If windows are placed at more than one level, formula (2) is suggested.

\[ V = 0.7 \cdot C_{\text{ref}} \cdot A_{\text{ref}} \cdot \sqrt{H} - 1.5T \]  

(2)

together with \( C_{\text{ref}} = 300 \text{ m}^{3} / \text{h} \cdot \text{K}^{0.5} \)

together with \( A_{\text{ref}} = \frac{1}{\sqrt{2}H} \)

together with the following interpretations of \( H \) (height) and \( A \) (area).

Both formulas take into account only the temperature driven component of the air flow, without any assumption of wind driven airflow. Thus, the outputs are conservative and “on the safe side”.

Driven by the hourly values of external and internal air temperatures used in the dynamic energy balance model, the airflow through windows is calculated in hourly steps, too.

Figure (3) exemplarily shows the air flow resulting from opening tilting a window of 40 cm width and 120 cm height, at increasing temperature difference between inside and outside air, according to formula (1).

Furthermore, above the scope of the code, it still is a point of discussion, how to define the summer performance of buildings with thermal mass activation but without Air-Conditioning. By definition those buildings are mechanically cooled. By perception they are very much anticipated as free running mode buildings. It’s worth a consideration to include them in the scope of the calculation methods of free running mode buildings.

7 ACKNOWLEDGEMENTS

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MARKET TRANSFORMATION TOWARDS NEARLY ZERO ENERGY BUILDINGS THROUGH WIDESPREAD USE OF INTEGRATED ENERGY DESIGN

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ABSTRACT

ID is a design procedure that considers the building as a whole system with the aim of optimizing it throughout the lifecycle. ID can be used to reach high ambitions by developing, discussing and evaluating a scheme using a multidisciplinary team from the initial design phases and it is a proven approach for achieving high-performance buildings with good indoor environment without sacrificing architectural quality or result in excessive costs. Integrated Design support designers in delivering buildings which satisfy occupant’s needs much more than conventionally designed buildings.

Towards this direction MaTrID project supports the implementation of directive 2010/31/EU by widespread market adoption of ID on the national level. The main targets of MaTrID are:

- Establishing the general understanding on the advantages and requirements of ID
- Improving the know-how basis on ID
- Testing the practical implementation of ID on a large scale
- Development of a common tool-kit for the integrated energy design of NZEB
- Adoption of the common tool-kit to national requirements
- Implementing EU-wide promotion and dissemination activities
- Drawing conclusions for a further market adoption

The benefit of EU collaboration is to link good practices among leading European countries (including clients, private industry, public sector, etc.). Knowledge transfer among Europe and various actors is the main benefit of MaTrID.

KEYWORDS

nearly zero energy buildings, integrated design

1 INTRODUCTION

Buildings account for around 40% of total energy consumption and 36% of CO2 emissions in Europe. The reduction of energy consumption and the use of energy from renewable sources in the buildings sector therefore constitute important measures which are needed to reduce energy dependency and greenhouse gas emissions. The mitigation potential of emissions from buildings is important and as much as 80% of the operational costs of standard new buildings.
can be saved through integrated design principles, often at no or little extra cost over the lifetime of the measure. The payoffs in terms of the energy performance of buildings (EPBD) stipulates that by 2020 all new buildings constructed within the European Union after 2020 should reach nearly zero energy levels. This means that in less than one decade, all new buildings will demonstrate very high energy performance and their reduced or very low energy needs will be significantly covered by renewable energy sources.

In parallel, Member States shall draw up national action plans for increasing the number of nearly zero-energy buildings (NZEB). These national action plans shall include policies and measures to stimulate the transformation of existing buildings which will be refurbished into nearly zero-energy buildings. In addition, by 2015 all new buildings and buildings undergoing major renovation must have minimum levels of energy from renewable sources. The implementation of these policy goals will have a major transformation in the building sector during the next few years.

