International Energy Agency
Energy Conservation in Buildings and Community Systems Programme

Twenty Five Years of Achievements in Building Energy Conservation

The ECBCS Chairman, Richard Karney, reflects on the programme's successes over the last quarter-century.

With this issue, the Energy Conservation in Buildings and Community Systems Program marks its 25th anniversary. I certainly believe the participants owe themselves a pat on the back. The agreement has achieved quite a lot since it began with Annex I, "Load Energy Determination of Buildings." It is easy to say we've come a long way over these years, but what does that really mean?

Thirty-two completed annexes? Two completed working groups? Development of the Future Buildings Forum? Collaboration with other Implementing Agreements on joint annexes? Being the catalyst for the IEA Buildings Coordination Group?

Yes, it does mean all that. It means the agreement has grown from its initial projects dealing with investigations of individual aspects to buildings and community energy consumption and the reduction of energy use. It means the agreement has taken on an expansion to research the larger concept of broader or systems approaches to the mechanisms of building energy use such as ventilation, HVAC commissioning, retrofit application to non-residential facilities, the environment, sustainability, and the interaction of all of the above. It means the Agreement is working with other Implementing Agreements to synergize the limited resources available in order to pursue common goals.

It also means ECBCS has taken the charge handed out by the IEA and crafted a new strategic plan to meet today's, and tomorrow's, new challenges. Our mission remains to facilitate and to accelerate the introduction of new and improved energy conservation and environmentally sustainable technologies into buildings and community systems, by developing product information, design methodology, system engineering, systems integration on various levels, and performance assessment. However, the

In this issue:

methods to meet our mission will change dramatically.

During the upcoming years we will work, again at times collaboratively with other Agreements, to reduce green house gas emissions via such mechanisms as a "Whole Building" Performance Approach, to define, measure and convey the thematic concept of sustainability, to quantify and reduce the impact of energy on indoor health, comfort and usability, to continue the exploitation of innovation and information technology, and to work to integrate changes in lifestyles, work and the business environment.

ECBCS work in the past has influenced national policy development and added to the architectural and engineering community by transferring the products it has created. In the future we foresee similar successes, but we also envision the greatest opportunities, not only for ECBCS but also for all the players within Building Coordination Group, in Sustainable Buildings Projects, with the attraction of new member countries and the improvement of information dissemination. These will be the success factors for all building-related implementing agreements.

Our eight ongoing annexes are targeted for these advances; we expect all future work to mirror the success of our past twenty-five years by attacking the challenges put forth not only by the IEA but also by our participants' National Program challenges.

Richard Karney, Chairman, ECBCS

Promotion of Low Cost Measures to Save Energy in Space Heating and Job Creation: A USAID-GEF Project in Poland

Adam Gula[1,2], Maciej Surówka[1,2], Jacek Markiewicz[2] and Mariusz Filipowicz[1]

1) Faculty of Fuels and Energy, University of Mining and Metallurgy in Krakow

2) Polish Foundation for Energy Efficiency, Center in Krakow

Abstract

A low cost approach to saving heat energy in residential and public buildings is described. The approach has been developed in Poland in two projects sponsored by USAID: in 1992-94 in Kraków and 1997-2000 in six Polish cities. The results of the latter are briefly described. Simple measures, such as professional draught-proofing of windows or attic insulation lead to significant savings and - at the same time - create jobs for people who do not possess specialised skills.

Introduction

Experience teaches us that energy is mainly wasted where there is no money available to invest in limiting its consumption. Considering a very typical example - old window frames - a typical attitude, particularly among the residents of housing co-operatives and municipal housing stock, but also among the administrators of budget-maintained buildings (e.g. schools) is to complain and wait for someone to finally find the resources to solve the problem in accordance with their expectations, i.e. to replace the existing windows by new ones, demanding significant expenditure. Waiting for a costly solution usually takes a long time, during which the energy losses accumulate.

In 1992-94 Polish engineers and technicians were trained by experts and technicians experts from American companies, led by Lawrence Markel and George Reeves, who demonstrated in Kraków the strategy implemented in the USA when the financial resources set aside for an investment designed to reduce energy consumption for heating are limited. Polish engineers and technicians were trained by the American experts and technicians.

The works carried out in one of the Kraków housing estates showed that simple and inexpensive operations can lead to heat savings of several (7-15%) per cent with a payback period of about 3 to 4 years [1]. Let us enumerate the most important ones:

- repair and draught-proofing of door and window frames and doors;
- elimination of redundant glass surfaces, particularly glass brick ones;
- insulation of outside walls identified through the audit as having considerable heat losses;
- insulation of the ceilings above the top floor; installation of heat reflecting shields;
- installation of simple draught temperature controls;

- numerous other low cost operations not demanding high expenditure, defined on the basis of building inspection by an experienced specialist.

However, in order for such operations to bring the expected results (savings with low investment costs), several conditions must be fulfilled:

- professional assessment of potential energy savings and their relation to the costs,
- professional definition of the hierarchy of work;
- a professional standard of work, requiring technicians to be trained in the works carried out and to be provided with appropriate experience;
- organise operations in such a way that the costs are affected by economies of scale, i.e. organisation of the operations by large units (housing co-operatives, local government authorities, education authorities, etc.) with wholesale purchase of materials at reduced prices;
- professional control over the quality of work and monitoring of the outcome.

A strategy recommending mainly easy, low-budget operations seems to be very simplistic. However, the outcome of the Kraków project proves that even simple and cheap solutions may be surprisingly effective [2,3]. Polish technicians trained by Americans as part of a demonstration project were able to repair windows sentenced to technical death by residents or school headmasters. By the end of the project the windows met all the thermal performance characteristics demanded of them and were in good technical condition, in spite of the earlier doubts of the residents or administrators.

