AGENCE NATIONALE DE LA RECHERCHE

ANR

Outline of granted projects in 2010

Programme " Habitat intelligent et solaire photovoltaïque "

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title	**BOLID - Suppression of Boron-Oxygen related Light-Induced-Degradation effects in Solar-Silicon Solar Cells**

Abstract

The cost reduction of the solar panels made from multicrystalline silicon could be achieved by using silicon feedstocks purified throughout metallurgical processes. In addition such processes could decrease the environmental impact (carbon balance, absence of polluting agent) of the solar panels fabrication process. Such solutions for the refining of the metallurgical silicon are under study in major international companies, and first results are promising since cells with conversion efficiencies of about 16% have been made from such feedstocks.
However, a major obstacle slow-downs the industrial development of these new purification processes. This issue is due to the fact that the efficiency of the cells made from these new materials is unstable under standard illumination. Indeed the efficiency strongly decreases under illumination (in few hours), the efficiency losses being equal to about 1-2 absolute %!

This effect is known under the name of Light-Induced-Degradation (LID). These efficiency losses counterbalance the cost reduction offers by the use of this low-cost material and furthermore alter the commercial image of these cells.
The goal of the BOLID project is to solve these problems of LID, while maintaining high dopant concentrations in the feedstocks. To achieve this objective, the BOLID project will first develop a strong base of understanding on the properties of the BO complexes (responsible for the LID effects) in solar silicon. Then these understandings will be used to develop innovant and efficient "defect engineering processes" able to trap / passivate or suppress the species responsible for the LID process. This new processes will be then integrated to the industrial solar cells fabrication process.

Consortium	CEA/LITEN-INES Université Paul Cézanne Aix-Marseille III - IM2NP CNRS - INL - UMR5270 CEA-INAC/SP2M PHOTOWATT
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ANR Grant	829 k€
Kick off and duration	January 2011 - 36 months
Reference	ANR-10-HABISOL-001
Competitivenes Cluster	TENERRDIS

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

CANASTA - Novel plasma processes for Carbon Alloyed NAnocrystalline Silicon TAndem (CANASTA) thin film solar cells

Abstract

The production capacity of photovoltaics continues its amazing expansion, with an average yearly growth of 50% between 2001 and 2008. Keeping pace with this growth, large-area thin-film PV production has maintained its ~10% market share, but the technology that was expected to dominate the photovoltaic industry – thin film hydrogenated amorphous silicon (a-Si:H) and nanocrystalline silicon (nc-Si:H) tandem cells (the so-called "micromorph" design) – has not completely fulfilled its destiny. This due to a recent challenge by a simple, robust technology (CdTe) that has now grown to be the single largest thin film technology by production volume, and by slower than expected advancements in the stabilized efficiency of micromorph devices. Despite gradual and incremental improvements in thin film silicon technology, this PV module design continues to be limited by two factors:

(1) a fundamental property of a-Si:H (its metastable light-induced degradation), and (2) the slow deposition rate of nc-Si:H. The proposed project aims to address these two limiting factors: firstly, by removing the primary barrier to stable thin-film silicon-based tandem cells by eliminating the troublesome a-Si:H and replacing it with a hydrogenated nanocrystalline silicon carbide alloy, and secondly, by depositing high-quality hydrogenated nanocrystalline silicon at a high deposition rate. The advantages of the micromorph tandem photovoltaic cell can be retained (high efficiency at low cost due to all silicon/carbon-based absorber layers), while opening new doors in terms of stabilized cell efficiency. The primary challenge to this Carbon Alloyed Nanocrystalline Silicon TAndem (CANASTA) design is obtaining absorber layer quality nanocrystalline silicon carbon (nc-SiC:H) at low temperatures (<300°C).

This challenge will be addressed using novel deposition techniques with new levels of precursor flux control. To achieve the widest range of freedom in processing conditions, three novel deposition strategies will be investigated for this challenging material to learn the most about the specific physical processes required to produce high quality material. One of these techniques (for which a patent is currently being filed by the LPP and LPICM), the use of novel excitation voltage waveforms, will also be applied to the challenge of high deposition rate nc-Si:H, the second crucial component of the CANASTA design. The other technique will include the use of high-density microwave excited PECVD and the use of novel precursor gases.
In addition, the project addresses a major barrier to the development of new thin-film photovoltaic materials – the lack of a foolproof intrinsic layer characterization method that accurately predicts out-of-plane electronic transport properties, as most thin-film characterization methods probe the in-plane transport properties and can give misleading optimization guidelines.