The design of NZEB requires an interdisciplinary approach. Reducing the energy demand in the design phase demands specifications of the different designers and engineers such as architects, building physics or façade designers. For the demand side concept of a building the best possible heating or ventilation system should be applied. Activating of thermal mass for example requires the interaction between the structural designer and HVAC engineers. Alternative energy systems have to fit to the concept design and the building energy systems. For this reason, the introduction of a design team is compulsory for the design of NZEBs. In this context the building design phase of is of particular importance. IED is a valuable assisting approach to reduce the complexity of the design process, to allow decision makers to decide based on transparent facts. Only if IED is a assisting approach to reduce the complexity of the design process, and to allow decision makers to decide based on transparent facts. Only if IED is applied from the very beginning of the design phase we can assume that a cost-effective solution for NZEB can be identified, because only at the early design phases changes of the general design concept can be implemented at low cost. Therefore, the application of IED is of part of the best way towards the intended NZEB at low cost. Experience from several demonstration and pilot projects shows that IED frequently leads to highly energy efficient solutions at least cost over the life cycle of the building, because the integration of all required expertise already in the early design phase brings forward easy and thus cost-efficient solutions. The objectives of the proposed project have been identified based on an in-depth assessment of barriers for IED resp. on the preconditions which are required for a practical application of the IED approach. Activities are needed on the side of the building owner (developer) as well as on the side of designers. Starting from this, the following specific project objectives can be derived:

- Establishing the general understanding on the advantages and requirements of IED
- Improving the know-how basis on IED
- Testing the practical implementation of IED on a large scale
- Development of a common tool-kit for the integrated design of NZEB
- Adaptation of the common tool-kit to national requirements
- Implementing EU projects and disseminate results
- Drawing conclusions for a further market adoption

The construction, architects and engineering market is very much focused on regional and local level. Additionally, the state of the art for IED in each country is different. For this reason, the emphasis of the project is on widespread market adaption on national level.

2 PRINCIPLES FOR NEARLY ZERO-ENERGY BUILDINGS

1. Energy demand

There should be a clearly defined boundary in the energy flow related to the operation of the building that defines the energy quality of the energy demand with clear guidance on how to assess corresponding values.

2. Renewable energy share

There should be a clearly defined boundary in the energy flow related to the operation of the building where the share of renewable energy is calculated or measured with clear guidance on how to assess this share.

3. Primary energy and CO₂ emissions

There should be a clearly defined boundary in the energy flow related to the operation of the building where the overarching primary energy demand and CO₂ emissions are calculated with clear guidance on how to assess these values.

3 THE INTEGRATED DESIGN PROCESS

Integrated design is an approach that considers the design process as well as the physical solutions, and the overall goal is to optimize buildings as whole systems throughout the lifecycle. Firstly, for the purpose of reaching high sustainability performance, the alternative building and technical solutions should be developed and discussed by an integrated, multidisciplinary team. IED emphasizes a decision process rooted in informed choices with regard to the project goals, and on systematic evaluation of design proposals. This approach for building design is parallelizing the principles of environmental management referred in the international ISO 14001 standards. Here, identifying and prioritizing goals, and developing an evaluation plan with milestones for follow-up are central issues. A shift of approach emphasizes that the early phases need more attention because well informed decisions have a major impact on the lifespan of the building. Well informed planning from the start can allow buildings to reach very low energy use and reduced operating costs at very little extra capital cost, if any. Considering the whole life cycle of a building and the cost of running costs and refurbishment costs; thus, it becomes obvious that it is a shortighted approach to squeeze the first design phase regarding performance. Experience applying IED shows that the investment costs may be about 5 % higher, but the annual running costs will be reduced by as much as 40%. Thus the process of IED results in buildings that are assessed in a lifecycle perspective, both regarding costs (LCC) and environmental performance (LCA). Figure 1 indicates the importance of the integrated design process at the early phases of NZEB achievable.

Figure 1: Early design phases offer opportunity for large impact on performance to the lowest costs and disruption. Therefore, a shift from work load and conflict stress in the early phases will probably pay off in the lifecycle of the building.

3.1 The benefits

- Higher energy performance

Optimization of building form, orientation and facades is reached through open multidisciplinary discussion and design decisions in early project phases, where knowledge about important conditions is exchanged to inform the design of the building.

- Reduced embodied carbon

Optimized design is given priority before advanced technical systems and control mechanisms. The high embodied carbon of HVAC components are thus reduced.

- Optimized indoor climate

The building and technical systems work together in a logical symbiosis in order to achieve sufficient indoor air quality, temperature control and daylight access/ solar protection.

- Lower running costs

- Simplified technical systems are more cost efficient, both in terms of investment costs for manufacturing and installation and in terms of running costs and maintenance.

- Reduction of risks and construction defects

- Improved planning leads to less building faults. Thus, less claiming, and money saved.

- More user involvement

Enrollment of users and inclusion of user needs in the design process may improve the following performance of the building in the operation phase, as well as increase user satisfaction.