Observations made by FEWE in co-operation with the American specialists following the conclusion of the Kraków project revealed that in Poland very often investments intended to result in financial energy savings due to energy conservation are carried out the wrong way round. They begin with very costly investments with a long payback period or even – from the point of view of energy conservation – ones that will never give a positive return. It quite often happens that an investment financed as energy saving turns out to be one where energy conservation is more of a side effect and the main purpose is, for example, aesthetics.

It is not in itself a bad strategy, particularly if the investment, e.g. renovation of the exterior, must be carried out anyway for other reasons. In such cases the failure to take advantage of the situation and insulate the walls would be an obvious loss. However in the situation where the same, or almost the same, heating effect can be achieved with much lower expenditure – and the financial resources are also necessary to fulfil other important needs – the matter demands close consideration.

Description of the Project

The project was implemented over the period October 1997 to August 2000 by the Polish Foundation for Energy Efficiency (FEWE), Kraków Center, and was supported, both organisation- and content-wise, by the Association of Municipalities, Polish Network ‘Energie Cites’ (PNEC). The project covered six towns of different sizes: Krapkowice, Olsztynek, Nowy Sacz, Luban, Trzcianka and Bialystok. The aim of the project was to demonstrate how countries much richer than Poland approach thermal energy conservation in buildings when financial resources are limited. The USAID grant for implementation of the project amounted to USD 546,000 and was supplemented with an additional grant from the Global Environment Facility (GEF) amounting to USD 25,000. The total financial input on the part of the participating towns was planned to be above USD 190,000. However, it considerably surpassed this amount, which emphasises the success of the project

The resources put into the project enabled demonstration thermal improvement work to be carried out in twelve buildings, including five multi-family blocks of flats and seven public buildings (schools, a medical center, and a kindergarten), achieving high thermal energy savings at low cost. A particularly successful restoration was conducted in one of the buildings in Nowy Sacz. It was awarded the title ‘Modernisation of Year 1999’ in the fourth edition of the competition held by The Polish Office of Housing and City Development and the Polish Association of Architects, SARP.

The following paragraphs illustrate the results of the project by describing the effects of the application of one of the low cost measures applied: the professional repair and draught-proofing of window frames.

First let us note that heat losses due to excessive infiltration of cold air exceed by far the heat losses by transmission and radiation through window panes. Typically the latter constitute 4-18 per cent of the air exchange losses. The measurements taken after the draught-proofing showed that the professional repair of the windows’ joinery gives fully satisfactory results, i.e. window joinery repairs give sufficient and required air-tightness. With regard to air infiltration, this is a remarkably important measurable proof of the fact that professional repair and draught-proofing of joinery windows gives practically the same results as the replacement of old windows with new ones. (Moreover, in reality a larger problem may be excessive rather than insufficient air-tightness after draught-proofing.)

The experience of the project allowed us to assess approximate average costs for repair and draught-proofing. The results obtained from the practical experience gathered during the project and in other cities updated with the recent estimates for the city of Tychy (where a follow-up of the project was carried out) are presented in Table 1 as an average expenditure in USD for renovation and draught-proofing of one square meter of a window surface in a particular group of windows, characterised by the level of damage (1 = slightly damaged, 2 = moderately damaged, 3 = significantly damaged, 4 = very damaged). Typical painting costs are also included. (1 USD is assumed to be 4 PLN).

As we can see, except for badly damaged joinery, the installation of new windows is significantly more expensive. Therefore the dilemma that municipal or housing administrations really face now is whether they should replace the windows in one block of flats or in two, three or, perhaps, even more blocks, achieving practically the same heat saving effect (See Table 1).

The only case where repairs are not cost effective is that of heavily damaged box windows. This is, however, due mainly to very high costs of painting (30-35 USD per square meter). If heat savings alone are the compulsory priority and the aesthetic aspects can be ignored, repairs and draught-proofing of such windows can be still recommended.

Let us add a few practical comments to Table 1.

(i) In the case of box-windows the draught-proofing of one pair of windows gives the proper outcome in terms of the decrease of air infiltration. Usually the draught-proofing of the inside pair is recommended, which prevents the outside windows steaming up in winter. However, the draught-proofing of both pairs results in additional effects, such as a further decrease in heat losses, a decrease in dirt penetration in the space between

Table 1 (Figures represent average expenditure in USD for renovation and draughtproofing of one square metre of window surface in a particular group of windows characterized by the level of damage.)

Type of window	Type of investment	Damage level 1	2	3	4
Box windows	Draught-proofing of one wing pair	20	42	58	105
Traditional double-pane windows	Draughtproofing and hermetization of the inter-panel space	24	38	52	66
New windows	Replacement	130	130	130	130

the sashes and a decrease in noise penetration.

(ii) By far the most frequent type of windows is the double-glazed window (the so-called ‘Swedish’-type window). They are the prototype of and a substitute for windows with double-glazed panes. A layer of air 18-20 mm thick is enclosed between a two pane set with separate frames screwed together. If we assume that the space between the panes is hermetically sealed, such a window would not be much worse than the window with glazed panes and air filling. However, in the case of the windows encountered in Poland, the glazing is never hermetic so that there is convection air movement in the inside layer and this, in turn, decreases the insulation properties of the layer.

Dust also penetrates into the space between the panes, which results in the need to unscrew and clean the window from the inside as often as from the outside.

