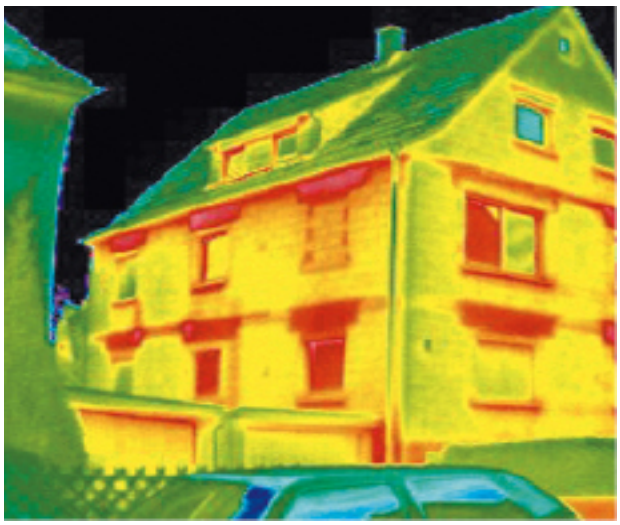
DTU Byg

Section for Building Energy

Student projects offered within fields of Building Energy and Services, Indoor Environment and Solar Energy



Project Catalogue

2016

PREFACE

This catalogue presents a selection of projects offered by the Section for Building Energy, at the Department of Civil Engineering, DTU.

Our work in the section is related to the building envelope and services, a common description for installations, which is the basis for creating buildings with good indoor environment and low energy consumption. We deal with the interaction between those and methods needed to control them. The building envelope includes windows and solar shading devices and the building services include heating, cooling, ventilation, solar heating systems and district heating.

As buildings have to be energy efficient, durable, and have good indoor environment, as well as being functional and cost-effective, the field is central both in connection with design and operation of buildings and in connection with development of products and system solutions.

The subject area deals with the technical, social and environmental problems that require a development towards sustainable building design based on energy conservation and sustainable energy systems.

The work performed is of relevance to new buildings as well as to renovation and maintenance of existing buildings. In the light of the great value that buildings and infrastructure represent, the maintenance of knowledge and research in the field is of great economic importance.

B.Sc. and B.Eng. Final Projects can be carried out in groups of 2 students. Likewise, M.Sc. Thesis Projects with experimental activity can be carried out in groups of 2 students.

The projects presented are thought as inspiration, and the outline can most often be discussed with the supervisor. Also other projects can be formulated in cooperation with teachers from the courses presented below.

Possible Subjects:
Energy efficiency, relations between energy use and provided indoor environment, integrated design, solar energy, building services such as: domestic hot water, heating systems, ventilation etc.

Possible Methods:
Field investigation, laboratory measurements, numerical simulations, analysis of data collected in several previous research projects etc.

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COURSES

The courses offered by the section can be seen below. At the specific projects desirable requisites will be listed.

Bachelor of Engineering courses in Architectural Engineering

11937 Basic building design with regard to indoor environment, services and energy (1)
11947 Basic building design with regard to indoor environment, services and energy (2)

Bachelor of Science courses in Civil Engineering

11112 Technical Building Services 1
11121 Thermal Building Physics
11141 Energy and Indoor Environment

Master of Science courses in Civil Engineering

11115 Building energy and technical services - Integrated design
11116 Sustainable Buildings
11117 Solar Heating Systems
11122 Heat and mass transfer in buildings
11124 Computational Fluid Dynamics on Buildings
11127 Sustainable heating and cooling of buildings
11128 Development of solar energy systems
11129 Sustainable District Heating
11142 Daylight and lighting
11982 Integrated Functional Project

OFFERED PROJECTS

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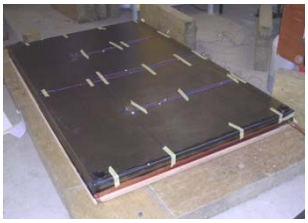
COMPACT PCM SEASONAL HEAT STORAGE

Project type



[] B.Eng. Final Project
[] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course

Prerequisite 11117, 11128

Background

Theoretical investigations have shown that a 36 m² solar heating system can fully cover the yearly heat demand of a low energy house in Denmark if the solar heating system is based on a 6000 l seasonal heat storage with sodium acetatate trihydrate supercooling in a stable way. The heat storage is divided into a number of separate modules.

The heat storage concept is based on the advantage of stable supercooling to achieve a partly heat loss free heat storage. If sodium acetate trihydrate, which has a melting point of 58°C, has been fully melted, it can cool down in its liquid phase to the surrounding temperature and still preserve the latent heat related to the heat of fusion. The heat storage can be left in this state with no heat loss until a heat demand occurs, in which case solidification is activated, the heat of fusion is released and the heat storage temperature increases almost immediately to the melting point.

Project Description

Experimental and theoretical investigations with the aim to develop a compact seasonal heat storage will be carried out.

