Dear all

The COORDICY project has now been running for a year and we have submitted the first annual report to the Innovation Fund Denmark. The project is overall progressing as planed and in this second news letter you can read more about the interesting work and collaboration that has been done so far.

You can also read about COORDICYs part in The 2016 New York Energy week where we hope many of you would like to join.

If you have any news that your would like to share in the next news letter please contact Heidi Maglekær Jensen (hmje@mmmi.sdu.dk)

Greeting from
Bo Nørregaard Jørgensen

NEW YORK ENERGY WEEK 2016

COORDICY will take part in the 2016 New York Energy Week. The Energy Week is on June 13-17. The Danish Cleantech Hub high-level event featuring COORDICY, followed by 2 thematic workshops will be on June 16. So please save the date. You can read more on www.newyorkenergyweek.com.

OU44 – A WORLD CLASS BUILDING WHEN IT COMES TO ENERGY EFFICIENCY!

On February 24, 2016 the Danish Building & Property Agency and Center for Energy Informatics, SDU had a joint event in building OU44 at University of Southern Denmark. At the event Head of The Danish Building & Property Agency Gyrithe Saltorp handed over the energy performance test protocol for the building to Vice-Chancellor, SDU Henrik Dam.

The energy performance of this building is at the top of the world, and it is classified as a class 2020 building. Building OU44 is of great importance to the COORDICY project and to other research projects as a Living Lab giving researchers access to a wide range of data.

Foto: Lene Magner – Bygningsstyrelsen

NEW EMPLOYEES

PhD student Elena Markoska

Center for Energy Informatics has employed Elena Markoska as PhD student from January 1st, 2016 to work on the COORDICY project.

Elena Markoska is from Macedonia and has a Master in Computer Science from the Faculty of Computer Science and Engineering at Ss. Cyril and Methodius University in Skopje, Macedonia, from November 2015.

In the COORDICY project Elena Markoska will be working with Building Intelligence Software.

DK-US COLLABORATION
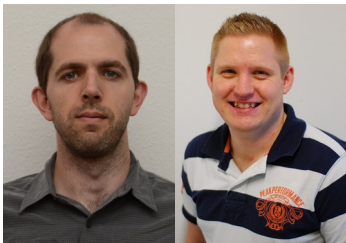
Post Doc Aslak Johansen and PhD Emil Holmegaard at UC Berkeley

Postdoc Aslak Johansen is currently on a six-month stay at UC Berkeley as a part of his work on WP3. Here, he joined PhD Student Emil Holmegaard. They are working on improving interaction between project partners. In particular, they are collaborating with Gabe Fierro and Arka Bhattacharya on defining a format for building metadata. Emil returned to Denmark in March.
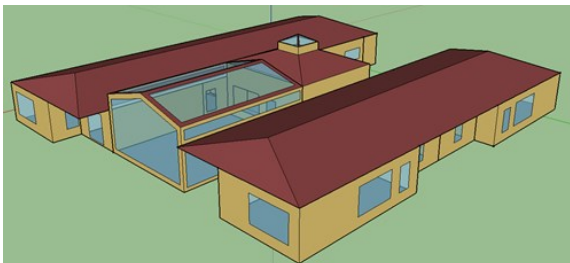

Morten Gill Wollsen at NASA Ames

PhD student Morten Gill Wollsen has just left for a one month stay at NASA Ames Research Center. At NASA Morten will be working closely with Rodney A. Martin from the Intelligent Systems Division.

NEW PROJECT DEVELOPEMENTS

Aarhus Daycare centers

Four daycare centers have been selected in Aarhus to be investigated as case studies. The 4 Aarhus daycare centers were chosen from 33 centers based on a plan of two main points in collaboration with Aarhus municipality. The plan is as follows:

1) Concentrating on the energy consumption, select Bøgevangen 101 and Runevej 107-109 buildings, having the same indoor heated area but the first consuming 70% more energy compared to the other.

2) Concentrating on the occupants behavior and energy management, select Hassel-haven 1 and Hasselhaven 3, which are two buildings in the same building block having the same characteristics and orientation.
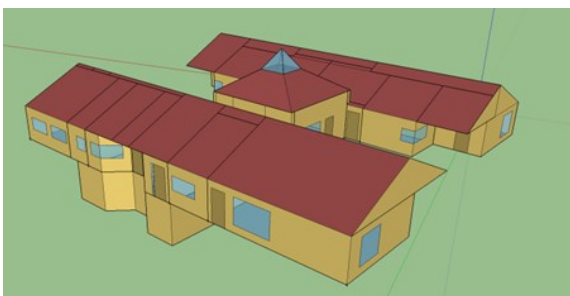
Two Bachelor Projects were initiated within the Energy Technology program at SDU under the supervision of Muhyiddine Jradi. Building models have been developed for the 4 daycare centers and currently investigations are performed to analyze various renovation and energy management techniques to be implemented.