Consortium

CNRS - LPICM
CNRS - LPP
SUPELEC - LGEP

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ANR Grant

567 k€

Kick off and duration

January 2011 - 36 months

Reference

ANR-10-HABISOL-002

Competitivenes Cluster

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title	**CEPHORCAS - Organique Photovoltaic cells stabilised by cross-linking of the active layer**

Abstract

The project entitled CEPHORCAS is submitted to the theme of "innovative concepts and procedures", itself aimed at the development of solar photovoltaic materials (axis 3) and specifically concerned with the development of organic devices that will allow low cost production from readily available raw materials. The targets are to increase device efficiencies and lifetimes. The proposed project is concentrated on the latter target as it is a critical parameter that must be confronted so that these devices can be used in industrial and private spheres. The active layer in organic polymer devices is based on two components: a polymer donor which acts as the dominant chromophore, giving rise to excited electronic states; and an electronic acceptor such as fullerene derivative which permits these states to become separate positive and negative charges.

The importance of the morphology of the active layer at this point cannot be understated, as it determines the route that these charges once formed take in reaching the electrodes. Great steps have been taken to understad the morphology at a nanometric scale; it has been realised that the long term changes that a structure can undergo, such as excessive phase separation, can be detrimental to the operation of the device. This project aims to improve the stability of the morphology of the donor/acceptor blend by using cross-linkable materials in the active layer. These will form covalent bonds that will fix the structure into place. It is envisaged that the cross-linking technique that will be used will be as simple as possible (i.e. thermally or photochemically provoked) so that device preparation remains undemanding. The ideal scenario will be that sunlight which provokes the cross-linking.

The current literature shows that, so far, this route has been little explored, making it strategically important. Materials to be developped include polymer donors based on polythiophenes that can be cross-linked with each other within the device, the same but to be crss-linked with the acceptor in the device, and finally derivatives of fullerenes that may be cross-linked with each other in the formed device. It is essential that these three different routes be explored so that by the half-way point in the project a clear understanding of the most appropriate technique can be made. On the basis of the choice that will be made at this point, the second part of the project will be spent fully characterising the materials and optimising their use in photovoltaic devices. Ink formulation optimisation will be adressed with our industrial partner RHODIA. Above all, the latter will include extensive characterisation of device aging so as to understand the profile of the materials in hand with respect to materials that have not been cross-linked.

This will be performed using various conditions, including exposure to inert conditions and controlled amount of oxygen and water, so as to be able to define the reasons for any eventual device degradation. Finally, AM 1.5 conditions and accelerated aging will be used to give a complete profile of the cross-linked devices.

Consortium

IPB - IMS
Université d'Angers - MOLTECH
ENSCM - AM2N
CNRS - LPMM
RHODIA

Coordinator

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ANR Grant

783 k€

Kick off and duration

January 2011 - 36 months

Reference

ANR-10-HABISOL-003

Competitivenes Cluster

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

FIABILITE - Reliability of building energy performance modeling and simulation

Abstract

This project focuses on the fundamental question of validity of models and simulation codes for prediction of energy in buildings as well as simulation results reliability with regard to input uncertainties. The main goal is to develop efficient methods (robust and non computationally intensive) and appropriate methodologies to attest the quality of simulation results in terms of accuracy and reliability, to propose (if needed) some improvements of underlying models and to identify internal or external factors that significantly contribute to prediction uncertainties.

It is first needed to identify, in a structured way, assumptions or simplifications commonly made in building energy modeling and simulation that could produce significant biases in predictions. These biases are then evaluated by means of appropriate numerical experiments comparing predictions from "standard" models to "improved" ones. Then, experimental facilities will be used to get valuable data to develop efficient model validation methods and eventually reveal some ways of improvements of unsatisfactory models by identifying failing modeling assumptions or simplifications.

In order to carry through these objectives, we need first to identify uncertainty sources in internal and external factors and characterize the nature of this uncertainty (subjective or random). Model sensitivity analysis can then help in identifying factors that mainly affect simulation results and that may induce significant uncertainties. Finally robust and efficient methods of uncertainties analysis are required to evaluate model and simulation code predictions reliability.

