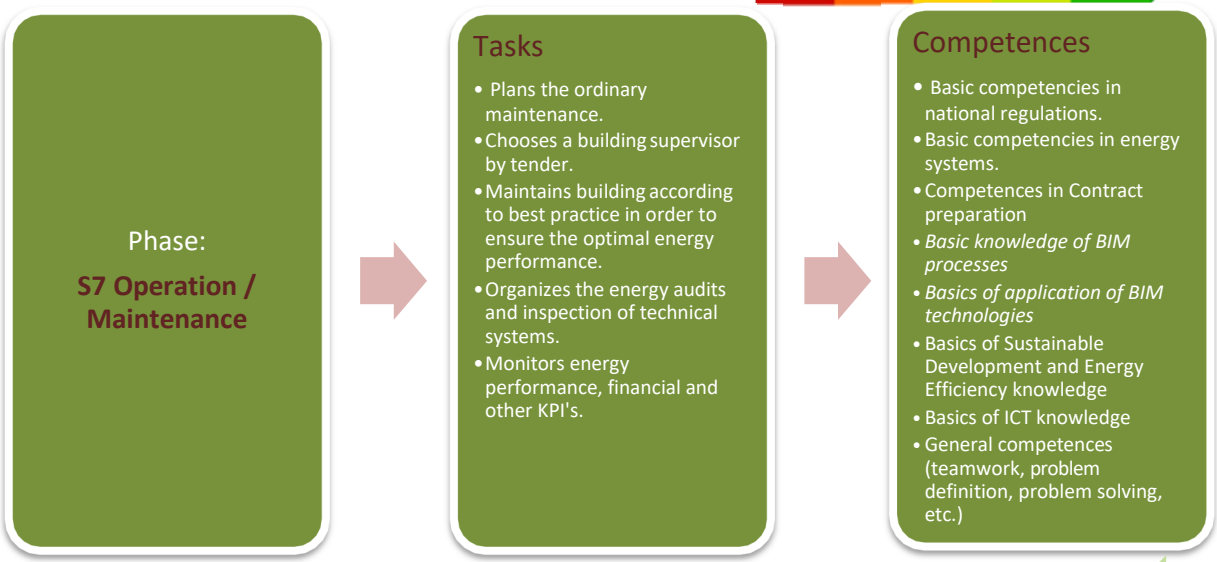

Graph.04 Building life cycle for Owners

3.4 Croatian Situation

Contributed by	Croatia
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Source	Building Act, Physical Planning Act, Energy Efficiency Act and their following regulations, Construction project tasks and activities which are ingrained in practice "*General guidelines for BIM approach in civil engineering*" published by Croatian Chamber of Civil Engineers in June 2017 (http://www.hkig.hr/fdsak3jnFsk1Kfa/izdvojeno/HKIG-BIM.pdf)

➢ General overview of the Building Life Cycle

The Building Life Cycle organizes the process of briefing, designing, constructing, maintaining, operating and using building projects in a different number of key stages. In Croatia, there are three different Acts (and their following regulations) which can help to better understand the process:

table.01 Croatian national law

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Starting from these three Acts and adding experiences in construction projects, it is possible to individuate five stages:

Phases	1. Initiation		
Sub Phases	Development of preliminary architectural design		

In the first phase, there are the definition of special physical area requirements and the development of the preliminary architectural design. Therefore, this initial phase has a duration which depends on the complexity of the project.

Phases	2. Conceptual Design, Main Design							
SubPhases	Development of architectural part of conceptual design	Development of mechanical engineering part of conceptual design	Development of civil engineering part in conceptual design	Development of electrotechnical part of conceptual	Development of architectural part of main design	Development of mechanical engineering part in main design	Development of civil engineering part of main design	Development of elctrotechnical part of the main design

In the second phase, it is possible to define the Conceptual and Main Design with the development of:

- architectural part of Conceptual Design
- mechanical engineering part of Conceptual Design
- civil engineering part of Conceptual Design
- electrotechnical part of Conceptual Design

The Conceptual Design doesn't have a substantial impact on surrounding physical area and is correlate with a Location Permit for gas, electric power, construction and physical planning, water supply and sewerage system.

- architectural part of Main Design
- mechanical engineering part of Main Design
- civil engineering part of Main Design
- electrotechnical part of Main Design

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The Main Design provide technical definition of the project and the design work of specialist subcontractors is concluded.

Phases	3. Build							
Sub Phases	Construction of structural part of building	Construction of mechanical engineering parts of building	Construction of electrical installations	Internal final (craft) works	Audit of structural part of building	Inspection of HVAC system	Inspection of electrical installations	Inspection of other internal works

During the Build phase, the building is constructed on site in accordance with the Construction Program. The Build includes the construction of:

- structural parts
- mechanical engineering parts
- electrical installations
- internal final works

At the end of the construction works there are the respective audit and inspection of HVAC systems, electrical installations and other internal works.

Phases	4. Exploitation / Maintain / Operate				
Sub Phases	Maintenance of structural part of building	Maintenance of HVAC system of building	Maintenance of other shared internal parts of building		

During the fourth phase, there are maintenance of:

- structural part of building
- HVAC system of building
- Other shared internal parts of buildings

Phases	5. End of life / recycling / reuse		
Sub Phases	End of usage period		

At the final stage, there are the activities of the end of use period.

table.02 Construction process phases

➢ Role of the Public Administration in the BLC

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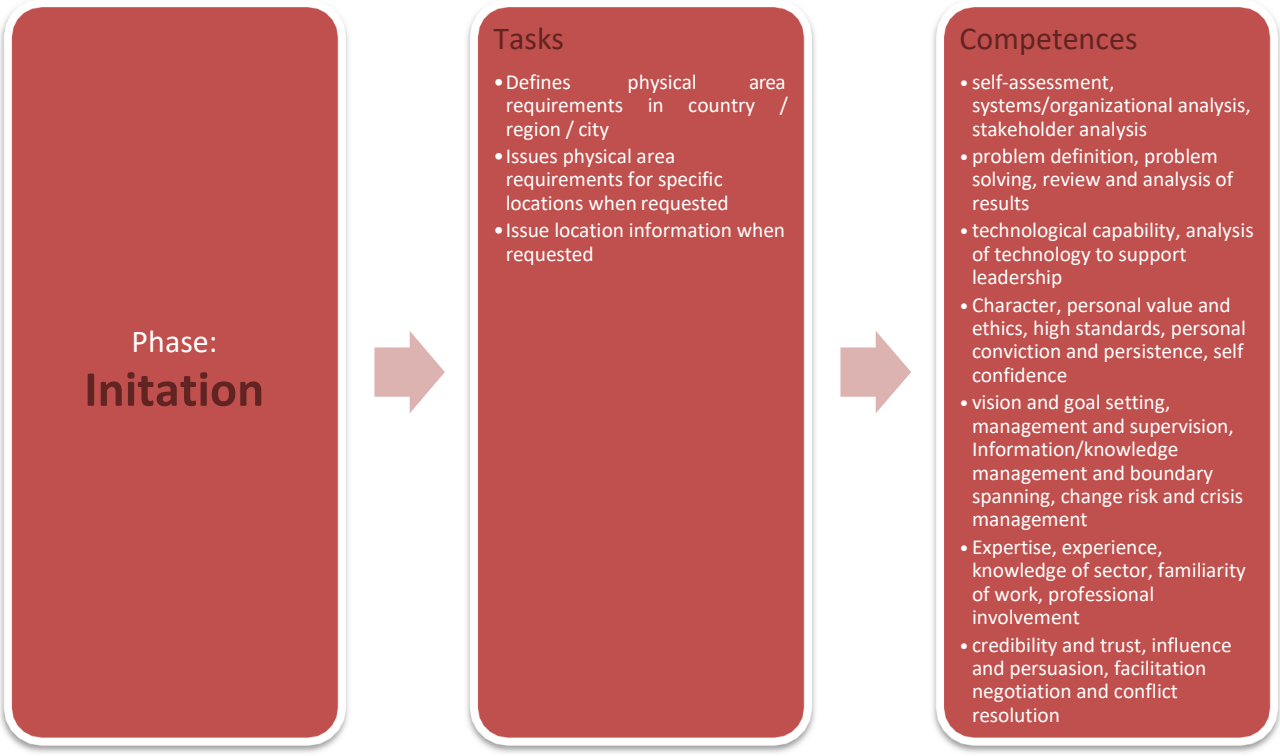
The Public Administration enforces acts and is the public authority who represents the regulation body. It sets physical area requirements for certain locations or in country/region/city in the initial phase, checks the compliance of the finished building with the design, acts and the regulation in force, provides inspections and possible refurbishments. At the end of the Building Life Cycle, it checks the compliance of the deconstruction design with the acts and the regulation in force and dispose the recycling and/ or reuse of resources (or, in case of waste, it controls their treatment).

➢ Role of the Public Administration when focusing on energy aspects

Focusing on energy aspects, the Public Administration shows the importance of energy efficiency requirements to the construction enterprises, contributing to shape and size the building. The defining of requirements includes the use of different energy sources in the future construction industry and the possibility to use RESs. In addition, the Public Administration checks the issuance and the validity of energy performances' certificates and of the inspections' reports on technical systems.

➢ Tasks and Competencies of the Public Administration in the BLC



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Phase:	Tasks	Competences
Conceptual Design, Main Design	• Defines and issues special physical area requirements • Defines and issues special construction requirements (including energy efficiency and RES requirements) • Checks compliance of the design (technical documentation) (for conceptual design) • Issues Location permit • Checks compliance of the design (technical documentation) (for main design) • Issues building permits	• credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution • self-assessment, systems/organizational analysis, stakeholder analysis • problem definition, problem solving, review and analysis of results • technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management • Expertise, experience, knowledge of sector, familiarity of work, professional involvement
Phase: **Build**	• Establish technical inspection commission • Runs the database and performs validity check of the issued energy performance certificate • Runs the database and performs validity check of the issued report on technical system inspection • Issue As-built permit • Runs database of Energy auditors (building performance and technical system performance) • Runs register of certified RES installers • Runs register of certified construction workers working in the field of energy efficiency • Runs an building inspection, health and safety inspection, fire inspection, etc.	• credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution • self-assessment, systems/organizational analysis, stakeholder analysis • problem definition, problem solving, review and analysis of results • technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management • Expertise, experience, knowledge of sector, familiarity of work, professional involvement