These shortcomings give double-glazed windows a big practical disadvantage, particularly because, with the continual unscrewing for cleaning, the bolts are loosened or damaged and even after the window is put together again the space between the panes becomes less and less air-tight.

Therefore in the case of ‘Swedish’ windows one of the very important elements of the thermal improvement is hermetically sealing the space between the panes. It is necessary in order to reduce heat losses, and for other practical reasons, to prolong the life of the joinery. The project was concerned that quite often, as in Poland, such windows form the majority of joinery in need of repairs, repairs that at the same time bring large energy savings.

With hermetic sealing properly done it is possible to obtain heat transmission parameters practically equal to those of double-glazed windows filled with air. In the course of the project the teams worked out a technique guaranteeing the air-tightness of the space between panes so that after glazing there is no need to unscrew the window for many years. This saves the time once lost in cleaning and – moreover – prolongs the life of the window.

Table 2 presents the results that can be achieved on a whole town scale by applying only the professional repair and draught-proofing of window frames. The table shows: (a) the potential thermal energy conservation, (PEC), and (b) the potential financial savings (PFS) resulting from (a). Moreover, the table includes (c) the potential creation of new jobs (PNJ) that would be necessary to implement low-budget thermal improvements on a whole town scale. The potential is shown by the number of years necessary for the implementation of such a program by one qualified worker (person-years, PY). For instance, in Bialystok, the repair of window frames alone would guarantee jobs to 100 unemployed people for almost 12 years or to 200 unemployed for about 6 years and would bring with it a long-term saving of about PLN 50 million a year. The figures quoted are based on a thorough statistical survey done within the framework of the project in the six cities. To account for uncertainties, figures are close to the minimum achievable.

Recommendations and Barriers

In the following paragraphs we present some practical recommendations which can very definitely be useful when the municipality lacks the resources for costly thermal improvement investments. They look trivial, but - as the experience gathered in the project shows - they are seldom realised by the local authorities in Poland:

The steps to be taken are rather obvious:

- One should employ an experienced auditor to identify the basic sources of heat losses and to suggest particular measures with an assessment of their outcome and cost. It should be emphasised that if the municipality does not intend to apply for a loan from a the Thermal Improvement Modernisation Fund, the audit does not need to be as detailed as the one demanded by law. In such cases, an experienced auditor will be able to assess approximately, in a good and practically sufficient way, the savings resulting from low-budget operations, without the need for detailed, complicated calculations – which, however, are necessary in planning more costly enterprises.
- Get in touch with potential contractors having appropriate experience, particularly ones who, apart from undertaking the works pointed out by the auditor, will agree to employ (for the period of implementing the work) and train (in the field of the works carried out) local technicians. This is important for the reasons presented in the introduction. Low-budget methods of preventing heat losses mean new jobs.
- Plan the works in such a way that the cost of the operation is influenced by the economies of scale, so reducing unit costs. It means asking for bids for a few buildings at the same time.
- It is very important that the municipal decision-makers are aware of the financial resources the municipality has for thermal improvements. The authorities should present the funds set aside for all of the municipality's schools and residential housing for the purpose of thermal improvement and convince the headmasters and housing administrators that for the same amount they together can achieve considerable improvements in several buildings, not just in one. It is important to create a mechanism motivating the respective administrators to save energy. One of the obvious elements of such a mechanism would be a system of control over the building management of saving measures and its internal control over the staff.
- Follow the basic IRP principle (Integrated Resource Planning), before one starts any works connected with heat distribution supply (purchase of a new boiler or heat exchanger) one should carry out basic works (mostly low-budget ones) on the body of the building. It is necessary to avoid overrating the heat source, which increases the costs unnecessarily in the investment stage as well as later at the exploitation stage in the framework of non-optimal parameters. Seeming savings resulting from not carrying out works in the area of heat consumption, so-called DSM (Demand Side Management), are soon consumed by the redundant investment cost and higher exploitation costs. Performing the works in the reverse order is a cardinal mistake, unfortunately quite common in Poland.

However, as the experience gathered by FEWE shows, the local authorities seldom follow these principles. Unfortunately, in Poland the drastic and omnipresent lack of money often goes

Table 2

Town	PEC [TJ/year]	PFS [thousand UDS/year]	PNJ	Population of the town [thousands]	Reduction CO_2 [1000 t/year]
Krapkowice	240.3	1,502	151	20	34.8
Olsztynek	63.7	398	45	14	9.2
Luban	71.8	449	73	24	10.7
Trzcianka	107.6	673	99	18	16.0
Nowy Sacz	579.7	3,623	469	84	86.3
Bialystok	1,953.6	12,210	1,164	284	290.8

PEC - Potential thermal energy conservation
PFS - Potential financial savings
PNJ - Potential creation of new jobs

hand in hand with the failure to acknowledge and take advantage of the opportunities for using the money much more effectively in limiting energy costs.

This situation results from:

- lack of awareness among representatives of the administration at various levels, concerning effective methods of achieving high energy efficiency, not demanding high expenditure and resulting in real savings and short payback periods;
- the deeply-rooted conviction that the use of simple methods, such as sealing up the frames, should be left to the residents themselves, and that the administration is on a different level of decision-making;
- the conviction that these methods are ineffective. This attitude results mainly from the fact that up till now such works were carried out at a domestic level, in a non-professional way, without the use of appropriate materials and tools. This led to some improvements being hard to notice and the consolidation of the above mentioned conviction;
- lack of examples which demonstrate that the professional implementation of such works can produce the desired effect and that the costs are relatively low;
- lack of local potential to carry out professional standard work in the small companies offering services in the field.