Finally, in order to promote and disseminate the results of this project, we plan to implement part of the developed methods in existing building energy simulation tools (Comfie). This approach could make these notions of models validity and uncertainty more familiar to professionals of the building sector.

Consortium

CNRS - TREFLE
Université de la Réunion - LPBS
Université de Savoie - LOCIE
ARMINES - CEP
CEA-LITEN
EDF R&D / EnerBAT
Grenoble INP - G2ELaB
CSTB
Grenoble INP - G-SCOP
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ANR Grant

1073 k€

Kick off and duration

January 2011 - 36 months

Reference

ANR-10-HABISOL-004

Competitivenes Cluster

TENERRDIS

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

HYGRO-BAT - Methodology of hygro-thermal design of energy efficient buildings

Abstract

There is a gain of interest for Coupled Heat-Air-Moisture (HAM) transfers processes in buildings. Researchers from building energy field foresee here an opportunity to reduce energy needs for buildings. Indeed, some recent works had shown the impact of mass transfers on energy behaviour of buildings, under varying external and internal loads.

However, even if a lot of work had been done, we are still not able to explain some observations. For example, differences between simulated and measured values have been remarked in a few national and international projects (Annex 24 and 41 of International Energy Agency, French ANR PREBAT OPTI-MOB). The reason of these differences is not really known: measuring system, properties of materials, HAM models themselves? Past and current projects showed the complexity of the problem, but, up to now, were not able to explain clearly reasons of divergence and elaborate adapted tools. However, this is a fundamental question, because energy savings are expected precisely in dynamic thermo-hygric behaviour. Indeed, few publications, where the impact of dynamic moisture conditions is analysed, show energy savings up to 30%.

Our project gathers the experience of leading French institutions in this field around experimental and numerical benchmarks. Our ambition is to understand and master main physical phenomena and to elaborate experimental (characterisation methods) and numerical (coupled HAM-BES simulation) tools .

Our main objective is to elaborate a methodology for hygro-thermal design of buildings, based on reliable tools and methods. The aimed methodology should be able to qualify and to quantify the novel solutions, representing energy impact of mass transfers. Proposed project uses wood-based construction, and more generally construction materials based on vegetal fibres, as application example.

These materials have interesting hygroscopic properties and complex hygro-thermal behaviour. Moreover, the perspective of the further economic development of the corresponding industrial sector in France seems promising.

We propose a progressive working plan starting at precise measurements of material properties, as reliable inputs for numerical models. Then measurements and numerical simulations of dynamic behaviour of materials and wall assemblies will be performed, first under well known laboratory conditions. Then a more complex scale of building behaviour under real climate will be assessed, first in an idealised way (using well known PASSYS cells) then using real buildings. The possibilities of integration of project results in official standards will also be assessed.

HYGRO-BAT project is proposed by 13 institutions: 7 research laboratories form Universities (CETHIL, LEPTIAB, TREFLE, LERFOB, LERMAB, LOCIE, LMDC), 3 semi-public technical centres (CEA-INES, CRITT-Bois, CSTB) and 3 enterprises (EDF, LIGNATEC, NR GAÏA).

Consortium

Université Claude Bernard - CETHIL
ECOLE CENTRALE PARIS - LGPM
Université de la Rochelle - LEPTIAB
CEA/LITEN-INES
EDF
Arts & Métiers ParisTech - TREFLE
Université Paul Sabatier - LMDC
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ANR Grant

1694 k€

Kick off and

January 2011 - 48 months

Reference

ANR-10-HABISOL-005

Competitivenes Cluster

AXELERA, TENERRDIS, Fibres Grand Est, Xylofutur

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title	**MEMOIRE - Energy performance assessment based on monitoring and calculation for efficient energy renovation design of existing buildings**

Abstract

This project aims to develop an audit method based on the combination of measurements and modelling so that relevant renovation solutions can be obtained, leading to effective energy performances after renovation.
What is original in this method, when compared to existing methods, is that it sets out to accurately determine the intrinsic performance of a building on the one hand, and that it aims to assess how a building is used and operates, on the other hand.
The process of identifying the intrinsic thermal characteristics of a building is twofold: a first phase including in-situ measurements and a second phase consisting of inverting thermal and aeraulic models.
The global audit method comprises a thermal behaviour model applied to building whose input data result from developments obtained when conducting the project.
Beyond the scientific development of the method and its validation according to usual procedures, this project provides for the analysis of its economic feasibility together with approval of the method by the various professionals involved. Furthermore, three pilot projects are intended to analyse how the method can be applied on site.