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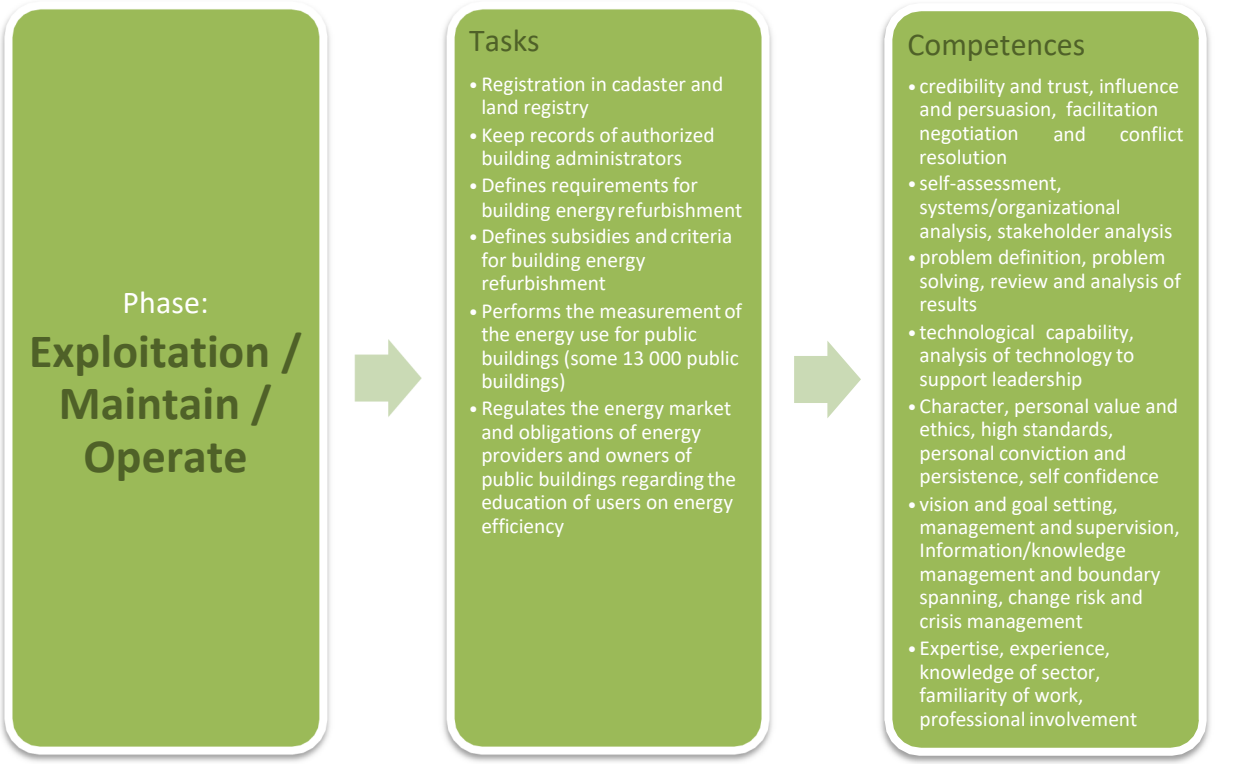

Graph.01 Building life cycle for PA

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➢ Role of the Professionals in the BLC

The Professionals are Project Managers and Consultants who oversee the production of design technical documentation (such as architectural design, mechanical engineering design, electrical engineering design, fire protection design) and audits. They supervise specific integral parts of construction works and performs all prescribed tests on the finished building. After the construction works, the Professionals performs the maintenance of the building and provide refurbishment projects, up to the production of technical documentations for the demolition of existing buildings.

➢ Role of the Professionals when focusing on energy aspects

Focusing on the energy aspects, the Professionals work as consultants of issues related to energy efficiency for new buildings and as energy auditors for existing buildings, inspecting the technical systems every year and monitoring the measurement of energy consumption for public buildings.

➢ Tasks and Competencies of the Professionals in the BLC

Phase:	Tasks	Competences
Initation	• Consult owner about how to implement construction project requirements, implementing energy performance requirements • Production of prefeasibility studies and preliminary architectural design	• Leadership, negotiation, communication • fundamental project management skills, project management tools and techniques, stakeholder analysis • Breadth (not depth) in specific application / industry knowledge, life cycle management • Strategic in approach: understand and addresses interdependencies and real issues • Clear definition of requirements (tested by real customer requirements) and timetables • Experience managing to deliverables and milestones on time, within budget, meeting business needs • Ability to manage troubled teams / projects bringing them to success • Proven experience with projects of similar size and scope • Organized and efficient in work processes • analytical thinking, teamwork, problem definition and solving, review and analysis of results

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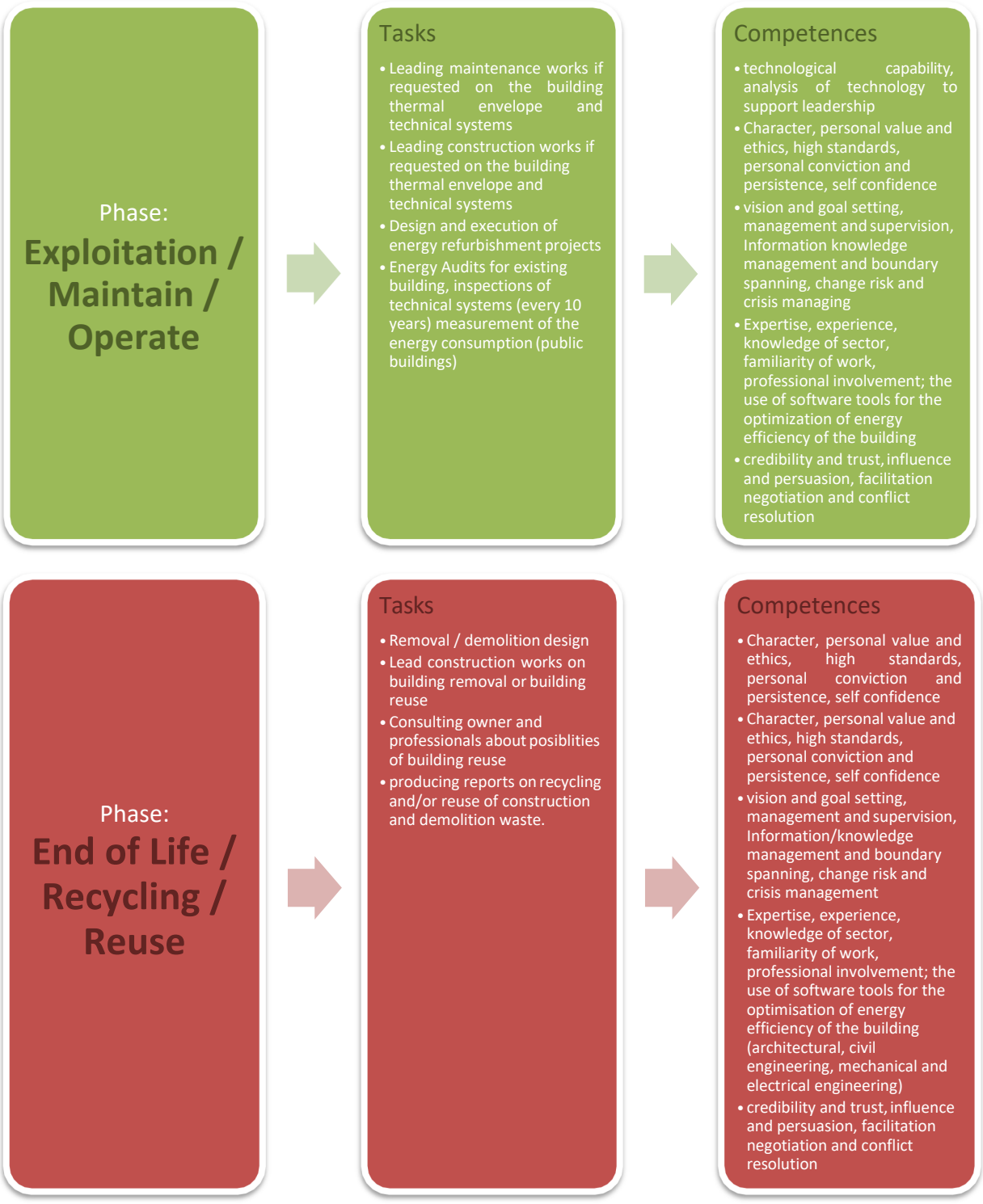
Phase:	Tasks	Competences
Conceptual Design, Main Design	• Production of conceptual and main design compliant with all location and building requirements (including energy efficiency requirements) • Coordinate all specialists / professionals (which delivers separate parts of building designs, i.e. mechanical engineering part of building design, civil engineering part of building design) • Audited when there is need to control compliance with essential requirements for building	• technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • vision and goal setting, management and supervision, Information and knowledge management and boundary spanning, change risk and crisis managing • Expertise, experience, knowledge of sector, familiarity of work, professional involvement and use of software tools for the optimization of energy efficiency of the building • credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution
Build	• Construction of building following design technical documentation (architecture, civil engineering, mechanical engineering, electrical engineering) • Supervises all building activities (controlling compliance with project technical documentation) • Issuing report on technical specification of building • Technical inspection of the building • Issuing report on energy performance / efficiency of building • Perform all prescribed (necessary test) on the finished building, i.e. blower door, thermography, etc.	• technological capability, analysis of technology to support leadership • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • vision and goal setting, management and supervision, Information/knowledge management and boundary spanning, change risk and crisis management • Expertise, experience, knowledge of sector, familiarity of work, professional involvement; the use of software tools for the optimization of energy efficiency of the building (architectural, civil engineering, mechanical and electrical engineering) • credibility and trust, influence and persuasion, facilitation negotiation and conflict resolution

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.754016



Graph.01 Building life cycle for Professional

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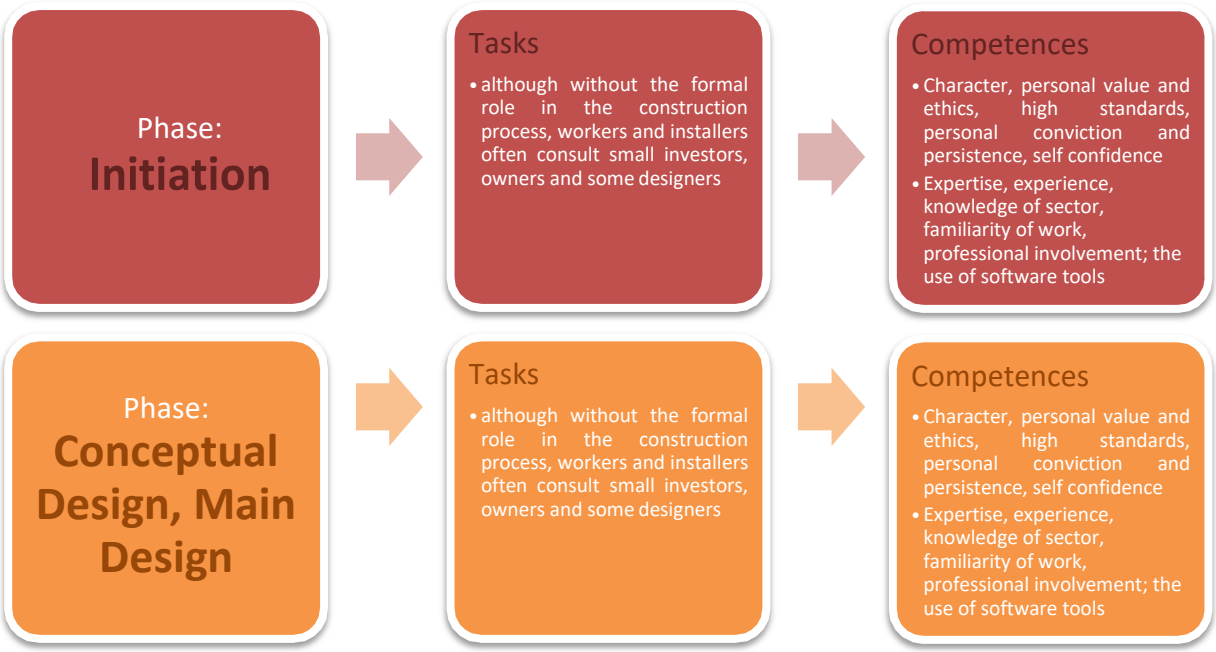
➢ Role of the Technicians in the BLC

The Technicians are workers and installers who provide installing materials and systems for the building such as HVAC, lighting and RES.