Notes

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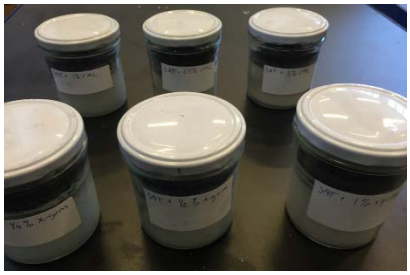
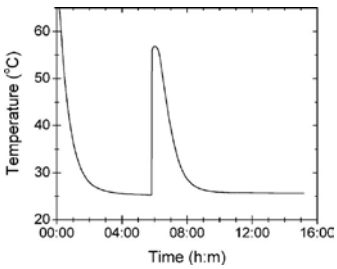
DEVELOPMENT OF OPTIMIZED PHASE CHANGE MATERIAL (PCM) COMPOSITE FOR SEASONAL HEAT STORAGE

Project type

[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course





Prerequisite

11117, 11128 or similar basic knowledge in phase change material

Background

Phase change materials are being intensively investigated as heat storage materials by researchers across the field of thermal engineering. Storing heat in the phase change of a material allows for more dense energy storages compared to sensible storages. Many phase change materials based on salt can cool down below its melting point and remain in liquid phase. This ability for a material to supercool allows for storing heat for summer to winter.
To increase the performance of the system in which the PCM is used and to design storage tanks for the PCM, a better understanding of the behavior of the PCM is needed. Focus points are stability of supercooling, cycling stability of the material and increasing heat transfer in PCM.

Project description

A series of different PCM composites will be made based on sodium acetate trihydrate. Different additives for stabilizing phase separation combined with different types of graphite for increasing thermal conductivity will be investigated. A parameter variation with different amount of additives will show how the measured thermal conductivity will vary. Heat stress test and cycling test will help evaluate the long term stability of the developed PCM composite.

Requirements

Solid background in fundaments of energy engineering, civil engineering, mechanical engineering or comparable fields of study as well as good English language skills are mandatory. Furthermore interests in solar thermal engineering and thermal energy storage as well as knowledge about heat transfer are beneficially.

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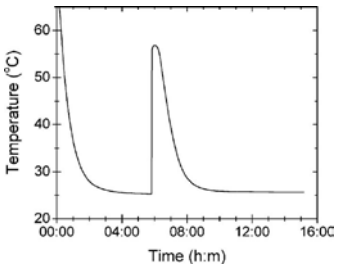
PERFORMANCE EVALUATION OF A SEASONAL HEAT STORAGE DEMONSTRATION SYSTEM WITH SUPERCOOLED PHASE CHANGE MATERIAL (PCM)

Project type

[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course



Prerequisite 11117

Background

The possibility to store solar thermal heat in summer and use it in wintertime is a key technology for solar thermal heat use and a way to reach much higher solar fractions in heat supply of domestic buildings. A long-term and partially loss free thermal storage is needed to conserve thermal energy in summer in order to deliver tap water and energy for room heating in winter. Therefore a concept for a novel compact seasonal heat store based on stable supercooling of a phase change material (PCM) has been defined in previous research activities at DTU. With the concept a partly heat loss free heat storage is achieved, i.e. if the PCM has been fully melted in summer when there is excess solar energy, it can cool down in its liquid phase to the surrounding temperature and still preserve the latent heat related to the heat of fusion.

Project description

The project will contribute to ongoing research activities within an international research group. The performance of the test rig will be evaluated based on monitoring data. The investigation will result in recommendations for system optimization. In this context key performance indicators have to be evaluated based on defined parameters. As benchmark water based heating systems of domestic houses in Danish climate will be considered.

Requirements

Solid background in fundaments of civil engineering, mechanical engineering or comparable fields of study as well as good English language skills are mandatory. Furthermore interest in solar thermal engineering and thermal energy storage as well as specific knowledge about heat transfer are beneficially.

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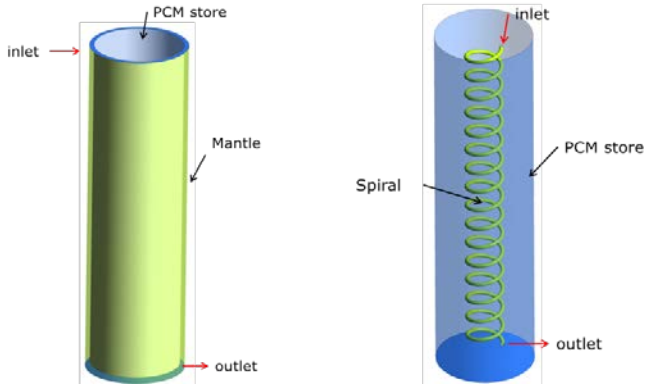
OPTIMIZED DESIGN OF A COMPACT THERMAL ENERGY STORAGE WITH SUPERCOOLED PHASE CHANGE MATERIAL (PCM)

Project type

[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course



Prerequisite

11117

Background

The possibility to store solar thermal heat in summer and use it in wintertime is a key technology for solar thermal heat use and a way to reach much higher solar fractions in heat supply of domestic buildings compared to conventional solar thermal applications. A long-term and partially loss free thermal storage is needed to conserve thermal energy in summer in order to deliver tap water and energy for room heating in winter. Therefore a concept for a novel compact seasonal heat store based on stable supercooling of a phase change material (PCM) has been defined in previous research activities at DTU.