Students: Kristian Emil Oxholm Bloch-Hansen, Casper Fälling Thielsen and Nikolaj Vinkel Hansen

Supervisor: Assistant Professor Muhyiddine Jradi

Rasmus Rask School

This work is carried out in collaboration with Odense Municipality and DTI. BIM models has been developed by Kenneth Larsen and Bo West with accurate representation for the building geometry and construction characteristics. The revit model was implemented for energy modeling in E+ and a complete dynamic energy performance simulation has been carried out. Currently, work is underway to investigate various solutions to renovate the School and improve the energy performance taking into account various factors and schedules.

Students: Kenneth Larsen and Bo West

Supervisor: Assistant Professor Muhyiddine Jradi

NEW PROJECT DEVELOPEMENTS

OU44 Teaching Building
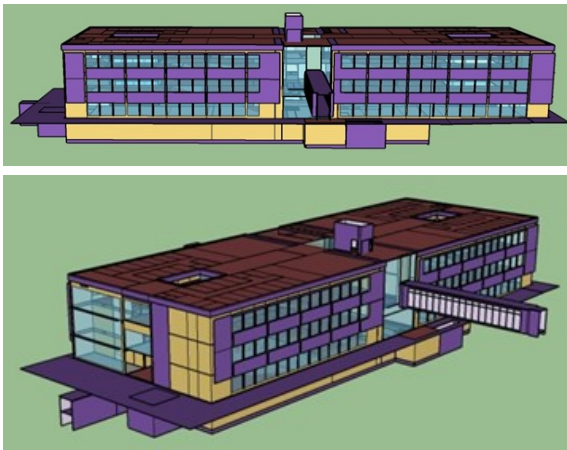
BIM models has been revised and implemented for energy modeling in E+ and ideal loads based energy simulation has been performed. FMU's of the preliminary E+ model has been successfully exported and included in the energy dashboard. Preliminary performance tests have been developed and implemented to assess the operation of the building in the first 3 months of use. After successful implementation of the methodology, next steps are inclusion of systems, validation of the holistic model, develop detailed zone models, monitor the building performance and carryout a complete online simulation.

Students: Kenneth Larsen and Bo West

Supervisor: Assistant professor Muhyiddine Jradi

Energy performance monitoring tool for the OU44 building
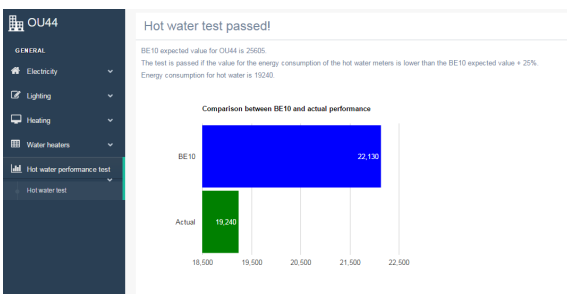
A new tool has been implemented that aids the monitoring of the OU44 building. It contains a set of functionalities that help visualize the data received from the numerous sensors and meters within the building. A model of the building has been developed in EnergyPlus and used to simulate its expected behavior for different subsystems. By comparing these results with the building's actual behavior we gain a deeper insight into whether the building is behaving as intended.

The energy performance monitoring tool has been enriched with four performance tests, each testing a separate subsystem in the building. So far, these include ventilation, lighting, heating, and hot water. The tests use data metered within the building, and are executed on a daily basis. The outcome is checked against a modeled figure that determines whether the test has been passed or failed.

The future development of the tool involves improvement of the EnergyPlus model, implementation of many more performance tests, as well as usage of the outcomes of those tests for further research.

PhD Students: Elena Markoska and Claudio Giovanni Mattera

Green Tech Center

Based on the Revit BIM model, an E+ model has been developed. An ideal load energy plus performance simulation of the building has been completed and pre-tuned. The model needs to be upgraded by implementing the accurate energy supply system characteristics and specifications. In addition zone models have been developed and preliminary testing is underway.

PhD Student: Ana Ionesi

Supervisor: Associate Professor Christian Veje and Assistant Professor Muhyiddine Jradi

NEW PROJECT DEVELOPEMENTS

Anthropological studies of occupant behavior in case-study buildings

So far, a team of energy anthropologists from Danish Technological Institute has just recently conducted a study of occupant behavior in one of the case-study buildings in Odense Municipality. By studying occupant behavior and comfort, the aim is to gain qualitative, in-depth knowledge on user behavior and the interplay between occupants, technology and building. Methodologically, participant observation and in-depth interviews are deployed to cover to what extent and how the occupants play an active role in the energy performance of the building.