➢ Role of the Technicians when focusing on energy aspects

The technicians work on the building thermal and RES envelope and for this reason they need a certain certification (mandatory for the implementation of NZEBs). Certified construction workers and installers (for instance for gas burners) install systems related to energy efficiency (not mandatory but ordinance is in force).

➢ Tasks and Competencies of the Technicians in the BLC



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Phase: **Build**	Tasks	Competences
	• Understanding of designs and implementation / construction / installation of all designed materials and equipment • Collaboration with other workers and installers to deliver building (and its special parts) as required - Cross crafting • Taking care of all required procedures to construct / install materials and technical systems properly • ensure proper operations of technical systems and RES	• Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Expertise, experience, knowledge of sector, familiarity of work, professional involvement, using software tools • credibility and trust, influence and persuasion, negotiation and conflict resolution • understands and addresses inter-dependencies and real issues • Clear definition of requirements and timetables • Experience managing to deliverables and milestones on time, within budget, meeting business needs • proven experience with projects of similar size and scope • Organized and efficient in work processes • teamwork, problem definition and solving
Phase: **Exploitation / Maintain / Operate**	Tasks	Competences
	• maintaining and installing materials and systems on the building envelope, HVAC, automation and control, lighting as well as RES.	• Character, personal value and ethics, high standards, personal conviction and persistence, self confidence • Expertise, experience, knowledge of sector, familiarity of work, professional involvement using software tools • credibility and trust, influence and persuasion, negotiation and conflict resolution • understands and addresses inter-dependencies and real issues • Clear definition of requirements and timetables • Experience managing to deliverables and milestones on time, within budget, meeting business needs • Proven experience with projects of similar size and scope • Organized and efficient in work processes • teamwork, problem definition and solving

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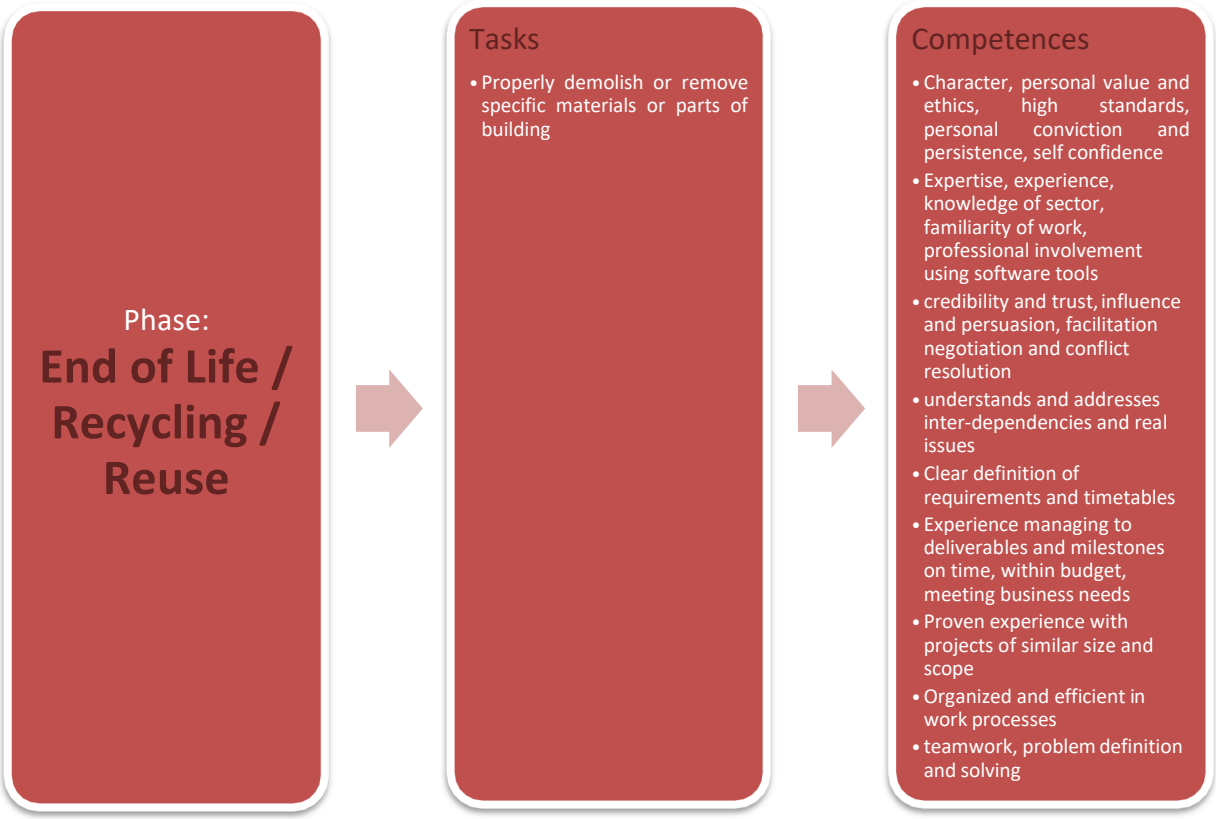

Graph.03 Building life cycle for Technicians

➢ Role of the Tenants/Owners in the BLC

Owners (such as Initiators and Investors) take all needed actions to start with all the phases of the Building Life Cycle.

➢ Role of the Tenants/Owners when focusing on energy aspects

Owners / Tenants / Users and Building Administrators set project requirements and a wish-list regarding energy efficiency and RES, make decisions on the project budget and the direction to take in order to construct NZEBs with sustainable materials. The supervising engineers, in name of the investor, check the compliance of the works with the design and legislation in force. At the end of the Building Life Cycle, they enable the renewal of energy performance certificate and the inspection of systems, maintaining the building and ensuring the safe of the operations.

➢ Tasks and Competencies of the Tenants/Owners in the BLC

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Phase	Tasks	Competences
Initiation	• Initiate production of (or produce) prefeasibility study and other preproject documentation • Hire all necessary project participants (i.e. Architect - leading designer…) and consult important stakeholders • Coordinate all project actions • Ensure fairness and quality of tender process for designers	• Leadership, negotiation, communication, • Clear definition of requirements and timetables • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence
Conceptual Design, Main Design	• Hire all necessary project participants and consult important stakeholders • Coordinate all project actions • Authorize all possible project changes (changes of building design) • Collaborate with leading architect and make final decision about conceptual and main design • Ensure fairness and quality of tender process for contractors	• Leadership, negotiation, communication, • Clear definition of requirements and timetables • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence
Build	• Hire all necessary project participant (i.e. main site supervisor, main contractor, authorized energy auditors, authorized companies which provide test) and consult important stakeholders • Coordinate all project actions • Collaborate with main contractor and make final decision about possible changes ensuring all necessary building certificates and permits (also for energy performances) • Manage final handover to tenants and/or building administrator	• Leadership, negotiation, communication, • Clear definition of requirements and timetables • Character, personal value and ethics, high standards, personal conviction and persistence, self confidence

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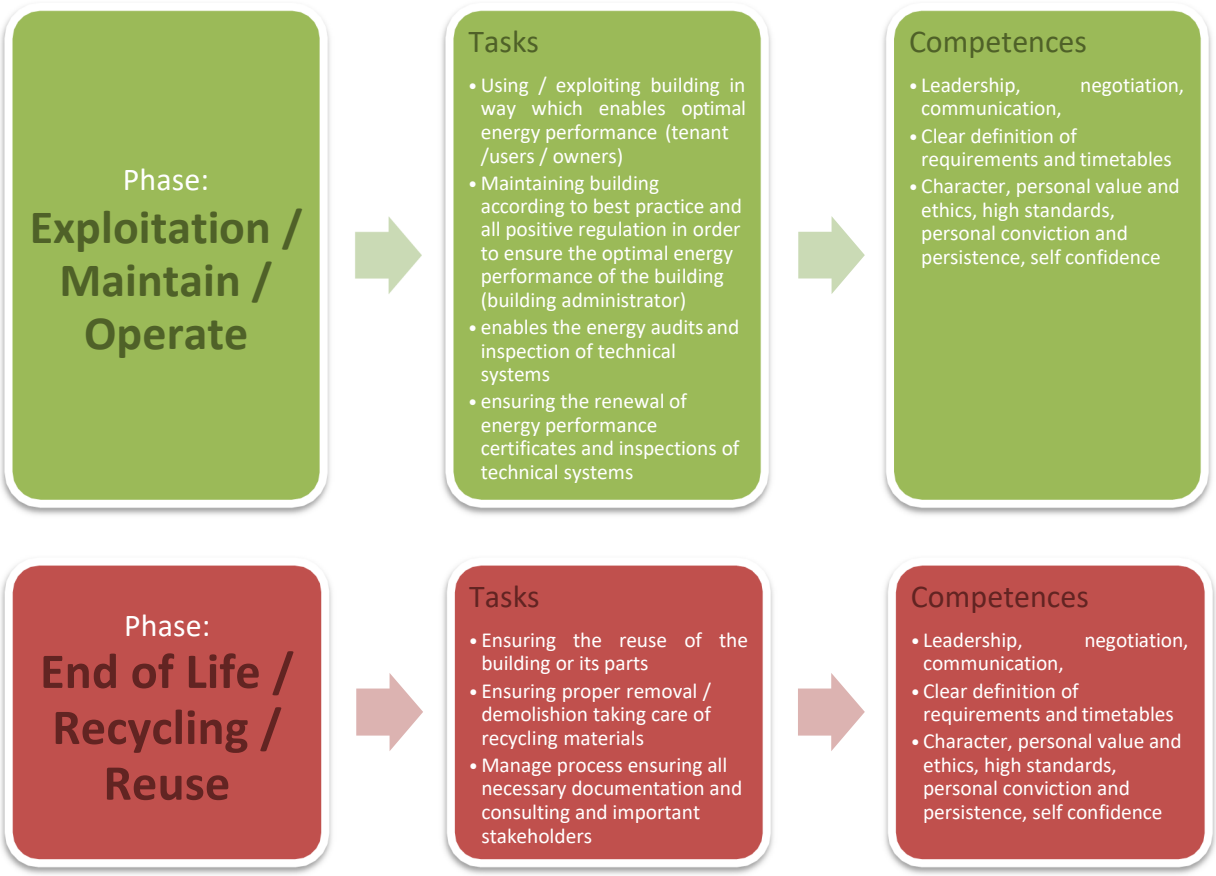