Project description

The student project will contribute to one or more of the following ongoing research activities:

a) The development of an optimized storage design with emphasis on:
- Improved heat transfer between PCM and the heat transfer agent. Therefore a calculation model has to be worked out.
- Economic design → materials & geometry (flat module, barrel)
- PCM envelope → mechanical stability, durability, stability of supercooling

b) Characterization of the optimized storage design by experimental tests on a small scale prototype

Requirements

Solid background in fundaments of civil engineering, mechanical engineering or comparable fields of study as well as good English language skills are mandatory. Furthermore interest in solar thermal engineering and thermal energy storage as well as specific knowledge about heat transfer are beneficially.

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DESIGN AND CONTROL OF SOLAR COLLECTOR FIELDS

Project type

[ ] B.Eng. Final Project
[ ] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course

Prerequisite 11117, 11128

Background

Currently an explosive growth is seen in the large solar heating plants in Denmark. By the start of 2011 there were about 137,000m^2 solar collectors in large (collector areas higher than 1400 m^2) solar heating plants in operation. In 2014 this area has been quadrupled to 555,420 m^2 solar collectors. The growth is due to the fact that the solar heating plants have become so competitive that they can compete with district heating plants based on natural gas and biogas.
There is a lack of knowledge on how best to design and control large solar collector fields, inclusive knowledge on which collectors are most suitable.

Project Description

Theoretical and experimental investigations will be carried out for two flat plate collectors with one and two covers in order to elucidate how the collector efficiencies are influenced by the volume flow rate, the collector tilt and the solar collector fluid. Based on the findings the yearly thermal performance of differently designed and controlled solar collector fields will be calculated.

Notes

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EVACUATED TUBULAR SOLAR COLLECTORS

Project type

[ ] B.Eng. Final Project
[ ] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course

Prerequisite 11117, 11128

Background

Evacuated tubular solar collectors are produced inexpensive in high numbers in China. The collectors have low heat loss coefficients, and they are suitable for solar combi systems.
There is a lack of knowledge on the collector efficiencies for different flow rates and collector tilts.

Project Description

Theoretical and experimental investigations will be carried out for different evacuated tubular solar collectors in order to determine the efficiencies for different volume flow rates and collector tilts.

Notes

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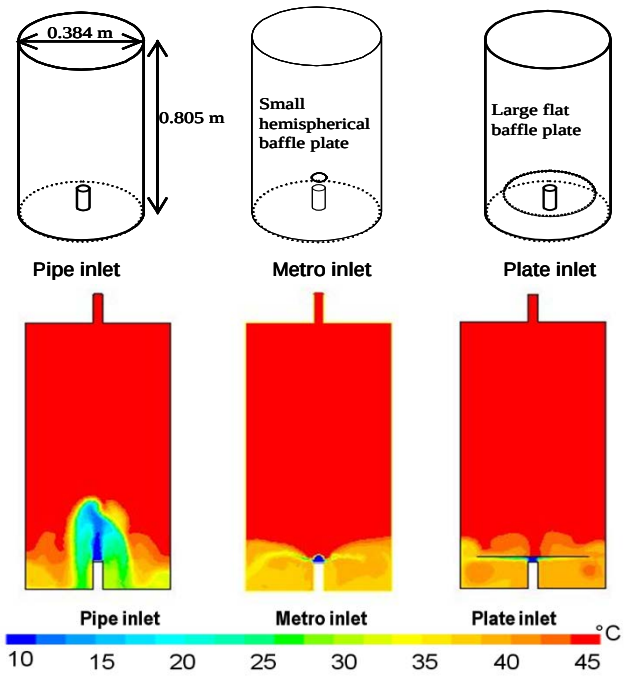
CFD AIDED OPTIMAL DESIGN FOR SOLAR HEATING SYSTEMS

Project type

[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[X] Special course



An example showing CFD calculations of differently designed inlet pipes for a hot water tank

Prereq-uisite 11124, 11117

Back-ground Today solar heating systems cover the largest installed renewable energy capacity worldwide. Design of the solar collector, heat storage tank and other components can be further optimized by means of Computational Fluid Dynamics (CFD) investigations.

Project Description The following project topics are offered: Optimal design of a PCM heat storage module; Development and validation of a CFD model of air solar collector; Influence of wind conditions around the collector on collector efficiency, etc.
Exact topic of the project will be determined together with the supervisor.

Notes Own project ideas are welcome.