Additional barriers identified during and after the project are perhaps even more important:

- the counter-action at local decision-making level taken by the manufacturers and installers, whose lobbying capacity and opportunities are far greater than those of small companies or individual technicians offering the low-cost services.
- The counter action at the municipal level or - at least - a destructive reluctance to support a low-low cost, city-wide action, of the local suppliers of heat energy, which most often are still owned or co-owned by the municipality.

These barriers can be overcome only by a combination of a national and local government level action. The Polish Foundation for Energy Efficiency and the Polish Network “Energie Cites” are presently working on policy recommendations to overcome these barriers.

Finally, it should be mentioned that recently two cities, Bielsko-Biala and Tychy - both members of PNEC - have undertaken city-wide low-cost heat saving initiatives in their building stock (ca. 70 and 440 buildings, respectively). Also, as a result of the Project several other cities asked FEWE to perform similar training actions. The training has so far been completed in 6 municipalities. Last but not least, the usefulness of this approach has been further demonstrated by USAID in Armenia, Georgia and Moldova. At present the Alliance to Save Energy, Advanced Engineering Associates International and FEWE are considering an initiative to enable the different groups to exchange experience which may greatly benefit the heat saving projects in the whole region.

Acknowledgements

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IEA Building Coordination Group Unites the Buildings-Related Implementing Agreements

Representatives of the seven IEA Buildings Related Implementing Agreements (BRIA's) met at the end of January 2002 to discuss closer cooperation and the coordination of research.

The outcome of the successful meeting was the determination to focus on a better exchange of information.

A common homepage is currently under construction: details will be posted as soon as available.

The meeting was managed by the IEA secretariat representatives, led by Hans Nilsson.

Mel Kliman gave a presentation on the role and mandate of the Building Coordination Group. He suggested that it has the mandate to align all the BRIA's to a cohesive approach in the area of building energy research, and mainly sustainable buildings.

He suggested that the sustainability aspect could play the integrating role for the BRIA's and that the Building Coordination Group would focus on results rather than processes. Communication would be improved by various measures including developing effective communication between the Implementing Agreements, emphasising links to sustainable initiatives, maintaining a public website, developing a common sales and distribution system for publications, using the Building Coordination Group as an intermediary between the IEA Secretariat and the Implementing Agreements, holding a regular workshop and other collaborative projects, instigating collaborative projects on market development, developing a sustainable working policy and raising the profile of the Future Buildings Forum.

The ECBCS representatives, Morad Atif and Mark Zimmermann, explained the format of the Future Building Forum, and gave a historical perspective. They discussed the relevance of the Future Building Forum to the strategic plan of all IEA Building-Related Implementing Agreements. It was suggested that the Future Building Forum (FBF) should be recognized as a major planning exercise for all BRIA's.

Phil Harrington, from the IEA Secretariat, gave a presentation on BRIA's/ BCG/IEA Collaboration on the Sustainable Buildings Project.

Each attendee gave an overview of the activities of their Implementing Agreement:

The Chair of the IEA District Heating and Cooling Program, Robin Wiltshire, of the BRE Best Practice Program, gave an overview of the major activities within his Implementing Agreement. Major projects include the cost effective service of low-density areas; distributed CHP and DHC Networks; the impact of DHC Storage and CHP on electrical and gas networks; new concepts for lower lifetime cost district energy systems; small scale biomass/biogas CHP and/ or DHC systems; policies for harmonizing market liberalization with achievement of environmental goals;

The websites for the Buildings-Related Implementing Agreements:

Buildings and Community Systems http://www.ecbcs.org/

District Heating and Cooling (incl. CHP) http://www.iea-dhc.org/home.htm

Demand Side Management http://dsm.iea.org/

Energy Storage http://cevre.cu.edu.tr/eces/

Heat Pumps http://www.heatpumpcentre.org/

Photovoltaic Power Systems http://www.iea-pvps.org/

Solar Heating and Cooling http://www.iea-shc.org/

Under consideration for inclusion:

Energy Efficient Lighting http://www.iea.org/LIGHTING/index.htm

Future Buildings Forum http://www.ecbcs.org/Futurebuldforum.htm and concepts that will increase DELTA-T in district energy systems.

The major activities of the IEA Photovoltaic Power Systems Program include: Exchange and dissemination of information on photovoltaic power systems; operational performance, maintenance and sizing of PV power systems; use of PV power systems in standalone and island applications; design and grid interconnection of building integrated and other dispersed PV; PV in the built environment; and the large scale application of grid connected PV in the built environment.

The Energy Storage IA is seeking collaboration on energy storage in sustainable buildings; energy conservation and effective use of energy; natural heating and cooling; and building materials with PCM. Suggestions included joint workshops with other BRIA's; joint ventures in R&D, D projects; joint Ex. Co. Meetings; continuous exchange of information; developing and sharing marketing tools; and the coordination of marketing activities.

Information Exchange and Dissemination

The plan in this area is to establish and maintain a public Web Portal, with links to all the BRIA's to homepages and other related links; compile a common list of publications, held at the IEA; information on the BRIA's should be updated regularly, including the website, an annual workshop and a Building Coordination Group newsletter.

The next meeting for the BCG is planned for 23-25 of September 2002 in Oslo, in conjunction with the Conference on Sustainable Buildings

Sustainable Design for Four State-of-the-Art Japanese Buildings

A Selection of Annex 35 Case Study Buildings from Japan

This article provides a brief overview of four state-of-the-art Japanese buildings that have been assessed for their sustainability as an integral part of their design processes. The first is the Jetro Building, located in Chiba City, the second is the Fukita Technology Building in Atsugi, a third is the Komatsu Dome at Ishigawa, and the fourth is the Catalog House Building located at Shibuya ku, Tokyo. (These buildings have also been studied within the framework of the ECBCS Annex 35 HYBVENT project, "Control Strategies for Hybrid Ventilation in New and Retrofitted Office and Educational Buildings".)