Graph.04 Building life cycle for Owners

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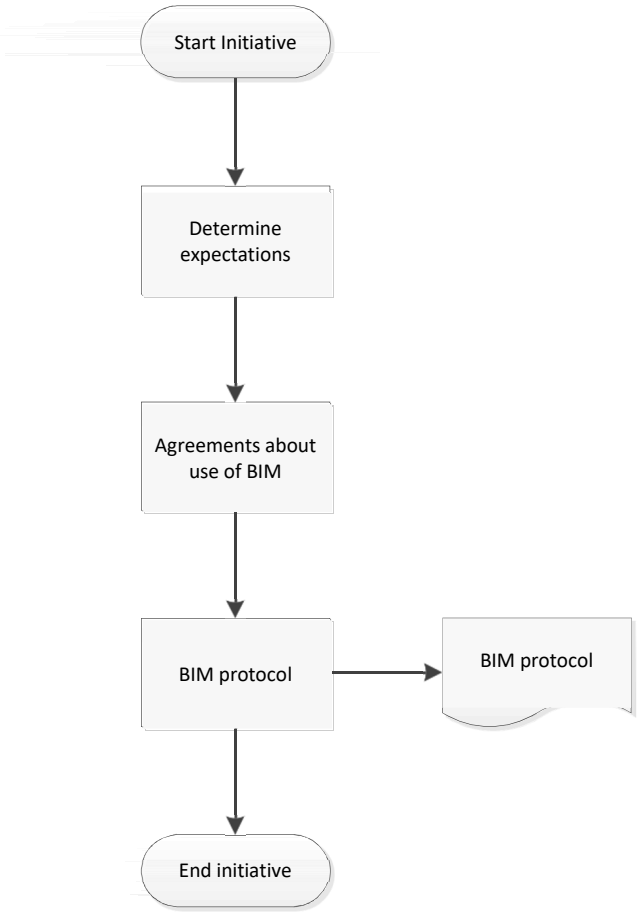
3.5 Dutch Situation

Contributed by	Stichting ISSO
Author	Arjan Schrauwen
Contact	a.schrauwen@isso.nl
Source	1. ISSO-publicatie 109 "Starten met een BIM" https://kennisbank.isso.nl/publicatie/isso-publicatie-109-starten-met-een-bim/2017. 2. "Overzicht BIM rollen en competenties" – Bouw Informatieraad. https://www.bouwinformatieraad.nl/main.php?mode=download_file&id=12

➢ General overview of the Building Life Cycle

In the Netherlands the following phases are used in a project with BIM:

- Initiative or program phase: In this phase the client/future owner defines the requirements of the new building, such as location, needed floor area, number of people etc. There are no design activities in this phase.



Graph.01 project BIM phases

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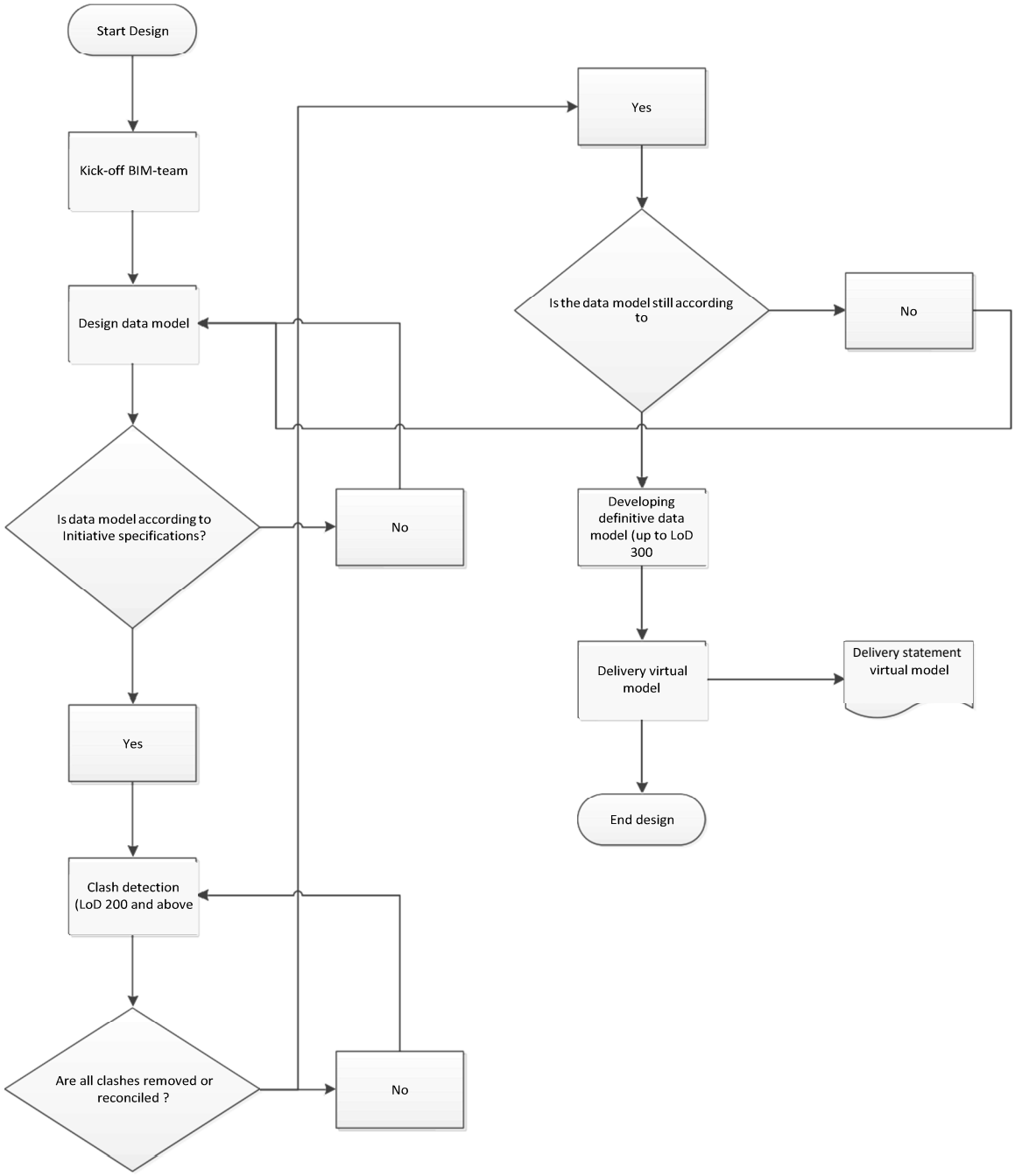
Design: In the design phase the building is designed by designers and engineers. The result is of this phase is a detailed design. With this detailed design contractors and installers are able to construct the building.

This phase can be divided in two subphases:
Subphase design:



Graph.02 project BIM sub-phases

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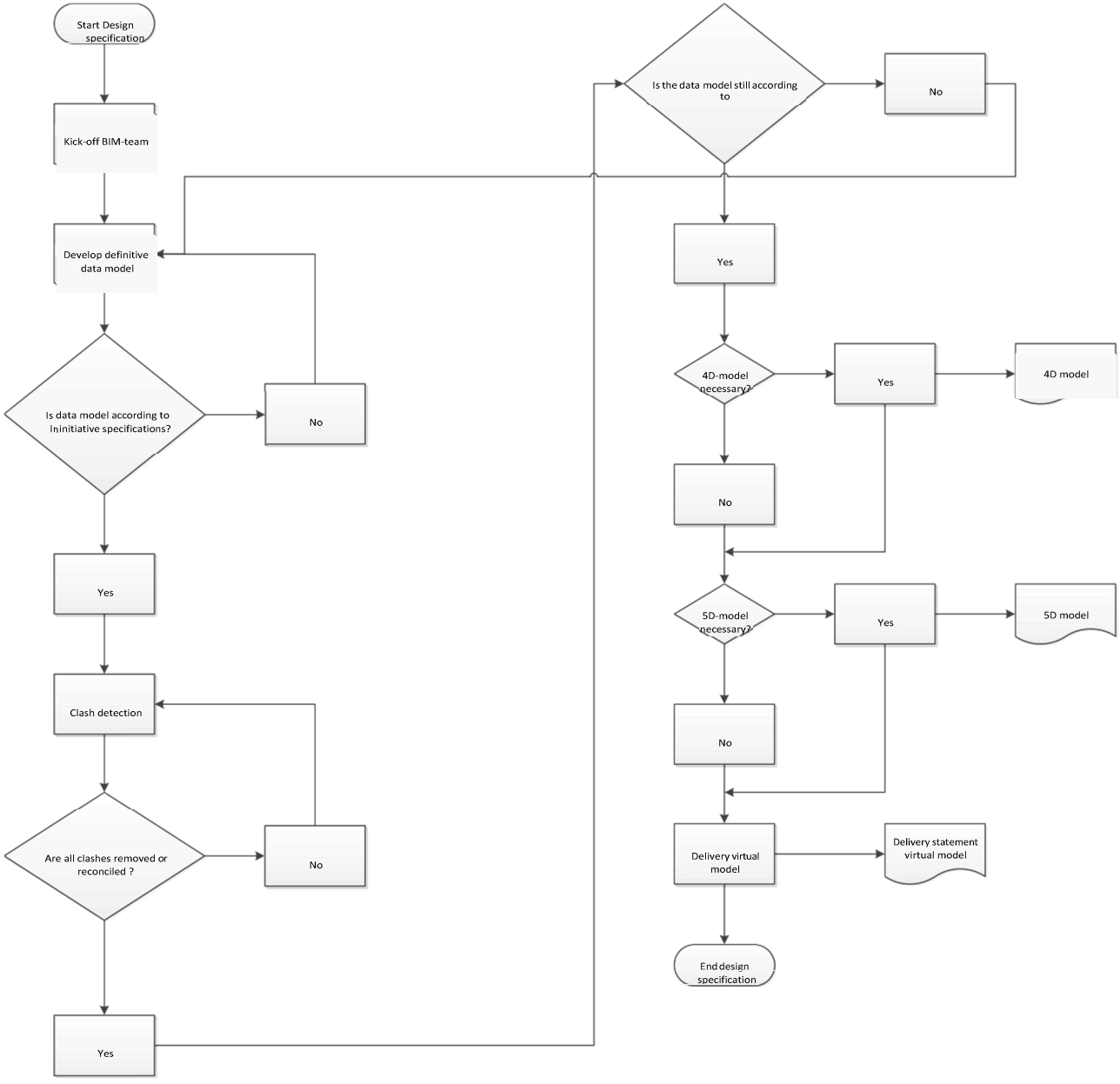
Subphase design specification:



Graph.03 Subphase design specification

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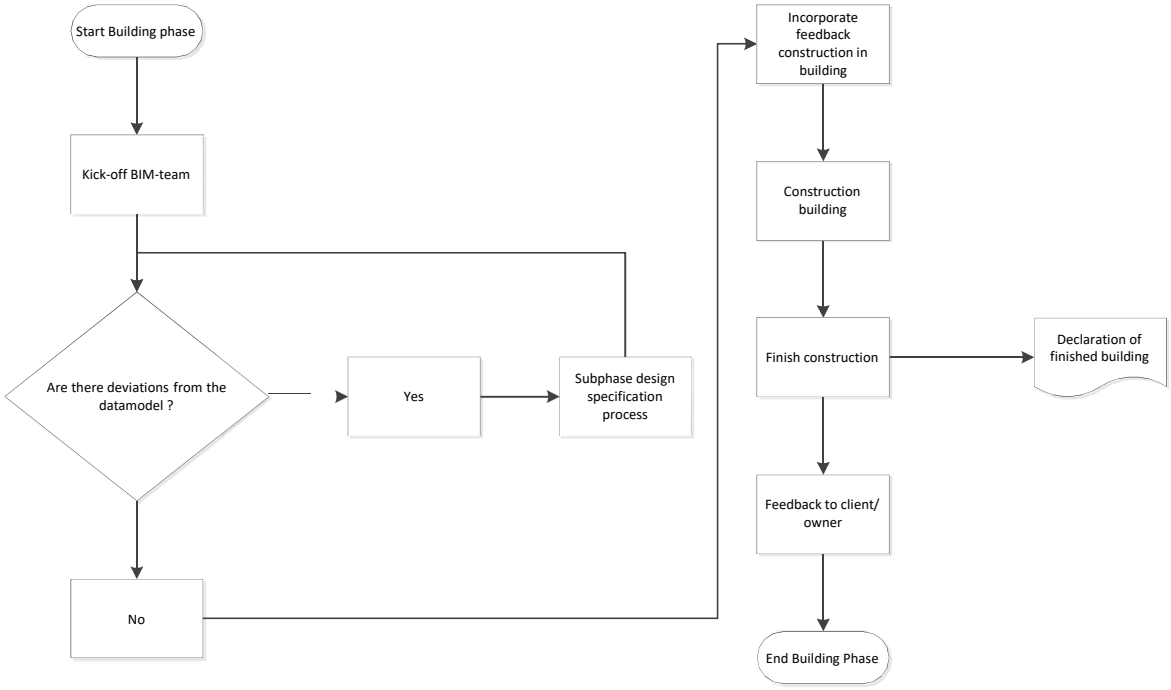
Build: In the building or constructing phase the building is realized. At the end of this phase the building can be used by its tenants/owners.



Graph.04 construction phase specification

Exploitation/maintain/operate: In the maintain/operate phase the building is used and maintained by its tenants or owners.

End of life/recycling/reuse: In the end of life phase the building will be demolished and recycled. It is also possible the building is reused for other purposes.

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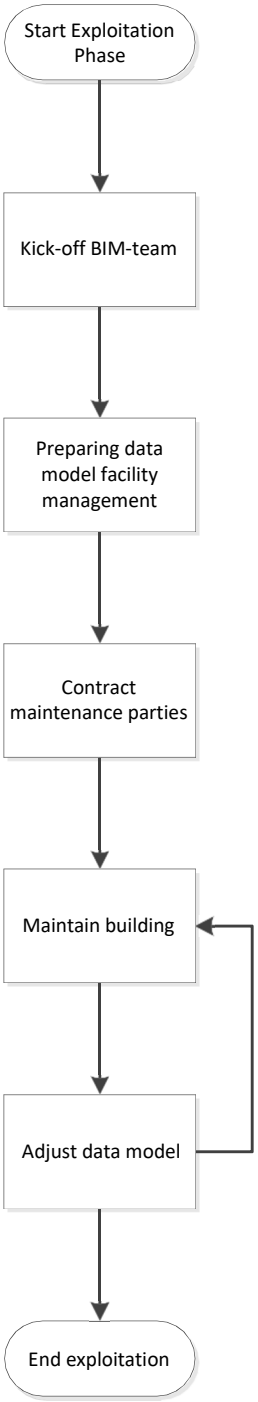

Graph.05 construction phase specification

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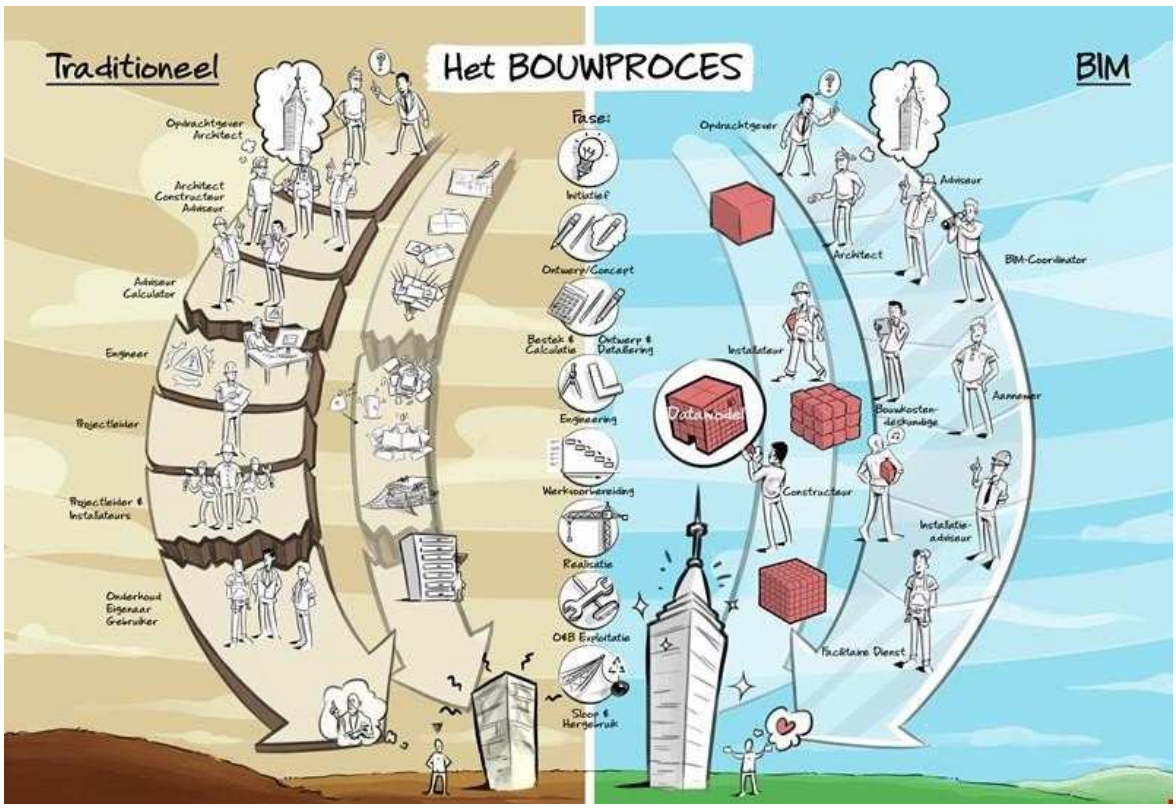

Graph.06 The traditional and BIM methods compared for the Dutch situation

➢ Role of the Public Administration in the BLC

In the Netherlands, the Public Administration is the authority who approves the final design according the Dutch regulations (Bouwbesluit) with a building permit (Omgevingsvergunning). Depending on the activities within the building, extra approval of the use of the building may be necessary. This is when activities may harm the environment. When the building will be demolished a permit is necessary to recycle and/or dispose waste.

It is also possible the public administrator itself is the owner and user of a new building.

➢ Role of the Public Administration when focusing on energy aspects

The Public Administration has energy aspects incorporated in its legislation. When a contractor receives a building permit, the design complies with this legislation. In the realization phase the public administrator checks if the contractor has realized the building according to the building permit.

➢ Tasks and Competencies of the Public Administration in the BLC

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Its tasks (and consequent competences) in the Building Life Cycle are:

Phase:	Tasks	Competences
Program/ Initiative	• Public administrators as a client: discusses building requirements with its tenants, translates these requirements in a program • Public administrator as a legislator: Creating legislation related to energy aspects and construction	• Public administrator as aclient: Negotiation skills, • Public administrator as a legislator: To be able to understand the construction sector
Design	• Public administrators as a client: designs a building based on the requirement program • Public administrator as a legislator: Checks if the design complies with the legal requirements related to energy aspects.	• Public administrator as a client: design skills and negotiation skills • Public administrator as a legislator: To be able to understand the design of a construction project
Realization	• Public administrator as a client: To check if the realization of the building complies with the design • Public administrator as a client: To manage a project from the clients perspective • Public administrator as a legislator: To check of the realization of the building complex with the building permit	• Public administrator as a client: to be able to check the realization in respect to the design. • Public administrator as a client: communication skills. • Public administrator as a legislator: to be able to check the realization in respect to the building permit.

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Phase: **Exploitation/ maintain/ operate**	**Tasks** • Public administrator as a client: to maintain the building (in respect to energy aspects) • Public administrator as a client: to create contracts for third parties who will maintain the building.	**Competences** • Competencies to establish energetic focus, developing goals in support of the national regulation • Legislative and regulatory competencies in building energy performance • Public administrator as a client: management skills (to manage a facility organization), communication skills, to be able to create a contract for third parties, negotiation skills
Phase: **End of life/ recycling/ reuse**	**Tasks** • Public administrator as a client: to manage the demolition, recycling or reusing the building. • Public administrator as a legislator: Checks if the demolition or recycling of the building complies with environmental legislation.	**Competences** • Public administration as a client: Management skills (to manage the demolition or recycling project), communication skills, negotiation skills, to be able to create contracts for third parties.