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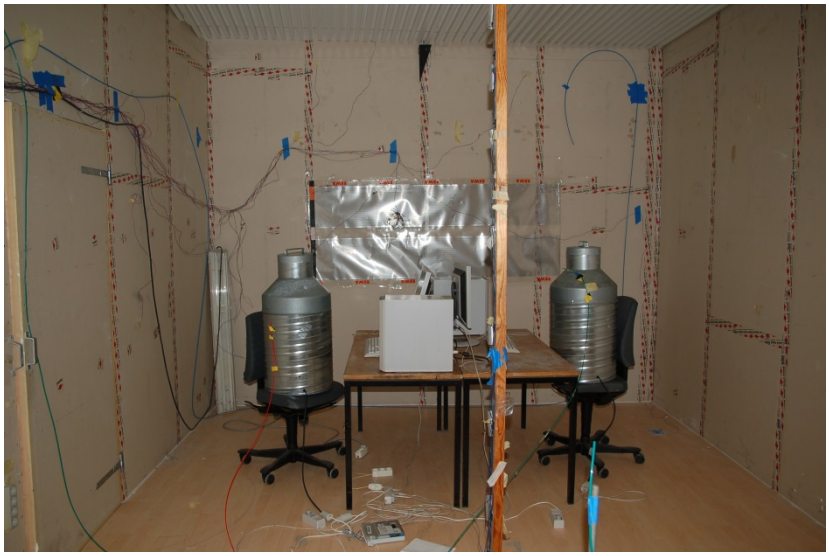
VENTILATION EFFICIENCY AND INDOOR THERMAL COMFORT

Project type

[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[ ] Special course



The test room for measurement of ventilation efficiency and indoor thermal comfort in building 119

Prerequisite 11124, 11127

Background Most people spend as much as 90% of their time indoors. The indoor environmental quality is therefore of great importance to our health and general well-being. The indoor air quality is to a large extent influenced by the movement of air in the space. In combination with experiments, Computational Fluid Dynamics (CFD) can be used to investigate ventilation efficiency and indoor thermal comfort under certain room conditions.

Project Description The aim of the project is to determine indoor temperature distribution and air flow by means of experimental and CFD investigations. Ventilation efficiency and indoor thermal comfort will be analyzed for different operation conditions and weather conditions.

Notes Own project ideas in relevant areas are welcome.

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CO2 NEUTRALITY

Project type
[] Diploma project
[] Bachelor
[X] Master
[X] Special course


Prerequisite

Background

CO2 emission is often a direct consequence of fossil fuelled combustion. Diminishing the environmental impact and cost can be obtained when installing solar heating, solar cells, windmills, or geothermal heating.
Two cooperative housing associations will by 2013 renovate their heating station. CO2 neutrality, sustainability, water, and cost are in focus.

Project Description

An ambitious target is to be reached: to become CO2 neutral and obtain a lower energy cost with a short horizon for the payback.
Concrete calculations showing the energy saving and investment cost of suggested ideas need to be performed.
Realistic and existing equipment is the scope of the project.
Sustainability is a keyword which needs to be reflected.
Alternative environmental effects are appreciated as part of the considerations.

Notes

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INVESTIGATION OF ENERGY EFFICIENT MEASURES FOR DTU CAMPUS DISTRICT HEATING SYSTEM

Project type

[] B.Eng. Final Project
[] B.Sc. Final Project
[X] M.Sc. Thesis Project
[] Special course

DTU campus district heating/cooling plant

Prerequisite 11127

Background District heating is an energy efficient and environmental benign solution comparing with inefficient decentralized heat generation. The building heating needs at DTU at Lyngby are supplied through the central heating plant located at the DTU campus.

Project Description The DTU district heating network supply/return temperature is around 90°C/70°C. The high network supply temperature and low network temperature drop is largely due to the inefficient in-door heating units. In this project, the heating system in the campus building will be investigated. Solutions to lower the network supply temperature and increase the network temperature drop will be proposed. The feasibility to implement the energy efficient measures will be evaluated based on the system thermo-economic analysis.

Notes

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COMPARISON OF RESULTS FROM IES VE AND BE10

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite 11115 or 11116

Background

According to the 2010 recast of the European Energy Performance of Buildings Directive, new buildings must, by 2020, be 'nearly zero energy buildings'. Residential buildings have a share of nearly half of the energy consumption of our society. Research and solutions targeting this building type are necessary.
In order to fulfil this goal, the consultants use different building performance simulation tools to analyse different concepts and find the optimal solution in the given case. However using different tools give different results and the best program does not necessarily give the lowest calculated energy consumption. This is a dilemma since the Building Regulation in Denmark requests specific targets in order to fulfil the regulations.
The Danish Building Institute has developed the simulation program Be10 for documentation of the Danish building regulation.
IES VE-Pro is a building performance simulation tool used for sustainable design to create understanding of the performance impacts of different low-energy design strategies.

Project Description

The aim of the project is to look into the different results that the simplified program Be10 gives in comparison with the more advanced dynamic program IES VE-Pro. What consequences does it have for the documentation of the building and do the consultants have to change from IES VE to Be10 in order to get lower calculated energy consumption?