Institute of Developing Economies, JETRO

Architects and Engineers: Nikken Sekkei Ltd. (www.nikkensekkei.com)
Contact person: Dr. T. Chikamoto, Nikken Sekkei Ltd., Japan (chikamoto@nikken.co.jp)
Location: Chiba City, Chiba, Japan
Site area: 20,000 m^2, Total floor area: 23,940 m^2

Building area: 8,299 m^2
Building Type: Research Institute
Completed: 1999

2.1 Concepts for energy saving: using natural energy

* Natural ventilation system: hybrid air-conditioning system ('Task and Ambient' concept)
* Natural lighting with automatic dimming system (large window for natural lighting, top light, high-side light)
* Photovoltaics using sunlight
* Pre-heating of fresh air using sunlight
* Cooling and heating tunnel (pre-cooling and -heating of fresh air using soil energy)

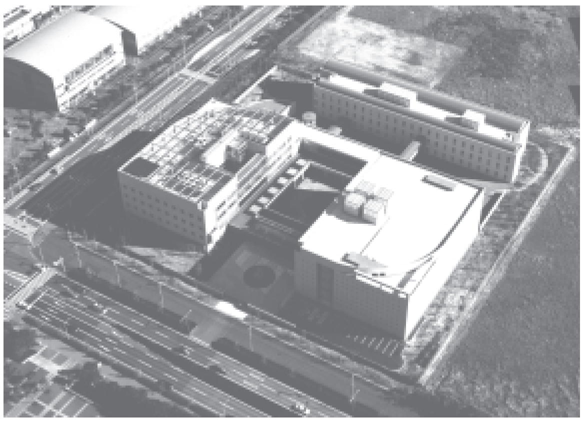
2.2 Hybrid NV and AC system

Hybrid natural ventilation (NV) and air-conditioning (AC) system

2.3 Pre-heating and -cooling by natural energy

The corridor is located around the pond in the centre of this facility to connect each building.

Under the corridor, a tunnel for pipes and equipment is established and also used for cooling/heating the tunnel.



The JETRO Building

2.4 Adaptive and intelligent AC control

If the occupant feels hot, for example in the morning just after they arrive, because their "metabolic rate" is high, they will change the target temperature of the AC controller. The building automation system records the operation activities and changes the pattern of the AC target temperature, according to the operation frequency.

2.5 Natural lighting with an automatic dimming system

* Top light (sunlight is diffused by "Japanese paper sandwiched by glass", automatically controlled for natural ventilation)
* An atrium is also used for promoting natural ventilation in middle seasons, etc. using the stack effect, and also for storing smoke in case of fire.

2.6 Operation of lighting control based on infrared sensor

* A reading zone and a stack zone
* Lighting controlled by infrared rays sensor
* Bright and comfortable
* Library: 500,000 books are stored, and a further 500,000 books can be stored in the future.

2.7 Concepts for energy saving: high performance HVAC system

* Task and Ambient HVAC system
* Electric heating and cooling system with water thermal storage (1300 m^3)
* Low speed of supply air to avoid pressure loss by friction
* VAV (variable air volume system)
* VWV (variable water volume system)
* Automatic fresh air intake control system by CO_2 sensor
* Total heat exchanger
* Operating number control of heat source

2.8 Task and ambient HVAC

* Air volume and direction are easily changed by each user.
* Task supply unit is detachable.
* Ambient zone is controlled mildly by central BA system for energy saving.
* Task zone is controlled by individual choice for human comfort.

2.9 Concepts for energy saving: minimize energy loss

* High insulation: Insulation values (K-values in $W/m^2/K$): exterior wall (0.34), glazing (2.2 - high insulation glass) and roof (0.30)
* Roof garden
* Minimize window size of library (glass block: high insulation)
* Eaves
* Operating number control of transformer
* Operating lighting control by infrared sensor in WC and library to turn off excess lighting to the area without man

2.10 Concepts for ecology

* Recycling of water: use of rain water for reclaimed water (500 m^3 rain storage tank)
* Usage of wood: window sash; wooden water tank; cafeteria floor
* Waste separation system

2.11 Concepts for ensuring the longevity of the building

* Keep maximum flexibility, e.g. raised floor: Research building (450 mm), other sections (100 mm)
* Easy to remove, e.g. sufficient vertical service shafts and machine relocation spaces.

Inside the JETRO Building

* Information infrastructure, e.g. double communication pipe spaces (CPS) which are the space for nodes and hub etc. are located on every floor in every building, and each building is connected by 622 Mbps ATM optical network.

Fujita Technology – Development Division

Year of completion: 1999
Type of building: Laboratory
Design Team: Fujita Corporation

Design Philosophy for IAQ and Thermal Comfort and Issues of Concern for this Building

* Perimeter zone thermal control method: solar radiation shading by motor blind controlled by BEMS
* Perimeter air conditioning system composed of perimeter counter with fan coil unit and ceiling exhaust system.
* An air curtain system between office floors and atrium is adopted to give a sense of spaciousness.
* Excess air supplied to offices is exhausted from upper openings of atrium.
* The set up temperature in offices is changed by intranet occupant vote system linked to the BEMS.

Principle of Hybrid Ventilation

Office building*:* The natural ventilation system is used to save air conditioning energy in spring (from April to June) and autumn (from September to November). When natural ventilation is active the air conditioning systems do not operate. At night the ventilation windows are opened to cool the wall and floor of the building by use of the temperature difference between the room air and outdoor air. There is no wall between the office and atrium.