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Table.01 Building life cycle for PA

➢ Role of the Professionals in the BLC

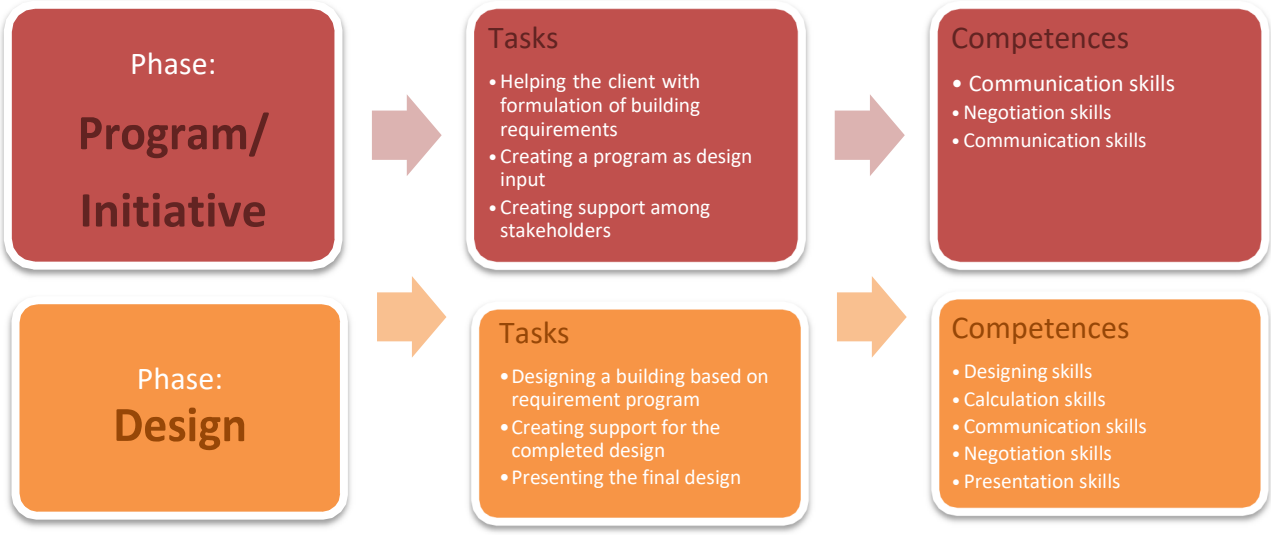
To help the client specify building requirements
To design a building based on client requirements
To manage a building project from the client perspective
To maintain the building in sufficient condition
To manage a recycle or reusing project.
To manage a building project from the contractor perspective.

➢ Role of the Professionals when focusing on energy aspects

To help the client specify building requirements in respect to energy aspects
To design a building with respect to energy aspects To manage a building project in respect to energy aspects
To operate and maintain the building with respect to energy aspects.
To design a reuse of the building in respect to energy aspects.

➢ Tasks and Competencies of the Professionals in the BLC

Its tasks (and consequent competences) in the Building Life Cycle are:



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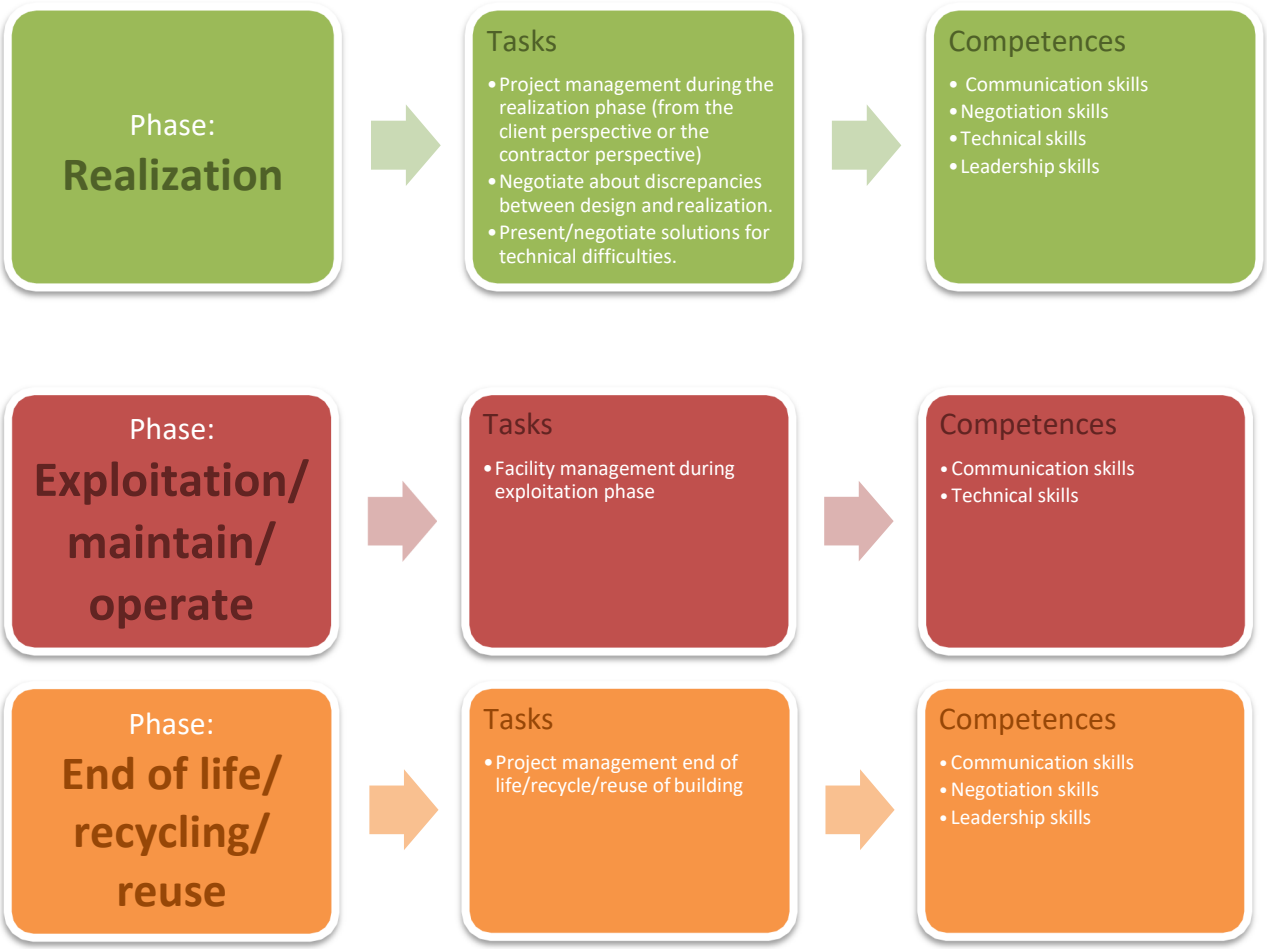

Table.02 Building life cycle for Professional

- **Role of the Technicians in the BLC**

  To transfer knowledge from the realization phase with the purpose to obtain a practical feasible design.

  To realize the design in a correct way.
  To operate and maintain the building according to the design.
  To transfer knowledge about the building, how it is/was maintained with the purpose of reusing or recycling the building.

- **Role of the Technicians when focusing on energy aspects**

  To transfer knowledge from the realization phase with the purpose to obtain a practical feasible design.

  To realize the design in a correct way.
  To operate and maintain the building according to the design.

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➢ **Tasks and Competencies of the Technicians in the BLC**

Phase:	Tasks	Competences
Program/ Initiative	-	-
Design	• Check design about the practical feasibility. • Advising designers about the practical feasibility of the design	• Extensive technical skills. • Communication skills. • Analyzing skills
Realization	• Realizing the building according to the design • Communicating with fellow technicians • Communicating with designers • Communicating with external construction partners	• Analyzing skills • Technical skills • Communication skills
Exploitation/ maintain/ operate	• -Operating the building according design • Maintaining the building according design • Communicating with external facility partners	• -Analyzing skills • Technical skills • Communication skills
End of life/ recycling/ reuse	• Transferring knowledge about the building to party which recycles or reuses the building	• Communication skills

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Table.03 Building life cycle for Technicians

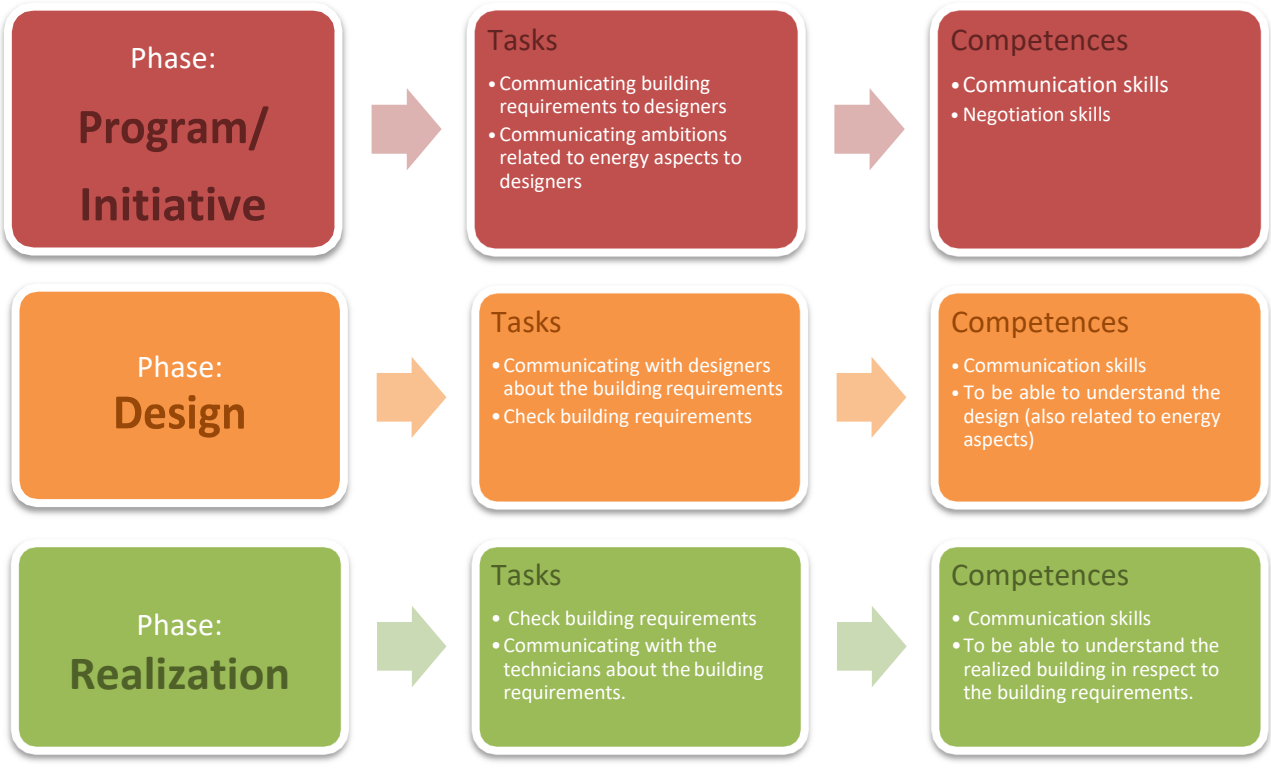
- **Role of the Tenants/Owners in the BLC**

To transfer building requirements to designers
To check the design with the building requirementsTo check the building requirements with the actual building
To use the building according the building requirements/design
To transfer knowledge about the building to third parties

- **Role of the Tenants/Owners when focusing on energy aspects**

To transfer ambitions related to energy aspects to designers
To check the energy related ambitions with the design
To check the energy related ambitions with the actual building related to energy aspects
To use the building with the energy aspects in mind. The building is built according to the energy aspects ambitions, it has to be used in this way.