Notes

The project will be in connection with consultants.

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OPTIMIZED DESIGN OF NEW PARTS OF COPENHAGEN AIRPORT – PRACTICAL PROJECT

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite 11115 or 11116 or 11127

Background

Copenhagen Airport (CPH) is the main airport in Scandinavia and in constant development. One of the latest developments is CPH Go, and this is a new concept designed to increase airline efficiency. In the design of CPH Go there has been focuses on low energy, saving 75% compared with other parts of the airport. CPH Go is the first building to benefit from the airport's new groundwater cooling system.
In order to increase the number of passengers to 30 million passengers per year before 2020, CPH plan to build Terminal 4.

Project Description

The project aims is to develop more sophisticated design methods for a total optimization from the design to the actual use of the buildings in CPH.
It is the intention in the project to use integrated energy design through the use of BIM and a dynamic Building Simulation Programme. The intention is to build up an advanced building energy model using IES and COMSOL, and develop methods for combining results from simulations using actual weather data combined with Building Management systems. This will open up for the possibility for feedback to the users and change the user behavior to be more optimal. The concept will support the intention for the energy performance for the building.

Notes Two students are recommended to the project.

Contact

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INTEGRATED DESIGN OF A BUILDING IN A REAL PRACTICAL PROJECT – FOCUS ON OPTIMIZED DESIGN

Project type
[] B.Eng. Final Project
[] B.Sc. Final Project
[X] M.Sc. Thesis Project
[] Special course

Prerequisite 11115 or 11116 or 11127

Background

The objective for the consultant's in the future Danish energy design will be based on renewable energy. This is a major challenge and it will be necessary to combine actual projects with new unique scientific knowledge. New buildings must be nearly zero energy buildings, while compre-hensive energy renovations are to be implemented in existing buildings.
Cowi is a key player in the process for redefining the integrated design process for optimizing the design of new building or retrofitting buildings. Cowi is involved in a broad spectrum of projects.

Project Description

The project will depend on the actual projects in Cowi at the specific time, or ongoing research projects. The content of the student project needs to have research content. Cowi has at all time a wide range of interest projects and will be a good entrance for the student, who want to combine practical engineering work with research and development.

Notes

The project can be adapted to an actual project.

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INTEGRATION BETWEEN IES VE AND BE10

Project type

[] B.Eng. Final Project
[] B.Sc. Final Project
[X] M.Sc. Thesis Project
[] Special course

Prerequisite 11115 or 11116

Background

To validate that new buildings in Denmark fulfil the energy requirements of the Danish building regulations (BR10) the energy demand has to be calculated with the programme Be10 developed by SBi (The Danish Building Research Institute). The Be10 software uses calculation methods based on monthly climate data. Be10 software will accept an XML file as import and then the BS10 software creates an XML for output. Energy Labelling of buildings is a requirement of the BR10 and this can be generated using the Be10 software.
IES VE-Pro is a building performance simulation tool used for sustainable design that predicts operatio-nal energy usage of buildings. This analysis is then used for Building Regulation compliance studies, such as the Energy Performance Building Directive in Europe and ASHRAE 90.1 energy modelling in North America. The users can also analyse their buildings against Voluntary Energy Rating Schemes such as LEED and BREEAM.
IES' Danish customer base is interested in integration between the IES VE and Be10 to increase the efficiency of the design & compliance process. Currently IES'/ Be10 customers are creating 'analysis' models twice.

Project Description

The project will focus on how to integrate the Danish Building regulations to IES and establish a link between IES and Be10. There will be looked into what kind of data, which is required from IES to Be10.

Notes

The project will be in corporation with IES/consultants.

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NUMERICAL MODELING OF REGENERATIVE HEAT EXCHANGERS

Project type
[] B.Eng. Final Project
[] B.Sc. Final Project
[X] M.Sc. Thesis Project
[] Special course

Prerequisite 11121

Background Numerical modeling is required to evaluate the efficiency of regenerative heat exchangers. Regenerative heat exchangers can be a rotating heat exchanger or a heat exchanger with periodic alternating flow direction. Decentralized ventilation units with regenerative heat exchangers could be an efficient solution to demand controlled ventilation.

Project Description The objective is to develop a numerical model of regenerative heat exchangers to evaluate the performance of heat exchanger designs. A result should be simplified formulaes for the efficiency that are useful for whole house dymanic simulations.

The numerical model can be implemented using tools such as Comsol, Simulink or general programming tools such as Matlab.

Notes

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OPTIMISATION OF A MUSEUM STORAGE BUILDING

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite

11115 or 11116 or 11127

Background

Generally, the conservation of historic objects benefits from stable and low temperatures and relative humidities. Strong variations in relative humidity and temperature may lead to mechanical decay due to the related dimensional changes and chemical decay as well.
The Centre for Preservation of Cultural Heritage (CPCH) consists of an old part and a new part. Based on the old part, DTU Byg has been involved in developing a new part with a new concept for climate control, which makes the museum storage building nearly CO2 neutral by using the physical properties of building materials and cheap night electric tariff and electricity from the general overproduction of wind power energy in Denmark.