Experiment yard*:* This large space has no air conditioning system, in order to save energy. Throughout the year, outdoor air that has passed through underground pits is supplied from the openings installed in walls.

The Fujita Building, Atsugi

Components Used to Solve Main Issues or Problems*:* Temperature control: Temperature sensors positioned in a zone area of 162 m2 (18m x 9m) dividing one floor into 4 zones. Air conditioning system controlled by BEMS.

Energy conservation: BEMS

Control of air flow rate: VAV system controlled by BEMS

Security: ID card system

Fire regulations: Smoke sensor

Maintenance: Periodical inspection

Control Strategies:

* The motor-driven apparatus of the upper part of the window is controlled by the BEMS.
* Window operation is controlled by the wind speed, outdoor air temperature and rainfall sensors. Future measurement results will be used to develop detailed window operation rules.
* The general architecture of the control system is centralised supervisory control.
* Interface with the occupants is via an intranet home page style occupant vote system linked to the BEMS.
* The type of management is internal.

Overall Performance: Performance to be confirmed by monitoring.

Komatsu Dome

Project Data

Architects and Engineers: Yamashita Sekkei Inc. and Taisei Corp.
Location: Komatsu City, Ishikawa, Japan (lat. 36°33' N, long. 136°30')
Main application : Sports facility
Total floor area: 22,343 m^2
Number of floors: +4, Structure: RC, SRC, S
Completed: Apr. 1997
Contact person: Mr. Hiwatashi (kiyoshi.hiwatashi@sakura.taisei.co.jp)

The Opening/Shutting Roof

The dome is equipped with an opening/shutting roof which unites the indoor and outdoor space. However, the temperature of the arena surface exceeds the outdoor temperature due to direct solar radiation. In order to prevent this temperature rise, it is planned to introduce outdoor air by opening the windows installed at the outer circumference of the running track inside the dome. In this way a sports space is created that unites indoor and outdoor space.

When direct solar radiation needs to be avoided or on rainy days, the arena is used with the roof closed. In order

Komatsu Dome

to keep the space inside the arena comfortable for sporting activities, natural ventilation is applied. For the supply air inlets of natural ventilation, the windows installed at the outer circumference of the running track are opened, while the ventilation opening installed at the upper part of the observatory and that of the opposite wall are opened for exhaust air. This makes it possible to match the temperature of the arena surface with the outdoor air temperature.

Catalog House Building

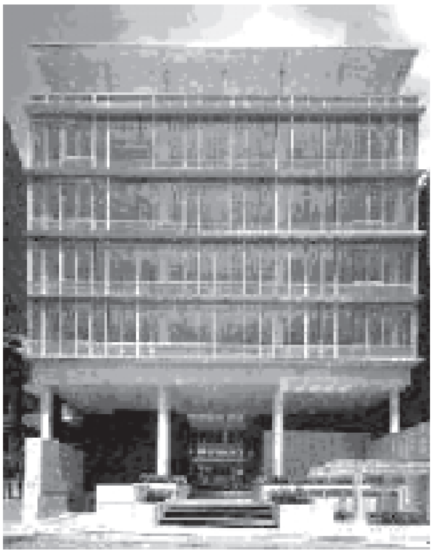
The photo shows the exterior appearance of the building from the west side. The building neatly incorporates three components: a pent roof, glass, and a vent to supply air. The larger eaves lead the west wind towards the upper section of the void and help to increase efficiency.

Project Data

Architects and Engineers: Ishimoto Architectural and Engineering Firm Inc.
Location: Shibuya ku, Tokyo, Japan
Main application: Office
Site area: 1,151 m^2
Building area: 732 m^2
Total floor area: 5,347 m^2
Number of floors: +8,-2, Structure: S, SRC, RC
Completed: May 1999
Contact person: Mr.Nomura (annex@po.tateyama.co.jp)

Details of the Natural Ventilation System

- *Natural Ventilation Concept*
When the weather is fair, the wind comes into the offices and flows towards the void. With the natural ventilation system, the sensor automatically judges whether to open or close the electric windows and turn the linked air conditioner on or off.



Catalog House

- *Modes of Natural Ventilation System*
Conditioned air blows from the floor and goes back to the air-conditioner through slits on the ceiling. When conditioned air blows from the floor, it doesn't mix up the air in the room, and so helps to save energy.

When the outside temperature is lower than that on the inside, operated windows are opened and the wind comes from the outside. Energy for cooling is saved, the air-conditioner is kept operating.

When the natural ventilation is enough to maintain the room climate, the air-conditioner is turned off to save energy.

At night when the air outside is cool, sashes on the exterior wall and bypass dampers inside the ceiling are opened. The cool air is stored during the night and the next day's cooling load is decreased.

The ecological void. The windows open automatically for natural ventilation.

Further Information

More detailed information about these and other Annex 35 case study buildings can be found on the Web at:

http://venus.iis.u-tokyo.ac.jp/abst/Annex35-exp.htm

and at:

http://hybvent.civil.auc.dk/

Websites for Ongoing ECBCS Projects

Annex 35
HybVent (Hybrid Ventilation)

Control Strategies for Hybrid Ventilation in New and Retrofitted Office Buildings (HybVent)

Progress in Hybrid Ventilation

The life of the hybrid ventilation concept and Annex 35 have been closely related during the past four years, but now their ways are set to part.

The Annex 35 project will soon be finished and the results will be published in September 2002 as a booklet and a CD-ROM, that are to be widely distributed in the participating countries and via the ECBCS Bookstore.