Similar studies will soon be conducted in buildings of Odense and Aarhus Municipality as well as in the new university building OU44 at SDU Campus within the coming year. The insights from the studies will identify paths for a successful balance between user involvement and technological interventions, and along with the simulation and modeling analyses, the findings will guide the energy-retrofits and the advancing of building intelligence of the buildings.

Development of Zone and System Models

Within the COORDICY project Post Doc Krzysztof Arendt is responsible for the development of zone and system models with auto-calibration capabilities, as well as a uniform interface to communicate with the models. The models will be used by Controleum for the Model Predictive Control (MPC) of building systems. Currently the main limitation hindering a widespread usage of MPC in buildings is the significant effort needed to develop an appropriate building model. Therefore, the goal is to provide a framework enabling an easy adaptation of models for new buildings. To achieve the goal the models being developed are generic and after auto-calibration can be used with all types of zones/systems (machine learning). Currently the calibration is based on Genetic Algorithm, but other techniques will be implemented and tested in the next months in co-operation with Assistant professor Ashok Singh.

Controleum interfaces
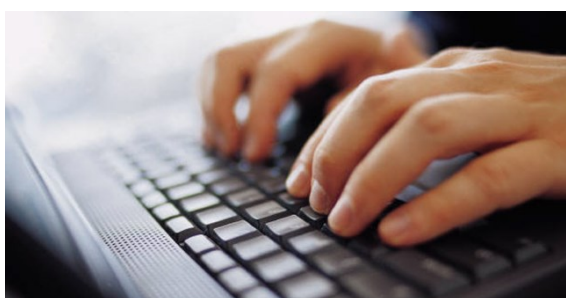
PhD student Peter Nellemann works on integration on the COORDICY project. The project itself is focused around utilizing the Controleum framework for optimization, utilizing a wide array of prediction algorithms, sensors, models and external partners for the decision-making process. Peter Nellemann is responsible for developing the various interfaces required for each external system to be able to communicate with Controleum and developing the Concerns for the decision-making process as well as work with external partners, such as Insero A/S, who provide additional information and functionality for the project.

PUBLICATIONS

Papers:

- Sanja Lazarova-Molnar, Hamid Reza Shaker, Nader Mohamed and Bo Nørregaard Jørgensen: Fault Detection and Diagnosis for Smart Buildings: State of the Art, Trends and Challenges, IEEE 3rd MEC International Conference on Big Data and Smart City (ICBDSC 2016), won the Best Paper Award, Muscat, Oman, March 2016.

- Sanja Lazarova-Molnar and Nader Mohamed: Challenges in the Data Collection for Diagnostics of Smart Buildings, The 7th International Conference on Information Science And Applications (ICISA 2016), Ho Chi Min City, Vietnam, February 2016, Lecture Notes in Electrical Engineering (Springer LNEE) (2016).

- Sangogboye, F. C., Imamovic, K. & Kjærgaard, M. B. 2016: Improving Occupancy Presence Prediction Via Multi-Label Classification, Proceedings of the 2016 IEEE International Conference on Pervasive Computing and Communication Workshops. IEEE Computer Society Press

- Kjærgaard, M. B., Johansen, A., Sangogboye, F. C. & Holmegaard, E.: OccuRE: an Occupancy REasoning Platform for Occupancy-driven Applications, 2016 Proceedings of the 19th International ACM Sigsoft Symposium on Component-Based Software Engineering (CBSE 2016). Association for Computing Machinery

- Holmegaard, E., Johansen, A. & Kjærgaard, M. B.: Towards a Metadata Discovery, Maintenance and Validation Process to support Applications that improve the Energy Performance of Buildings, 2016 Proceedings of the 2016 IEEE International Conference on Pervasive Computing and Communication Workshops. IEEE Computer Society Press

- Imamovic, K., Sangogboye, F. C. & Kjærgaard, M. B.: Poster Abstract: Improving Occupancy Presence Prediction via Multi-Label Classification, 2015 Proceedings of the 2nd ACM International Conference on Embedded Systems for Energy-Efficient Built Environments. Association for Computing Machinery

Posters:

- A. IONESI, M. JRADI, K. Larsen, B. West. Building Energy Performance Simulations Using BIM Integration -OU44 Case Study, University of Southern Denmark, Feb. 2016.

- A. IONESI, M. JRADI, C. Veje. Modeling the Energy Dynamics of Buildings, University of Southern Denmark, Feb. 2016.

Talks:

- M. JRADI. COORDICY: A Road to Energy Efficient and Flexible Office Buildings. 100% Climate Neutrality International Conference, 6-7 October 2015, Sonderborg, Denmark.

- M. Jradi. COORDICY Project. Møde om Energifleksibillitet i DEHA søjlen, 7 April 2016, Green Tech Center, Vejle, Denmark.