Project Description

The aim of the project is to set up a detailed model using IES and COMSOL for the new and old part, where the thermal interaction between the interior atmosphere and the volume of soil below the building is taken into account. This model has to be compared to the BSim model from DTU Byg, and the measurements from CPCH using real weather data. Based on these results, the project has to come up with a proposal for a further development of the design.

Notes

Two students are recommended for the project.

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VALIDATION & OPTIMIZATION OF NEW BUILDINGS AT DTU – PRACTICAL PROJECT

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite 11115 or 11116 or 11127

Background

DTU are investing four billions crowns in new building in the following years in a very dynamic process. There are a great variety of buildings with a lot of interesting challenges. This amazing buildings development open up for a lot of interesting projects, where it is possible to analyse new buildings using actual measurements and compare it with building simulations models. It will also be possible to look into new projects and come with proposals for alternative design or different optimizations strategies.
One new building is 127 next to building 116 – see photos above.

Project Description

The project aims is to develop more sophisticated design methods for a total optimization from the design to the actual use of the buildings at DTU. However the project will be quite open and can be adapted to the actual students and the need for DTU.
One very interesting building is our “own” newly opened building 127, which open up for very interesting analysis using the dynamic Building Simulation Programme IES and look into how the building behaves under different condition and compare it with actual measurements. This will open up for recommendations for different strategies, and possibilities to test them in practice.

Notes Two students are recommended to the project.

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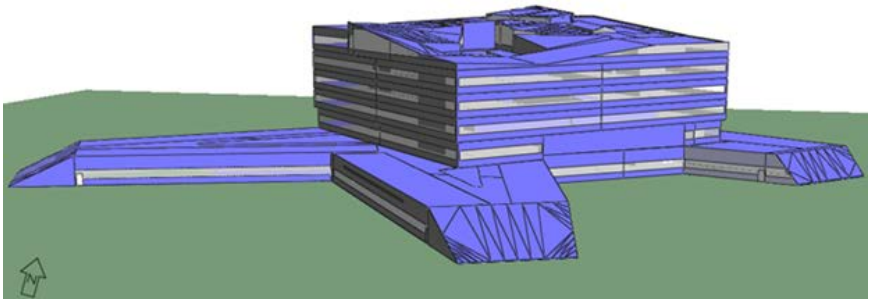
INTEGRATED DESIGN USING BIM AND BUILDING PERFORMANCE SIMULATION TOOL

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course



Prerequisite 11115 or 11116

Background Integrated design is a key issue in the future, and it is very important that Danish architectural and engineering companies strengthen their corporation in combining sustainable solutions with high architectural quality. Currently architects and consultants are creating 'analysis' models twice and there are very little integration in the design process. A major hurdle for integrating BIM and analytic tools is the lack of a methodology for simplification, translation and interpretation of BIM models to analytic models.

Project Description The project will look into how the architects work and handle information to the Building Information Modelling, BIM. In the BIM model information from design, construction, maintenance and operational processes are represented in a digital model of the building and the built environment. In many cases this information is not used by the consultants when they start the building performance simulation. Instead they build up a new model for their purposes. This is double work and at the same time makes integrated design impossible. The project will look into the challenges and come with recommendation for how a more effective procedure can be evolved.

Notes Two students are recommended.
Own project ideas are welcome

Contact

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DEVELOPMENT OF RECOMMENDATION FOR THE FUTURES DESIGN BASED ON THE CASE VIBORG CITY HALL – CORPORATION WITH COWI

Project type
[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite 11115 or 11116 or 11127

Background The objective for the consultants in the future Danish energy design will be based on renewable energy. This is a major challenge and it will be necessary to combine actual projects with new unique scientific knowledge. Experience has unfortunately shown large deviations between the projected, often in Be10, and the actual energy consumption, which is unsatisfactory for the building proprietor, the consulting engineers and the environment.

Project Description The project aims to recommend tools, legislation and methods to upgrade the way Danish building designers optimize the buildings' energy consumption. The recommendations will be based on research and practical engineering gained through a case study of Cowi´s newly constructed project Viborg City hall (2011), which is equipped with a large range of secondary meters. The building fulfils the low energy class 1 energy requirements from BR10, which is achieved through hybrid ventilation, photovoltaics, TABS and a very complex heating and cooling system using district heating, aquifer and heat pumps.

Notes Two students are recommended for the project.

Contact Cowi: Svend Erik Mikkelsen Jørgen Erik Christensen
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ENERGY OPTIMIZATION OF THE MUNICIPALLY AT THE GASVÆRK SITE – PRACTICAL PROJECT

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite

11115 or 11116 or 11127

Background

The Gasværk site on Østerbro in Copenhagen municipality has been chosen to be a pioneer project for the future's building projects, when they build a new day-care centre, which will fulfill the low energy class 2015 energy requirements from BR10.
The ground-breaking idea in the project is to use a highly advanced dynamic Building Simulation Programme (BSP) in the design process in combination with a 5 year service supervision contract with an incentive agreement. This will be combined with the actual energy consumption compared with simulated values with the BSP.