- Higher value

A high performance building can yield higher rental costs which can be compensated for by a lower energy bill thus the sales value of the building will increase.

- Green image and exposure of the building

A green image can benefit the building owner or tenant organization.

3.2 The barriers

- Conventional thinking

The building sector is known for being slow accepting new ways of working. IED calls for decision processes and design methods that challenge familiar habits, and require high communication skills. Professionals on both sides of the table must practice in collaboration, and maybe adjust their working habits.

- IED seems to cost too much

Developers traditionally give more attention to construction costs than lifecycle costs (LCC). However, when energy consumption and maintenance is included in the calculations, it usually supports investments in planning for high performance and robust solutions.

- Time constraints in initial design phase

Often developers underestimate the value of thoroughly planning, and expect high speed in conceptualizing a building. It can be challenging to convince the developer that the initial phase is crucial, and that giving time for design iterations often pay off in better concepts.

- Skills ‘synonym’

As the IED process requires more collaboration between stakeholders who may have diverging goals, conflicts could be accentuated. It is therefore necessary that the team members do not insist on ultimate demands within their fields of expertise, but rather endeavour to work with a holistic approach.
can be saved through integrated design principles, often at no or little extra cost over the lifetime of the measure. The payback period of the energy savings of buildings (EBRD) stipulates that by 2020 all new buildings constructed within the European Union after 2010 should reach nearly zero energy levels. This means that in less than one decade, all new buildings will demonstrate very high energy performance and their reduced or very low energy needs will be significantly covered by renewable energy sources.

In parallel, Member States shall draw up national action plans for increasing the number of nearly zero-energy buildings (NZEB). These national action plans shall include policies and measures to stimulate the transformation of existing buildings which are refurbished into nearly zero-energy buildings. In addition, by 2015 all new buildings and buildings undergoing major renovation must have minimum levels of energy from renewable sources. The implementation of these policy goals will involve a major transformation in the building sector during the next few years. The design of NZEB requires an interdisciplinary approach. Reducing the energy demand in the design phase demands specifications of the different designers and engineers such as architects, building physics or facade designers. For the demand side concept of a building the best possible heating or ventilation system should be applied. Activating of thermal mass for example requires the interaction between the structural designer and HVAC engineers. Alternative energy systems have to fit to the concept design and the building energy systems. For this reason, the introduction of a design team is compulsory for the design of NZEBs. In this context the building design phase is of particular importance. IED is a valuable assisting approach to reduce the complicity of the design process, to ensure the implementation of defined, to identify pros and cons of alternative variants of design concepts and to allow decision makers to decide based on transparent facts. Only if IED is applied from the very beginning of the design phase we can assume that a cost-effective solution for NZEB can be identified, because only at the early design phases changes of the general design concept can be implemented at low cost. Therefore, the application of IED is of part of the best way towards the intended NZEB at low cost. Experience from several demonstration and pilot projects shows that IED frequently leads to highly energy efficient solutions at least cost over the life cycle of the building, because the integration of all required expertise already in the early design phase brings forward easy and thus cost-efficient solutions.

The objectives of the proposed project have been identified based on an in-depth assessment of barriers for IED resp. on the preconditions which are required for a practical application of the IED approach. Activities are needed on the side of the building owner (developer) as well as on the side of designers. Starting from this, the following specific project-objectives can be derived:

1. Establishing the general understanding on the advantages and requirements of IED
2. Improving the know-how basis on IED
3. Testing the practical implementation IED in a large scale
4. Development of a common tool-kit for the integrated design energy of NZEB
5. Adaptation of the common tool-kit to national requirements
6. Implementing EU companies ambition in terms of alternative variants
7. Drawing conclusions for a further market adoption

The construction, architects and engineering market is very much focused on regional and local level. Additionally, the state of the art for IED in each country is different. For this reason, the emphasis of the project is on widespread market adoption on national level.

2 PRINCIPLES FOR NEARLY ZERO-ENERGY BUILDINGS

1. Energy demand

There should be a clearly defined boundary in the energy flow related to the operation of the building that defines the energy quality of the energy demand with clear guidance on how to assess corresponding values.

2. Renewable energy share

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3. Primary energy and CO2 emissions

There should be a clearly defined boundary in the energy flow related to the operation of the building where the overarching primary energy demand and CO2 emissions are calculated with clear guidance on how to assess these values.