However, the life of hybrid ventilation has just started. The investigations of first generation systems in Annex 35 have shown very promising results as well as pointing out the strengths and weaknesses of hybrid ventilation systems. The challenges for further improvements lie in three areas in particular: development of new integrated building and ventilation components; development of simple and robust control systems; and of easy to use performance prediction methods (based of life-cycle analysis) of buildings with hybrid ventilation and other passive technologies.

A note from Per Heiselberg, Operating Agent, Annex 35

Website

The Annex 35 Website can be found at http://hybvent.civil.auc.dk. This comprehensive, well presented and regularly updated site features an introduction to the annex, a collection of notes and photos about the annex's pilot study buildings, and a comprehensive list of publications, as well as a list of contacts and participants and a site guide.

The general information outlines the Annex's background, objectives, projected products and research programme.

The *Pilot Study Buildings* area shows how pilot studies in different countries are being used to implement hybrid ventilation systems and to demonstrate their performance. The studies include both retrofitted and newly built designs, and help to highlight similarities and differences in climatic issues. While concentrating on successes in hybrid ventilation, they also critically highlight some problem cases. Other sustainable technologies such as daylighting, passive cooling, passive solar gains etc, are also incorporated in the study buildings.

There is a two-page summary data sheet in pdf format and a list of reference papers where available for each study.

Publications

The results of Annex 35 are summarised in two final reports, and specific results of individual subtasks and workgroups are reported in technical reports and papers. The full *State of the Art Report*, summarising the initial working phase of the project, is available on the site in pdf format, including: an introduction listing the expectations for hybrid ventilation in the participating countries; a survey of 22 existing buildings; barriers to and opportunities for hybrid ventilation in building codes and standards; and control strategies and analysis tools.

The booklet *Principles of Hybrid Ventilation* will be the final product of the project. Besides explaining the principles of hybrid ventilation, it will include solutions for energy-efficient, comfortable and cost-effective hybrid ventilation as well as recommendations for control strategies and analysis methods.

Technical reports and analysis methods will be available in CD-ROM format, aimed at the building engineering community, helping engineers to design systems and to provide advice to architects. The booklet is expected to be available in 2002.

A list of around 50 research papers as well as the proceedings of the HybVent Forum 2001, are also to be found on the Website.

A restricted-access project area lists meetings, internal reports and workgroup activity.

Palzzina Building - one of the Annex 35 Case study buildings

Annex 36
Retrofitting in Educational Buildings - Energy Concept Adviser for Technical Retrofit Measures

The Website can be found at http://www.annex36.bizland.com/

Quoted from the website:

'The goal of Annex 36 is to provide Educational Building Decision makers with sufficient data, information and tools to improve their learning and teaching environments through the improvement of the energy efficiency of their buildings.'

This site is under development, but is well presented, colourful and informative. When complete it will feature a general introduction; FAQ; Articles/ Publications; Educational Building Case Studies; Links, Calculation Tools and Contact Details.

Currently the Links page is up and running and lists some interesting sites covering energy information, planning, design, green information and a selection of sites for sustainability in educational buildings.

Under *Publications*, the Annex 36 biennial newsletters are available in pdf format, and there is a list of related article literature.

The FAQ,Case Studies and Calculation Tools pages are not yet available.

Annex 37
Low Exergy Systems for Heating and Cooling

The site can be found at http://www.vtt.fi/rte/projects/annex37/ and is available in either Finnish or English.

The *General Information Annex 37* page gives a detailed outline of the project plan.

The *Publications* page for this site features Status Reports, LowEx Newsletters and Technical Reports from ECBCS Executive Committee Meetings, all in pdf format and easily downloadable. A comprehensive list of research papers produced by Annex participants would be useful here.

The *Links* page lists sites of conferences which have featured Annex 37 workshops, however some of the links were inactive at time of browsing.

The *Information for Participants* page is for consultation only at present.

Annex 40
Commissioning of Building HVAC Systems for Improved Energy Performance

The Website is at http://ddd.cstb.fr/annex40/annexe40.htm

This site is still under construction, but is well presented and will be informative when complete. It currently contains information on the annex's purpose, work organisation and work programme, participants, meeting information, and introductory technical information on some of the commissioning project's commercial building case studies. There is also a list of future conferences which Annex 40 participants are likely to be attending.

Annex 5
Air Infiltration and Ventilation Centre

Information from the Air Infiltration and Ventilation Centre

In June 2001, the Air Infiltration and Ventilation Centre (AIVC) started a new three year operating period. During this period, it is the intention to strengthen the role of AIVC as a dissemination centre in the area of air quality, ventilation and air infiltration in buildings. The new Operating Agent for AIVC is INIVE EEIG (International Network for Information on Ventilation) (www.inive.org) and there are at present five participating countries (Belgium, France, Greece, Netherlands and United States).

As part of its new strategy, all the information (AIVC technical notes, AIRBASE, etc) is now available on the AIVC-CD ROM, and this CD-ROM accompanies the Air Information Review (AIR) newsletter from September 2001. Moreover, the style of AIR has completely changed and the newsletter now offers information on a wide range of issues.

The INIVE members (BBRI, CETIAT, CSTB, Fraunhofer Institute for Building Physics, NBI, NKUA) have the right to distribute the newsletter and AIVC-CD free of charge to persons within their country, while others can take an annual subscription. For more information: www.aivc.org or info@aivc.org.

A note by Peter Wouters, Operating Agent, Annex 5

The website for this long-running annex contains all the information you will need to find out about AIVC activities. Don't forget to investigate the printed publications sale and the information on the newsletter and CD subscription.