Project Description

The project aims are to build up a building energy model using IES and COMSOL, and developed methods for combining results from simulations using actual weather data combined with Building Management systems. This will open up for the possibility for feedback to the users and change the user behavior to be more optimal. The concept will support the intention for the energy performance of the building.

Notes

Two students are recommended for the project.
The winner project is designed by Nøhr & Sigsgaard. EKJ is builder consultant for Copenhagen municipality.

Contact

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THERMO ACTIVE BUILDING SYSTEMS

Project type

[] Diploma project
[] Bachelor
[X] Master
[] Special course

Prerequisite 11115 or 11116 and 11127 (desired)

Background

Modern office building often has problems with too high indoor temperatures resulting in a cooling demand. An energy efficient office building has to solve this challenge. As energy saving has become increasingly important over the past years and at the same time the demand for cooling has steadily increased, it is prudent to minimize energy consumption of HVAC Systems. The combination of free cooling with high temperature cooling systems (radiant cooling e.g. TABS) offers this possibility.

Project Description

The project will explore two different approaches for using Building Simulation Programs for analyzing Thermo Active Building Systems – the very simple TCD and the very advanced IES. The building simulations shall investigate the performance of TABS for one or two selected office buildings under Danish climatic conditions. The TAB system performance shall be compared with other HVAC systems and investigate total energy consumption, indoor climate quality and the possibilities for integrating free cooling. Uponor has made several evaluations of the use of TABS in other European countries. The project will start with a review of these projects and use the findings for research under Danish conditions.

Notes Two persons are recommended

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EVALUATION OF ENERGY CONSUMPTION OF OFFICE BUILDINGS IN RELATION TO QUALITY OF PROVIDED INDOOR ENVIRONMENT

Project type
[X] B.Eng. Final Project
[X] B.Sc. Final Project
[X] M.Sc. Thesis Project
[ ] Special course



Prerequisite
11222, 11127 / 11112, 11141; preferably also: 11115

Background
Experiences from investigations in real buildings show that application of High-Tech HVAC and building managements systems in buildings does not always ensure outstanding quality of indoor environment for occupants. It is worth investigating the relations between energy consumption of climate conditioning systems in buildings and actual quality of indoor environment they provide.

Project Description
Aim of the project will be to conduct comprehensive analysis of measured data regarding energy use of climate conditioning systems and indoor environment originating from several European office buildings. Energy related data will be given into relation with indoor environmental quality indicators according to EN/ISO Standards.

Notes
N/A

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EVALUATION OF INDOOR ENVIRONMENT IN THE NATIONAL LIBRARY OF TECHNOLOGY (NTK), PRAGUE, CZECH REPUBLIC

Project type
[X] B.Eng. Final Project
[X] B.Sc. Final Project
[ ] M.Sc. Thesis Project
[ ] Special course

Prerequisite
11222, 11127 / 11112, 11141; preferably also: 11115

Background
The National Library of Technology (NTK) is a specialized public library with a unique offering of approximately 300,000 publications freely accessible in the Library's open stacks. From 2009 NTK serves its customers in new building that has 38 661 m^2 of floor area. The building is equipped by Thermo Active Building System (TABS) combined with both natural and mechanical ventilation. Ventilation is controlled according to measured concentration of Volatile Organic Compounds or CO2. Building management system (BMS) continuously monitors main indoor environmental parameters.

Project Description
Aim of the project will be to conduct comprehensive analysis of indoor environmental data collected from beginning of building's operation (9.9.2009). Indoor environment in the building should be assessed according to appropriate standards and guidelines (EN 15 251, CR 1752, EN/ISO 7730). Based on the obtained results, recommendations for optimization should be made.

Notes
Work will be part of current research project conducted at DTU BYG.

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Jan Zemlicka ZEMLICKA+PRUY GmbH

NEXT GENERATION BUILDING MONITORING

Project type
[x] B.Eng. Final Project
[x] B.Sc. Final Project
[x] M.Sc. Thesis Project
[x] Special course

Prerequisite Experiences with measurement techniques.

Background Building and Central Monitoring Systems (BMS/CMS) are monolithic solutions that are demanding to adjust. In this project we aim at finding light weight alternatives.

Project Description The project/s aims at establishing flexible monitoring systems that build on “open” solutions both on the physical sensor side but also on the software side for communication and control.
At the moment the first effort would be to make a state-of-the-art report on what can be found out there and to draw a strategy for DTU Byg in this topic.
The project could involve commissioning and continuous commissioning and the optimization of existing monitoring and control systems.

Notes The project can be coordinated with a private company with similar questions.