3 THE INTEGRATED DESIGN PROCESS

Integrated design is an approach that considers the design process as well as the physical solutions, and the overall goal is to optimize buildings as whole systems throughout the lifecycle. Firstly, for the purpose of reaching high sustainability performance, the alternative building and technical solutions should be developed and discussed by an integrated, multidisciplinary team. IED emphasizes a decision process rooted in informed choices with respect to the project goals, and on systematic evaluation of design proposals. This approach for building design is parallelizing the principles of environmental management referred in the international ISO 14001 standards. Here, identifying and prioritizing goals, and developing an evaluation plan with milestones for follow-up are central issues.

A shift of approach emphasizes that the very early phases need more attention because well informed decisions have to be made well ahead of the lifecycle of the building. Well informed planning from the start can allow buildings to reach very low energy use and reduced operating costs at very little extra capital cost, if any. Considering the whole life cycle of a building is a better远景 running costs and higher refurbishment costs; thus, it becomes obvious that it is a shortighted approach to squeeze the first design phase regarding everything. Experience from applying IED shows that the investment costs may be about 5 % higher, but the annual running costs will be reduced by as much as 40-60 %. Thus the process of IED ensures that buildings should be assessed in a lifecycle perspective, both regarding costs (LCC) and environmental performance (LCA). Figure 1 indicates the importance of the integrated design process at the early phases, respectively.

Figure 1. Early design phases offer opportunity for larger impact on performance to the lowest cost and disruption. Therefore, a well thought and executed strategy in the early phases will probably pay off in the lifetime of the building.

3.1 The benefits

- Higher energy performance
- Optimization of building form, orientation and facades is reached through open multidisciplinary discussion and design decisions in early project phases, where knowledge about important conditions is exchanged to inform the design of the building.
- Reduced embodied carbon
- Optimized design is given priority before advanced technical systems and control mechanisms. The high embodied carbon of HVAC components are thus reduced.
- Optimized indoor climate
- The building and technical systems work together in a logical symbiosis in order to achieve sufficient indoor air quality, temperature control and daylight access/solar protection.
- Lower running costs
- Simplified technical systems are more cost efficient, both in terms of investment costs for manufacturing and installation and in terms of running costs and maintenance.
- Reduced risks and construction defects
- Improved planning leads to less building faults. Thus, less claiming, and money saved.
- More user involvement
- More communication of the stakeholders, designers, manufacturers, contractors, clients, and users.
- Greater awareness and inclusion of user needs in the design process can improve the following performance of the building in the operation phase, as well as increase user satisfaction.
- Higher value
- A high performance building can yield higher rental costs which can be compensated for by a lower energy bill than the sales value of the building will increase.
- Green image and exposure of the building
- A green image can benefit the building owner or tenant organization.

3.2 The barriers

- Conventional thinking
- The building sector is known for being slow accepting new ways of working. IED calls for decision processes and design methods that challenge familiar habits, and require high communication skills. Professionals on both sides of the table must practice in collaboration, and maybe adjust their working habits.
- IED seems to costs too much
- Developers traditionally put more attention to construction costs than lifecycle costs (LCC). However, when energy consumption and maintenance is included in the calculations, it usually supports investments in planning for high performance and robust solutions.
- Time constraints in initial design phase
- Often developers underestimate the value of thoroughly planning, and expect high speed in conceptualizing a building. It can be challenging to convince the developer that the initial phase is crucial, and that giving time for design iterations often pay off in better concepts. "Skills tyranny"

As the ID process requires more collaboration between stakeholders who may have diverging goals, conflicts could be accentuated. It is therefore necessary that the team members do not insist on ultimate demands within their fields of expertise, but rather endeavour to work with a holistic approach.
3.3 The principles

Six steps can be identified for a successful integrated design implementation (Figure 2):

- Project development: this includes the discussion of the project ambitions and challenges initial client presumptions, initiating ID process and preferably make partnering contracts.
- Design basis: selection of a multi-disciplinary design team, including an ID facilitator, motivated for close operation, analysis of the boundary conditions. Also refine the brief and specify the project ambitions, preferably as functional goals.
- Iterative problem solving: facilitate close operation between the architect, engineers and relevant experts through workshops etc. Use of both creative and analytical techniques in the design process. Discussion and evaluation of the multiple concepts and finalise optimised design.
- On track monitoring: Use goals/ targets as means of measuring success of design proposals, make a Quality Control Plan, evaluate the design and document the achievements at critical points/milestones.
- Delivery: Ensure that the goals are properly defined and communicated in the tender documents and building contracts, motivate and educate construction workers and apply appropriate quality tests, facilitate soft landing. Make a user manual for operation and maintenance of the building.
- In use: Facilitate commissioning and check that the technical systems etc. are working as assumed, monitor the building performance over time regarding e.g. energy consumption, user satisfaction etc.