- **Tasks and Competencies of the Tenants/Owners in the BLC**



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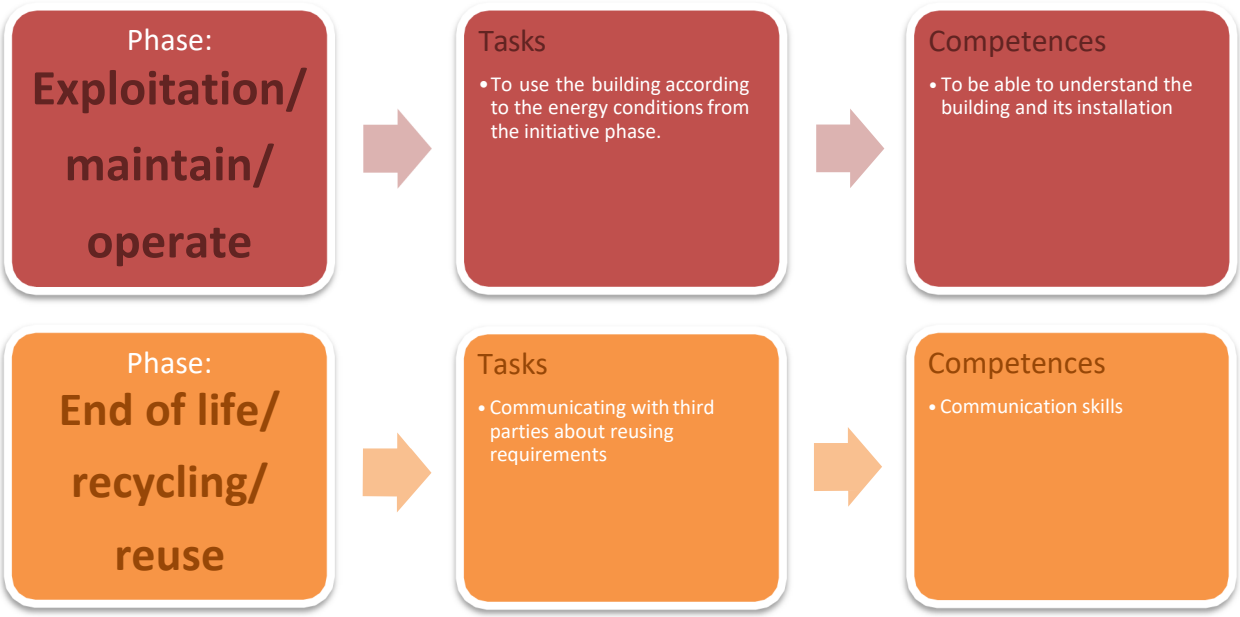

Table.04 Building life cycle for Owners

Estonian situation

Contributed by	Estonia
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Contact	ergo.pikas@gmail.com - targo.kalamees@ttu.ee
Source	EVS 928:2016 Building Information Modelling (BIM) Terminology EVS 932:2017 Construction design documents

➢ **General overview of the Building Life Cycle**

In Estonia, there is no commonly agreed life-cycle model for the built environment on a legislative level, and the model in the standards (not mandatory in Estonia to use) are concerned only with the design project delivery. Thus, the process outline proposed below is a rough synthesis of different documents, including legislative acts, standards, and guidelines by the authors.

Time periods:		Plan & Program		Design			Construction				Use			End of Use and/or Life
Phases:	Spatial Planning, Legislation and Standards	Strategic Brief	Building Programming	Schematic Design	Preliminary Design	Design Development	Construction Documents	Pre-construction Planning	Procurement, Fabrication and Delivery	Construction/ Installation	Commissioning and Handover	Operations and Maintenance	Remodeling/ Renovation	Deconstruction/ Recycling

Table.01 construction process phases

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Currently, the formal document explicitly defining the project delivery phases is the EVS 932:2017 Construction design documents. However, the focus in that document is on the delivery of design projects, excluding all the phases before and after the design project and only stating the formal connections to these on a high level. This process maps is shown below.

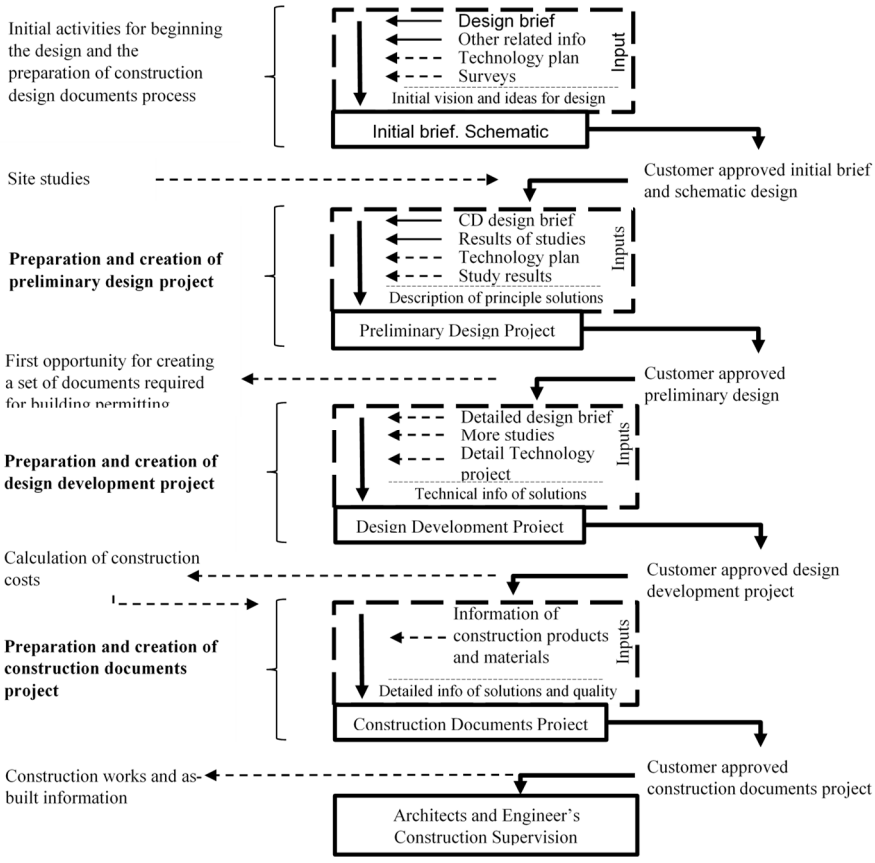

Table.02 formal document project delivery phases

➢ Role of the Public Administration in the BLC

In Estonia, the Public Administration by different public organizations are acting in different phases of the project delivery and are mainly responsible for planning, monitoring, controlling and/or conducting spatial planning and construction works. During pre-project phases, the main tasks of the Public Administration are related to spatial planning and the development of Building Code:

- The aim of this **Planning Act** is to create, through spatial planning, by promoting environmentally sound and economically, culturally and socially sustainable development, the preconditions that are necessary for democratic, long-term and balanced spatial development that takes into account the needs and interests of all members of the Estonian society to occur,

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for democratic, long-term and balanced land use pattern that takes into account the needs and interests of all members of the Estonian society to form and for high-quality living and built environment to develop.

- The authorities that organize planning work are, according to their competence, the Ministry of Finance, other relevant government agencies or local authorities:
  1. ensuring the existence of spatial plans corresponding to the land area;
  2. arranging the preparation of spatial plans;
  3. the preparation of spatial plans or commissioning the preparation of spatial plans;
  4. the taking of the procedural steps required in the course of preparing spatial plans;
  5. assessment of the relevant economic, social, cultural and environmental impacts resulting from the implementation of the spatial plan, including arranging the strategic environmental assessment;
  6. following, reviewing and implementing adopted spatial plans to the extent of the duties imposed by legislation on the authority that organizes planning work.

- The aim of **Building Code** is to promote sustainable development and to ensure the safety, purposeful functionality and usability of the built environment. Code applies to construction works: their design, building, use and maintenance insofar as this is not governed by other Acts, ratified international treaties or EU legislation. This Code also applies in the territorial sea and exclusive economic zone. The tasks assigned to public organizations as part of the Building Code include:
  - Public authority issues design specifications (local authority unless otherwise provided by law).
  - Authority is authorized to demand the submission of a building notice (Building Notice), when there is no building permitting requirement.
  - Public (local) authority issues the building permit, unless otherwise provided by law (Building Permit).
  - Competent authority decides on the need to initiate the assessment of environmental impact during building permitting process.
  - Authority is authorized to demand the notice of the commencement of building work and notice of the complete demolition of a construction work, when building permitting was required.

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- Authority is authorized to require the submission of a use and occupancy notice in advance of the use and occupancy of the construction work or of a change in its purpose of use, when there is no occupancy permitting requirement.
- Public (local) authority issues the use and occupancy permit, unless otherwise provided by law (Use and Occupancy Permit).
    - **In three cases it is the Technical Regulatory Authority that is responsible for use and occupancy permitting:** when construction works were built on the basis of a national special spatial plan; when the issuing of the use and occupancy permit is in the competency of the government; and when issuing of the use and occupancy permit is in the competency of several government agencies

➢ Role of the Public Administration when focusing on energy aspects

Tasks related to energy efficiency according to spatial Planning Act:

- When preparing spatial plans, preference must be given, where possible, to solutions that are environmentally sound and ensure good energy performance.
- To determine the principles and directions of other infrastructure, including energy, gas and communication networks;
- To determine the principles and directions of other infrastructure, including energy, gas and communication networks;

3.3 Tasks related to energy efficiency according to Building Code:

- May make regulations to establish the procedure for assessing the average building cost
- Makes regulations to establish requirements for the energy audits of buildings
- Makes regulations for the methodology of calculating the energy performance of buildings
- Makes regulations to establish the minimum requirements for energy performance, including the requirements for technical systems that consume significant amounts of energy, and the conditions for introducing the use of renewable energy in buildings:
    - The minimum requirements for energy performance are reviewed at least once every five years
- Makes regulations to establish the requirements for energy performance certificates and for the issuing of such certificates
- Makes regulations to establish the precise definition of the heating and cooling equipment, the list of the particulars to be entered in the register of construction works and the procedure of transmitting the particulars
- Makes regulations to establish the extent of protection zones, their protection and marking out and the recommendations for carrying out operations within protection zones

➢ Tasks and Competencies of the Public Administration in the BLC

(Local) authority verifies during the building permitting that designed construction works meet the energy efficiency requirements.
Authority assures that owners have entered the energy certifies during different stages of design.
The competencies of public authorities do not differ from the architecture and engineering as these are the prerequisite educations for working in publication administration positions.

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➢ Role of the Professionals in the BLC

"Professional" includes Architects and Engineers who are responsible for identifying and quantifying needs and requirements of the authorities, customers, users, contractors, building managers/maintainers, and design to these needs and requirements. In addition, during the construction, designers are responsible to provide test and control works conducted by blue-collar workers.