Contact
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SMART CITIES – A NOVEL TOPIC WITHIN ENGINEERING

Project type
[x] B.Eng. Final Project
[x] B.Sc. Final Project
[x] M.Sc. Thesis Project
[x] Special course

Prerequisite	Building modeling and simulation experience, or data handling expertise.
Background	Aiming at a CO_2 neutral society, the Smart Cities concept proposes cities as the turning point to balance the fluctuating energy production and demand.
Project Description	The project/s aims at many different aspects, amongst them: How to model the energy flows of “aggregations” of buildings from districts to whole cities? What are the demands for monitoring of buildings at an aggregated level, and what would we be able to do with the data? What potentials for storing energy and for shifting energy demands by smart solutions can be allocated to buildings, now and in the future – what would be the way to realize the future potentials?
Notes	The project can easily be coordinated with a private company with similar questions.
Contact	Fred Heller 4525 1861 alfh@byg.dtu.dk

INFLUENCE OF DISTRICT HEATING NETWORK TEMPERATURE ON THERMAL PLANT PERFORMANCE

Project type

[ ] B.Eng. Final Project
[ ] B.Sc. Final Project
[x] M.Sc. Thesis Project
[ ] Special course

Description

District heating (DH) plays a vital role in the Danish energy supply system. Around 62% of residential buildings are connected with DH, with 50% of total heating supply comes from DH. There has a potential to continuous increase DH supply.

The current Danish DH system is the 3rd generation DH system. The distribution network has supply/return temperature around 80 ºC /40ºC. The transmission network has supply/return temperature around 110 ºC /60ºC (Figure 1 illustrates Copenhagen DH transmission and distribution system) .

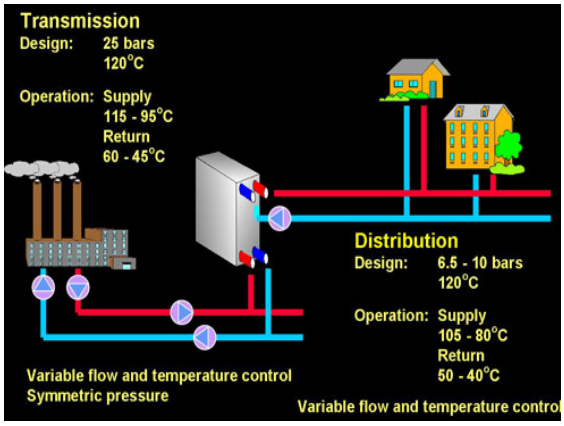

Figure 1 District heating transmission and distribution system in Copenhagen

The next generation (4th generation) DH syste temperature around 55 ºC /25ºC. Many research in adapt the low-temperature DH to building space heating and domestic hot water demand, and how to improve the DH network design.

Low network supply and return temperature can increase different types of thermal plant performance (biomass CHP, biomass boiler, waste incineration CHP, solar heating, heat pump, geothermal, etc). In this thesis, the research focus is placed on how the low network supply and return temperature influences on the biomass based CHP plant performance. Thermal plant process simulation tool will be applied in the thesis to evaluate plant performance under different design and operational conditions. In addition to plant performance, the optimal design and operation of transmission network for the 4th generation DH will also be evaluated.

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LYNGBY SMART CITY

Project type
[x] B.Eng. Final Project
[x] B.Sc. Final Project
[x] M.Sc. Thesis Project
[x] Special course

Prerequisite

Any experience will be valuable.

Background

Under the hood of Vidensbyen, there are a number of smart cities, big data projects, renovation projects, IT-developments and much more. We work tight together with the partners in the area to solve some of the real life challenges.

Project Description

You will be able to build on the projects you have experiences from and implement your ideas together with us in the Lyngby Smart Cities context (and others). Examples could be to develop a renovation strategy, a method to estimate energy demands, potentials for solar energy, green roof, energy conservation, the development of Apps on smart phones and much more. The project will be adjusted your experiences. We aim at getting the project done in cluster groups.

Notes

The project can be coordinated with the municipality or a private company with similar questions.

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See also student projects proposals:
https://projectsmap.wordpress.com

SMART CITIES – BUILDINGS AS ACTIVE COMPONENT IN THE ENERGY SYSTEM

Project type
[x] B.Eng. Final Project
[x] B.Sc. Final Project
[x] M.Sc. Thesis Project
[x] Special course

Prerequisite	Building modeling and simulation experience, or town planning or data handling expertise.
Background	Aiming at a CO_2 neutral society, the Smart Cities concept proposes cities as the turning point to balance the fluctuating energy production and demand.
Project Description	The project/s aims at many different aspects, amongst them: Modelling energy demand for types of buildings – how? Validation on basis of measurements. How to "aggregate" from single building to districts and whole cities? What are the demands for monitoring of buildings at an aggregated level, and what would we be able to do with the data? What potentials for storing energy and for shifting energy demands by smart solutions can be allocated to buildings, now and in the future – what would be the way to realize the future potentials?
Notes	The project can easily be coordinated with a private company with similar questions.
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Contact information

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