![Figure 2: Overview of the ID process.](image)

4 THE MATRID PROJECT

MaTrID aims to support the implementation of Nearly Zero Energy Buildings by 2020. In this context the building design phase is of particular importance. Integrated Energy Design (IED) is a valuable approach to reduce the complexity of the design process and facilitate the interactions between the members of the design team. IED allows them to provide the best solution for the whole building. MaTrID’s targets are harmonized with the integrated design process as described in the previous section (Leutgib, K. 2012)

4.1 Objectives

The objectives of the proposed project have been identified based on a holistic IED approach. Activities are needed on the side of the building owner (developer) as well as on the side of designers. Starting from this, the following specific project objectives can be derived:

1. Establishing the general understanding on the advantages and requirements of IED at the side of real estate developers and building owners: In this context, the project aims at convincing opinion leaders of builder’s associations, big property developers or other multipliers that IED is the way to be chosen for the design of cost-efficient NZEB.
2. Improving the know-how basis on IED: The application of IED requires practical know-how on the developer’s side as well as on the designers’ side. Therefore the project aims at developing practical tools, such as specific text modules for client briefs as well as for IED related contracts and remuneration models.
3. Testing the practical implementation of IED on a large scale thus setting best practice examples which can be easily copied and multiplied.
4. Development of a common tool-kit for the integrated energy design of NZEB
   - Clients brief for NZEB
   - IED-related model contracts
   - IED-friendly remunerations models
   - User-friendly IED guideline
5. Adaptation of the common tool-kit to national requirements
6. Implementing EU-wide promotion and dissemination activities
7. Drawing conclusions for a further market adoption of IED in the years after the end of the project including also practical recommendations on possible policy instruments that may support the widespread use of IED on daily design practice.

4.2 Focus area

The construction, architects and engineering market is very much focused on regional and local level. Additionally, the state of the art for IED in the participating countries is very different. For this reason, the emphasis of the project is on a widespread market adoption on national level. National activities are country specific and reflect the respective demand.

4.3 Benefits

The greatest benefits are provided only if applied in the earliest stages of the project, when changes to the design are still easy to implement. The benefit of EU collaboration is to cross-pollinate good practices among leading European countries (including clients, private industry, public sector, etc.). Knowledge transfer among Europe and various actors is the main benefit of MaTrID.

4.4 Outcomes

The outcomes of the project can be summarised as follows:

- A general understanding on the advantages and requirements of IED on the part of real estate developers and building owners as well as on the designers’ side.
- Practical tools – such as specific text modules for client briefs as well as for IED related contracts and remuneration models – which can be directly applied in daily practice.
- Successfully tested pilot projects with practical implementation of IED on a large scale. Examples can be easily copied and multiplied.
- General acknowledgement of IED beyond the limits of the participating countries.
- Conclusions for a further market adoption of IED in the years after the end of the project including also practical recommendations on possible policy instruments that may support the widespread use of IED on daily design practice.
- A specific award will give European visibility to outstanding IED processes. This award will contribute in spreading the ID approach, in highlighting its advantages and in showing possible and feasible ways to reach advanced building targets.

5 CONCLUSIONS

The European Union (EU) aims at drastic reductions in domestic greenhouse gas (GHG) emissions of 80% by 2050 compared to 1990 levels. The building stock is responsible for a major share of GHG emissions and should achieve even higher reductions of at least 88% - 91%. Therefore, without consequentially exploiting the huge savings potential attributed to the building stock, the EU will miss its reduction targets. More than one quarter of the 2050s building stock is still to be built. The energy consumption and related GHG emissions of these new buildings need to be close to zero in order to reach the EU’s highly ambitious targets.

The recast of the Energy Performance of Buildings Directive (EPBD) introduced, in Article 9, “nearly Zero-Energy Buildings” (NZEB) as a future requirement to be implemented from 2019 onwards for public buildings and from 2021 onwards for all new buildings. Integrated Design (ID) is necessary in managing the complex issues arising from planning buildings with high energy performance, emphasis is on collaboration in multidisciplinary teams as well as on clear goal-setting and systematic monitoring. In the early design phase, the opportunity to positively influence building performance is great, while cost and disruptions associated with design changes are very small.