➢ Role of the Professionals when focusing on energy aspects

Architects (Applied Architect EQF 6, Diploma/Certified Architect EQF 7, Principal Architect 7, Principal Architect-Expert 8):

Participate, lead, manage, coordinate, carry-out designs related spatial planning and architecture of the building projects. Use knowledge and principles to conceive systems as whole in architecture and energy efficiency in mind

Engineering, including civil engineer in buildings and structures; automation engineer; hydro-technical engineer; heating, ventilation and air conditioning (HVAC); road engineering; Water Supply and Sewerage Engineering on different levels, including EQF 6, 7, 8:

- Participate, lead, manage, coordinate, carry-out designs related spatial planning and engineering of the building projects. Use knowledge and principles to conceive systems as whole in technical and energy efficiency in mind

➢ Tasks and Competencies of the Professionals in the BLC

Architects (Applied Architect EQF 6, Diploma/Certified Architect EQF 7, Principal Architect 7, Principal Architect-Expert 8) tasks:

- Conception and design of spatial plans across all different types of plans (National Spatial Plan, National Designated Plan, County-Wide Spatial Plan, Comprehensive Plan, Local Government Designated Spatial Plan, Detailed Spatial Plan)
- Conception and design of building project architecture (interior, building, site) through all the phases (according to EVS 932:2017) of design project
- Auditing of design works related to building project architecture (interior, building, site), spatial planning, and built environment
- Facilitation and coordination of work related to spatial planning in public sector
- Management of spatial planning projects
- Management of building design projects

3.4 Architecture personal qualities:

Spatial imagery, creativity, logical thinking, generalization and abstraction, autonomy, decision-making, accuracy, collaboration, communication, stress tolerance, achievement needs and aesthetic skills.

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3.5 Engineering, including civil engineer in buildings and structures; automation engineer; hydro-technical engineer; heating, ventilation and air conditioning (HVAC); road engineering; Water Supply and Sewerage Engineering on different levels, including EQF 6, 7, 8:

- Construction project design with respect to buildings, external utilities and spatial planning
- Management of design projects with respect to buildings, construction site and external utilities
- Auditing of works with respect to buildings, construction site and external utilities
- Construction management with respect to buildings, construction site and external utilities
    - Feasibility and cost-benefit analysis
    - Management of construction procurement processes
    - Preparation of design works
    - Preparation of building processes
    - Owner's supervision and representation
    - Management of commissioning and handover processes
- Building process management
    - Preparation of tenders
    - Planning of construction works
    - Management and coordination of production of construction products and materials
    - Operations management
    - Quality management
- Building cost evaluations
- Surveys
- Maintenance and operations
    - Management and operation of buildings and equipment
- Training
- Research and Development

3.6 Engineering personal qualities:

Analytical, accuracy, sptial imagery, creativity, problem-solving, autonomy, decision-making, adaptability and communication, leadership and co-operation/collaboration skills

➢ Role of the Technicians in the BLC

In this Target Group are included supplier of raw materials and components, workers, installers and demolition companies. Thus, these groups are in or another part of the supply chain, responsible for the execution and delivery of work results.

➢ Role of the Technicians when focusing on energy aspects

- Carry out construction and maintenance works on the buildings and structures of buildings

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➢ Tasks and Competencies of the Technicians in the BLC

- Carry out construction and maintenance works on the buildings and structures of buildings
- Understands the possibilities and necessity of saving energy and resources in the real estate environment and works accordingly
- Only awareness of energy consumption and energy efficiency is required

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➢ Role of the Tenants/Owners in the BLC

According to Building the owner must ensure the conformity of the construction work, of building work and of the use of the construction work to the requirements arising from legislation; amongst other things, the owner must ensure:

- the conformity of the construction work to spatial plans or to design specifications;
- the existence of permits required for building work and for the use and occupancy of the construction work and the making of the required notifications and notices;
- that any work which is performed directly at the owner's instruction and which is governed by this Code is performed by a person possessing sufficient skills and knowledge (hereinafter, 'qualifications') that correspond to the specific character of the work;
- the maintenance and safety of use of the construction work;
- owner supervision in the cases provided in law.

➢ Role of the Tenants/Owners when focusing on energy aspects

The customer must ensure socially sustainable development, through the planning stage, a high- quality natural and built environment. It also includes energy performance as part of it based on following standards:

- Minimum energy performance requirements for buildings have been established in the state (03.03.2017)
- Nationally established methodology for calculating energy performance of buildings (07/01/2015)
- The contracting authority must take into account the requirements set out above when designing the initial task

➢ Tasks and Competencies of the Tenants/Owners in the BLC

Customer/Owner must ensure the fulfilment of legislative requirements throughout the life cycle of the building with respect to responsibilities stemming from the spatial Planning Act and Building Code.

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4. Table summarizing the profiles

Profile Number	European level harmonized BIM profile 1	European level harmonized BIM profile 2	European level harmonized BIM profile 3	European level harmonized BIM profile 4
1 BIM Profile for	BIM manager	BIM coordinator	BIM modeller / BIM evaluator	BIM Specialist / expert user
2 Additional info on profile	Lead and manages BIM (project) implementation	All partners	BIM modeller creates models according BIM standards	All partners
3 Contributed by	EU-partners	EU-partners	EU-partners	EU-partners
6 Source	Based on national inventory	Based on national inventory	Based on national inventory	Based on national inventory
1 EQF	Level 7	Level 7	Level 5/6	Level 6
1	Construction management	Construction management	Architecture	Architecture
2	Building management	Architecture	Structural engineering	Structural engineering
3 Working field	Financing and procurement	Building management	Mechanical Engineering (including plumbing)	Mechanical Engineering
4	Architecture	Structural engineering	Electrical engineering	Electrical engineering
5		Mechanical Engineering	Construction engineering	Construction management
6		Electrical engineering	Building management	Building management
1	Establish organization goals related to BIM	Coordination of models	BIM Modelling	Manage and coordinate project deliveries. Defines tasks together with project team.
2	Establish BIM implementation in organization	Dkigal workflow management	Content development	Strive to build strong network connections with project stakeholders.
3	To develop and implement BIM standards in projects and own organization	Ensure interoperability between individual parts of the BIM model	Preparing project documentation	Discussing with internal and external parties such as contractors and subcontractors
4 Tasks in BIM Project	Set up BIM in project with other project parties.	Advising project team in preparing development plan for using BIM in projects.	Ensure accuracy model	mediate between the different decision makers (for example, Client Project Manager designers, production managers or worksites) and BIM Modeler (Data Configurators in the Information Model)
5	Responsible for training employees	Integrating different aspect models	Collaborate and coordinate with other project members/professions	insert the disciplinary knowledge into the operational modeling and into the information management
6	Analysis and implement best practices related to BIM in organization and projects	Interface with different stakeholders in project	Following BIM standards	To create, develop and to extract documentation from models.
7	Coordinates operations among participating disciplines and establishes quality controls	Quality management on BIM model/ auditing		
8	Definition of the BIM Execution plan	Training project team members		
1		Training competencies	Modeling competencies	Technical skills and knowledge.
2	Leadership skills	Leadership skills	Technical skills and knowledge	Communication and collaboration skills.
3	Collaboration, communication, negotiation and coordination skills	Communication and collaboration skills	Communication and collaborating skills	Capability to contribute to produce and check a Model of current fixed assets
4	Research skills	Technical skills and knowledge	Analytical	Solution-oriented
5 Competencies in BIM Project	Analytical skills	Quality assessment skills		Capability to analyze a proposal of Information Management
6	Technical skills	Model coordination skills		Knowledge of BIM standards.
7	Risk control ?	Problem solving		
8				
9				
10				

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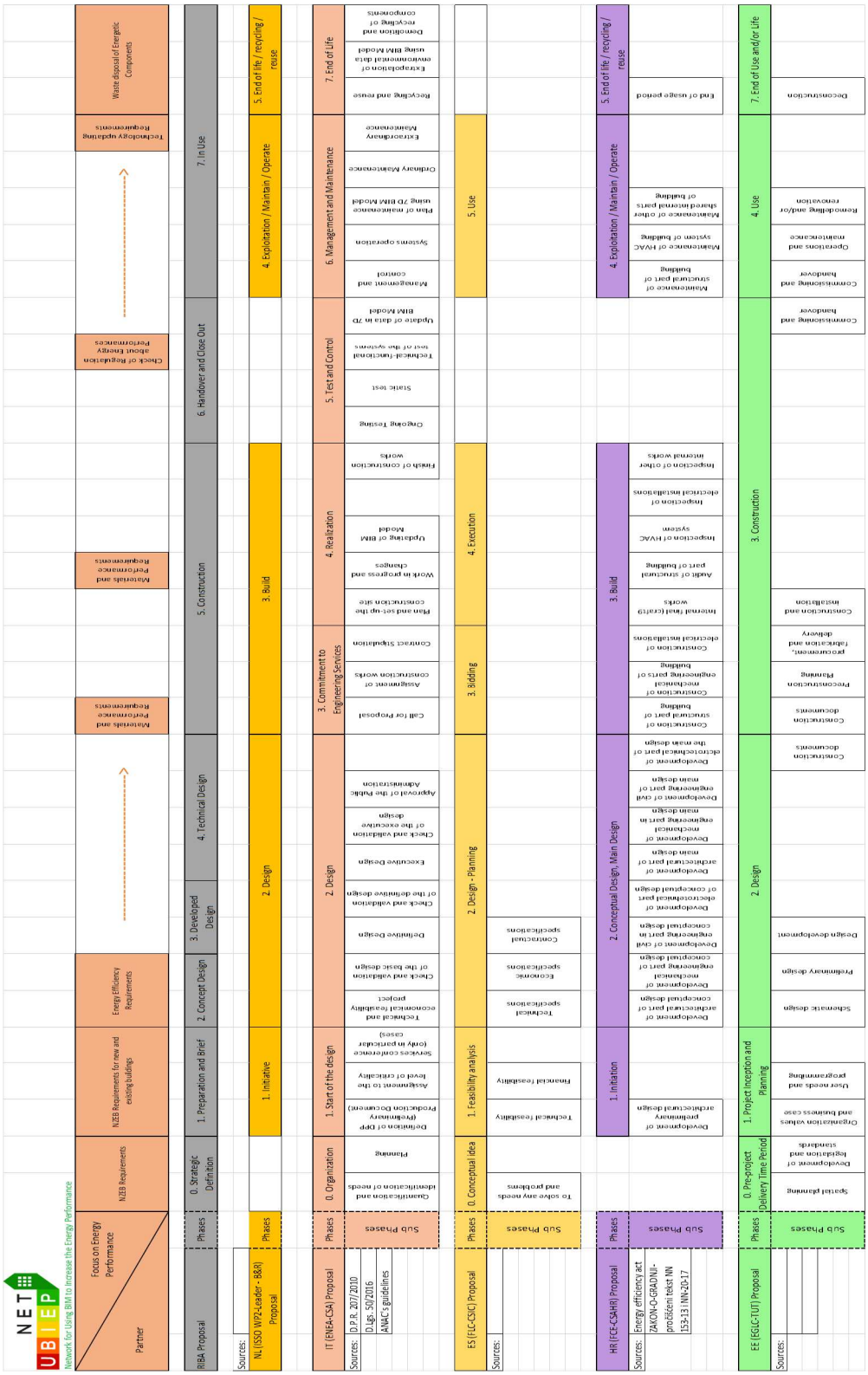
5. Table summarizing phases per building life cycle



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6. INDEX CHARTS/GRAPHS

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