This project falls within the scope of the professionalization of audit and renovation activities in order to ensure the economic relevance of the work proposed, its actual energy efficiency and the approval by the various building users through the positive impacts on both comfort and control of expenses.

Consortium	CSTB Solamen Laboratoire Central des Ponts et Chaussées - LCPC Université de la Rochelle - LEPTIAB CETE-OUEST
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ANR Grant	705 k€
Kick off and duration	January 2011 - 36 months
Reference	ANR-10-HABISOL-006
Competitivenes Cluster	Advancity

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

MOSAIQUE - Silicon wafers molding for photovoltaïc application

Abstract

The aim of the MOSAIQUE project is to propose a novel solution for the processing of PV silicon based on the directional crystallization of Si sheets molded in parallel.
In comparison with the current method of slicing bulk Si lingots prepared by directional crystallization, the proposed method allows avoiding the additional costs and material losses caused by the cutting step. And, in comparison with the ribbon pulling methods studied up to now, the new method should give a better Si microstructure while keeping a high productivity. Moreover the new method can be operated in the existing industrial crystallization furnaces and does not imply heavy investments, in contrast with the ribbon technologies.
The first part of the project is devoted to the development of a mould material with the associated coating that must lead to a spontaneous detachment of silicon during cooling.

This development will be based on an experimental study of wetting and adhesion of silicon on the coated mould. The results of this study will be used to develop a molding process at the scale of the laboratory. This consists in the control of : the infiltration of the mould by molten silicon, the heterogeneous nucleation of silicon at the mould walls, the surface shape and final microstructure of solidified Si as well as the pollution of silicon caused by the mould. The optimal parameters determined by this study will be used to process silicon sheets that will be tested as PV cell base material. From the measured cell efficiencies, the potentialities of the molding process will be evaluated.
The proposed project is an industrial collaborative research. It will be conducted using the basic knowledge of the three laboratories taking part into this project, specialized in the respective fields of wetting and adhesion, nucleation, crystal growth and segregation, and diffusion /precipitation of impurities in solid silicon in relation with electrical properties.

The application of the process will rely on the experience and contribution of two industrial societies, the first being implied in the development of the mould material, and the second in the development of the molding furnace.

Consortium

CEA/LITEN-INES
Mersen
CNRS - SIMaP
CNRS - InESS
ECM

Coordinator

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ANR Grant

756 k€

Kick off and duration

January 2011 - 36 months

Reference

ANR-10-HABISOL-007

Competitivenes Cluster

TENERRDIS

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title	**NovACEZ - New chalcogenide absorbers based on copper, zinc and tin for thin-film photovoltaic applications**

Abstract

Solar cells based on CIGS are on the path of industrialization, and First Solar is now the world's first solar module manufacturer with its CdTe technology. However there are doubts about the availability of indium in the long-term, and there are difficulties related to the handling of cadmium. It is therefore necessary to start working on the replacement of these technologies in the medium term. A possible solution is to replace the indium in chalcopyrite by a pair consisting of a zinc atom and a tin atom. This material, noted CZTS for Copper Zinc Tin Sulfur is promising and has already shown efficiencies of around 10%.

This project aims at developping a French working group on CZTS, working both on understanding the crystal chemistry and the band structure of the material, and the development of processes. It will therefore be possible to make a technology in the medium term to French companies that could develop the technology commercially.

In order to accelerate the developement of this technology, fundamental and applied research will be led :
- ab initio simulations and chemical crystallography studies will be led in order to to improve understanding of the CZTS material CZTS
- three processes of CZTS deposition will be investigated :
  - o Vacuum deposition has the greatest potential in terms of efficiency
  - o Two chemical techniques, electrodeposition and sol-gel, are mastered by the partners, both academic and industrial.