The guiding strategic objective of the MatTrID project is to contribute significantly to a widespread market adoption of integrated energy design of buildings. IED should become the standard way of European practice. The evaluation of the multiple concepts will find it easier to cope with the challenges coming from energy and climate change policy by producing sustainable buildings with very high energy performance in a cost-effective way, calculated over the life cycle of the building.

6 REFERENCES


Nobby, A. S. (2013) MaTrID ID process guideline


3.3 The principles

Six steps can be identified for a successful integrated design implementation (Figure 2):

- Project development: this includes the discussion of the project ambitions and challenges initial client presumptions, initiating design process and preferably make partnering contracts.
- Design basic: selection of a multi-disciplinary design team, including an ID facilitator, motivated for close cooperation, analysis of the boundary conditions. Also refine the brief and specify the project ambitions, preferably as fundamental goals.
- Iterative problem solving: facilitate close operation between the architect, engineers and relevant experts through workshops etc. Use of both creative and analytical techniques in the design process. Discussion and evaluation of the multiple concepts and finalize optimised design.
- On track monitoring: Use goals/ targets as means of measuring success of design proposals, make a Quality Control Plan, evaluate the design and document the achievements at critical points/milestones.
- Delivery: Ensure that the goals are properly defined and communicated in the tender documents and building contracts, motivate and educate construction workers and apply appropriate quality tests, facilitate self-monitoring. Make a user manual for operation and maintenance of the building.
- In use: Facilitate commissioning and check that the technical systems etc. are working as assumed, monitor the building performance over time regarding e.g. energy consumption, user satisfaction etc.

4 THE MATRID PROJECT

MaTrID aims to support the implementation of Nearly Zero Energy Buildings (nZEB) as a future requirement to be implemented by 2020. In this context the building design phase is of particular importance. Integrated Energy Design (IED) is a valuable approach to reduce the complexity of the design process and facilitate the interactions between the members of the design team. IED allows them to provide the best solution for the whole building. MaTrID’s targets are harmonized with the integrated design process as described in the previous section (Leutgib, K. 2012).

4.4 Outcomes

The outcomes of the project can be summarised as follows:

- A general understanding on the advantages and requirements of IED on the part of real estate developers and building owners as well as on the designers’ side.
- Practical tools – such as specific text modules for client briefs as well as for IED related contracts and remuneration models – which can be directly applied in daily practice.
- Successfully tested pilot projects with practical implementation of IED on a large scale. Examples can be easily copied and multiplied.
- General acknowledgement of IED beyond the limits of the participating countries.
- Conclusions for a further market adoption of IED in the years after the end of the project including also practical recommendations on possible policy instruments that may support the widespread use of IED on daily design practice.
- A specific award will give European visibility to outstanding IED processes. This award will contribute in spreading the ID approach, in highlighting its advantages and of the Council on the energy performance of buildings (recast).

5 CONCLUSIONS

The European Union (EU) aims at drastic reductions in domestic greenhouse gas (GHG) emissions of 80% by 2050 compared to 1990 levels. The building stock is responsible for a major share of GHG emissions and should achieve even higher reductions of at least 88% - 91%. Therefore, without consequently exploiting the huge savings potential associated with the building stock is still to be built. The energy consumption and related GHG emissions of the new buildings need to be closer to zero in order to reach the EU’s highly ambitious targets. The recast of the Energy Performance of Buildings Directive (EPBD) introduced, in Article 9, “nearly Zero - Energy Buildings” (nZEB) as a future requirement to be implemented from 2019 onwards for public buildings and from 2021 onwards for all new buildings. Integrated Design (ID) is necessary in managing the complex issues arising from planning buildings with high energy efficiency, emphasis is on collaboration in multidisciplinary teams as well as on clear goal-setting and systematic monitoring. In the early design phase, the opportunity to positively influence building performance is great, while cost drivers and disruptions associated with design changes are very small. The guiding strategic objective of the MaTrID project is to contribute significantly to a widespread market adoption of integrated energy design of buildings. IED should become the standard way of European building design. As a result, the real estate industry will find it easier to cope with the challenges coming from energy and climate change policy by producing sustainable buildings with very high energy performance in a cost-effective way, calculated over the life cycle of the building.

6 REFERENCES


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