Consortium

EDF - IRDEP
CNRS - IRDEP
CNRS - IMN
CNRS - ILV
OMG
Nexcis
CEA - LITEN
UPS - CIRIMAT
Screen Solar

Coordinator

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ANR Grant

1492 k€

Kick off and duration

January 2011 - 42 months

Reference

ANR-10-HABISOL-008

Competitivenes Cluster

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

PLUMES - Unified Modelling Platform for Building and Systems Energy Efficiency

Abstract

It is now acknowledged that the general trend of ever-growing energy consumption shall be put to an end and that this raises new and exciting technological challenges. This is especially true for Building energy efficiency since energy consumption of the area represents more than 40% of total consumption (in France and Europe). Improving building efficiency imposes not only to improve building envelopes, but also to provide efficient and reliable working support to practitioners as far as modeling and simulation are concerned (it is a necessary step in order to efficiently take into account energy aspects in building life cycle). A large number of software tools is already available for all modeling and simulation tasks and these already perform quite well. It is however still important to seek to improve them, and not only to obtain more precise and reliable results, but also to make them more interoperable and to improve their connection to other software tools of building life cycle.

These two aspects are actually crucial if we want these tools to spread among building design practitioners and doing so, to reach a higher level in building energy efficiency. To this end, the PLUMES project proposes to provide a unified modeling approach, independent from any modeling platform or modeling format or targeted domain. This approach will be completed by a software platform easy to couple with other building lifecycle software tools (and most important, to CAD tools) and which will rely on available modeling / simulation tools.

The project is clearly in line with the theme 1.4 ("modeling and design-support tools") of thematic axis 1 ("Systems-oriented approaches") of ANR Habisol 2010 call. Indeed the call explicitly puts an emphasis on the interoperability issue: "it will be necessary to ensure interoperability (standard data formats) between specific tools of different domains in order to propose completely integrated solutions".

From the scientific and technical points of view, interoperability and ability to reuse models are the main focuses of the projects. The main objective will be to design a candidate standard of components for building and building systems modeling. This standard component will be interoperable, will address various kinds of physics, and will be able to execute in various environment. This standard, which we call MUSE (for Modèle Unifiée pour les Systèmes Energétiques, which may be translated to "unified model for energy systems"), will offer the following features:
- Interoperability: Interoperability of MUSE components will be ensured thanks to a neutral language (i.e. independent from any specifics), from which executable components will be generated;

- Multi-physics: MUSE components will enable dealing with all kinds of physics related to building domain. In particular, thermal, electrical, and control-command domains will be targeted. It will also be possible to model building users, as well as financial aspects (e.g. investment costs). It will be possible as well to extend components to other physics, which are not dealt with in the scope of the project (e.g. lighting);
- Multi-domains: A MUSE component will integrate several models enabling to target various domains: simulation, control, diagnosis, etc.

Therefore, the aim of PLUMES will be to use this MUSE component model as a basis to build a unified software platform for building and building systems modeling. This platform will provide a comprehensive support for MUSE components: components editors and generators, and software modules to execute them in various environments (TRNSYS, MODELICA and G-Home Tech are especially targeted). Software support to connect building information model (expressed in IFC format) and MUSE components will also be provided. At last, a first library of MUSE components will be developed in the scope of the project in order to validate relevance and applicability of the approach.

Consortium
CEA
CSTB
EDF R&D / EnerBAT
Grenoble INP / G2ELAB
Grenoble INP / G-SCOP

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ANR Grant
850 k€

Kick off and duration
January 2011 - 36 months

Reference
ANR-10-HABISOL-009

Competitivenes Cluster

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

PROTERRA - Advanced processes using alternative raw materials for an economic production of high efficiency solar cells and modules.

Abstract

Abstract
In the very difficult context of today's photovoltaic market, the competition is increasingly fierce and consequently a very sharp decline in the selling price of PV modules, especially those from China, is observed. The financial results of Photowatt in the fiscal year 2009 have been very mixed. This dangerous situation weakens and may even, in the medium term, threaten the French photovoltaic industry.
To deal with this situation, Photowatt has put all its efforts to improve its market share. To achieve this goal, Photowatt will increase research and development actions to go deeper into more advanced manufacturing processes. These processes will achieve the desired solar cell conversion efficiency that must remain among the best worldwide, with a sharp reduction in the consumption of silicon and other raw materials while meeting the legal requirements of environmental and trade standards. This can not be done without innovations adapted to today's technology, on which PHOTOWATT expects national partners (CEA / LITEN-INES, laboratories of the CNRS and French SME) early results across an R & DT national project named PROTERRA.

The main objective of this project is to reach within 3 years the innovative manufacturing processes, giving an increase of average conversion efficiency of cells and modules of an absolute point compared to the current industrial process. We aim conversion efficiency above 20% on crystalline silicon solar cells with a significant reduction in production cost in order to reduce module cost towards the goal of 1 Euro per watt-peak. The most sensible approach for this project is obviously to work simultaneously on 2 areas: Raw material cost and more efficient manufacturing processes.
To achieve the objectives of the project, a new cell structure, which has never been used in the French PV industry, will be developed.

This structure has a stack of passivation and antireflection layers, a front grid contact with very fine lines formed above the heavily doped regions of passivable emitter, a passivated rear side by dielectric layers with located BSF and contact. Different approaches of thermal treatment will be used to achieve an excellent metallic contact quality using alternative materials and new concepts for the metallization.
This project will last 36 months and is divided into five technical areas:
- Selective removal / localized doping
- Advanced metallization
- Back side dielectric passivation
- Local BSF
- Efficient and recyclable modules.

To carry out these technical areas, a relevant and solid partnership has been established which brings together around PHOTOWATT, a photovoltaic manufacturer, laboratories of the CNRS (INL-INSA Lyon, IEMN) and CEA-LITEN who have revolved themselves since over twenty years designing and developing new photovoltaic cell concepts and a SME (TECHNIC IST) well known in the field of metallization for over 25 years.
The achievement of the goals of PROTERRA project will help reduce the cost of photovoltaic energy sources. The stakes are high as to create new employments and to preserve the jobs of 800 people within PHOTOWATT facility in Bourgoin-Jallieu. These actions will enable Photowatt to present on the market the modules of new generation with higher performances which significantly improves the competitiveness of the French PV industry. This will certainly increase the contributions of photovoltaic in renewable energy resources and to improve the sustainability of the national structure of energy supply.

Consortium
PHOTOWATT
Technic IST
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ANR Grant
1242 k€

Kick off and duration
January 2011 - 36 months

Reference
ANR-10-HABISOL-010

Competitivenes Cluster
TENERRDIS

Programme '' Habitat intelligent et solaire photovoltaïque ''

Call 2010

Project Title

SUPERBAT - Simulation tools for energy management in buildings

Abstract

The fulfilment of the « Grenelle de l'Environnement » is the long-awaited break-up in the field of energy in buildings. Starting from now the energy performance of buildings become a major concern. The will of the « Grenelle de l'Environnement » is to tool up the building sectors in order to design efficiently low energy and positive-energy building. This social and economical break-up is based on a increasing need to modernise the building industry. The energy simulation tools are now especially used only for the design of a new buildings. Impressive progress in the field of energy savings will be accomplished if simulation tools will be used also for the building commissioning. Building simulation programs offer an effective support for the energy management devices. For this kind of applications the simulation tool needs more accurate modelling skills in order to predict the power load of the building including the electricity uses. Questions arise over the ability of the existent simulation tools to predict et manage the power load of the buildings. The power load of the buildings is strongly related to the climate variations, building envelop, HVAC system and occupant behaviours.

Based on physical and sociological competences, the proposed project will try to go beyond the most ardent limitations of the existing dynamic simulation tool for the energy behaviour of the buildings :

- the most part of the simulation tools are designed to predict hourly (more or less) precisely the energy consumption of the building. This approach is inaccurate in order to estimate the power load of the building. Time step above 1 and 10 minutes are needed for all the applications related to the energy management and power load estimation.

- the occupant has a major impact on the energy consumption of the building and especially on the use of electricity uses. The electricity uses are commonly modelled by using standardized occupancy profiles. This profiles are hourly based and conventionally chosen for each thermal zone.

- the simulation tools provide an acceptable (hourly based) modelling of the classical energy uses (heating, ventilation, hot water, cooling) but the modelling is deficient concerning the electricity uses. The electricity use in the recent buildings (low energy and positive-energy building) represents half of the energy consumption.

- the physical modelling of the building are not adjusted or fitted to real time measurements of the power load (or other physical measurements such as internal and external temperatures, solar irradiation, …) in order to capture the caracteristics of the real world.

The developments of the stochastic modelling for the occupancy and energy uses integrated to the dynamic simulation tools and the development of the modelling adjusted to the real life measurements (power load, temperatures, …) will allow to study industrial applications such as the design and energy management of low energy and positive-energy building.

Consortium
EDF R&D / EnerBAT
INSA-LYON - CETHIL
UJF- Grenoble I GE2LAB
ENS Cachan - LMT
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ANR Grant
905 k€

Kick off and duration
January 2011 - 48 months

Reference
ANR-10-HABISOL-011

Competitivenes Cluster
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