New Reports from ECBCS

Annex 24 HAMTIE

Technical Synthesis Report by Hugo S.L.C. Hens, K.U.-Leuven, Department of Civil Engineering, Laboratory of Building Physics

Based on the five-volume final report of Annex 24
ISBN 0-9542670-0-1
Due Summer 2002

This summary report concentrates on Annex 24: Heat, Air and Moisture Transfer in Highly Insulated Envelopes.

Summary

Combined heat, air and moisture (HAM) transfer heavily impacts the energy performance and durability of well insulated building enclosures. Hence, the main objectives of the annex were to study the physics involved in HAM-transfer and to analyse the consequences for thermal performance and durability. Activities covered:

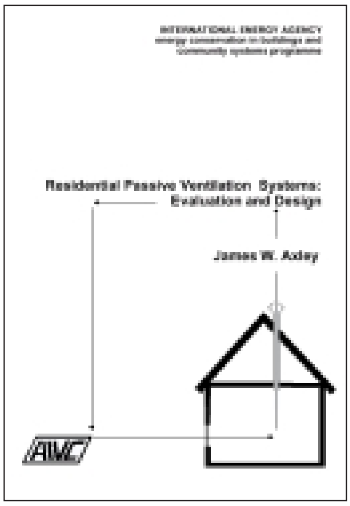
- Modelling of combined heat, air and moisture transport;
- An in-depth study of the environmental conditions involved;
- Round robin testing and data gathering in relation to material properties;
- Experimental verification and an analysis of the HAM response of a collection of envelope parts;
- Performance formulation in relation to HAM-transport and practice.

Annex 5 Air Infiltration and Ventilation Centre

Technical Note 54 Residential Passive Ventilation Systems: Evaluation and Design, by James W Axley, 2002

Attempts to answer the question: Can European passive ventilation systems be adapted for use in North American dwellings to provide ventilation in an energy conservative manner?

Reviews the configuration, specifications and performance of the preferred European passive ventilation system - passive stack ventilation (PSV); outlines innovative components and system design strategies recently developed to improve traditional PSV system performance; and presents alternative system configurations that may better serve the climatic extremes and more urban contexts of North America. Introduces a rational method to size the components of these and other systems to achieve the control and precision needed to meet the conflicting demands of new ventilation and airtightness standards. Finally, previews provisions of the new International One- and Two-Family Dwelling Code that are likely to relate to the installation of passive ventilation systems and puts forward proposals for changes to this code.



Technical Note 55 A Review of International Ventilation, Airtightness, Thermal Insulation and Indoor Air Quality Criteria, by Mark J Limb, 2002

Summarises available airtightness, minimum ventilation rate and indoor air quality requirements, standards, codes of practice and regulations. The report also attempts to determine the nature and type of thermal insulation requirements and the rationale behind the data outlined. Attempts have also been made to normalise the data, where appropriate to enable comparisons to be undertaken.

The two new Annex 5 reports are available as part of the Air Information Review/AIVC CD subscription package. For more details, visit the website at www.aivc.org.

The ECBCS Bookshop - www.ecbcs.org

c/o FaberMaunsell Ltd (Attn: Janet Blacknell),
Beaufort House, 94/96 Newhall Street,
Birmingham B3 1PB Great Britain
email bookshop@ecbcs.org, or janet.blacknell@fabermaunsell.com
Fax: +44(0)121 262 1994

Executive Committee Members

AUSTRALIA
Mr John Murray
National Executive Director, Master Builders Australia, 3rd Floor, Construction House
217 Northbourne Avenue, Turner, Canberra ACT 2612
Tel:+61 6 249 1433
Fax: +61 6 249 1373
e-mail: johnmurray@masterbuilders.com.au

BELGIUM
Prof Jean Lebrun, Director,
Lab.de Thermodynamique,
Université de Liège
Campus du Sart-Tilman, Bâtiment B49
Chemin des Chevreuils, B 4000 Liège
Tel: +32 43 664801
Tel: (Secretariat) +32 43 664800
Fax: +32 43 664812
e-mail: J.LEBRUN@ULG.AC.BE

CANADA
Morad R Atif
Director, Indoor Environment Research Program, NRCC,
1500 Montreal Road (M-24)
Ottawa, Ontario K1A 0R6
Tel: +1 613 993 9580
Fax: +1 613 954 3733
email: morad.atif@nrc.ca

CEC
Erich Nägele
DG RTD J3 MO75 7/18
200 rue de la Loi
B-1049 Bruxelles
Belgium
Tel: +32 2 296 5061
Fax: +32 2 299 3694
email: Erich.Naegele@cec.eu.int

CZECH REPUBLIC
Dr. Miroslav Jícha,
Associate Professor, Dept of Mechanical Engng., Technical Univeristy of Brno, Technická 2, 61669 Brno.
Tel: +425 4114 3271, Fax: +425 4114 3365,
email jicha@dt.fme.vutbr.cz

DENMARK
Mr Bjorn Hafstrom
Head of Section, Energy R & D, Danish Energy Agency, 44 Amaliegade, DK-1256 Copenhagen
Tel: +45 33 92 66 60
Fax: +45 33 91 55 81
e-mail: bkh@ens.dk

FINLAND
Mr Esko Virtanen
Programme Manager Construction Technology, TEKES Technology Development Centre, PO Box 69, Malminkatu 34
FIN-00101 Helsinki
Tel: +358 10 521 5833
Fax: +358 10 521 5904
e-mail: Esko.Virtanen@tekes.fi

FRANCE
Mr Pierre Hérant
Bâtiment et Collectivités, Agence de l'Environment et de la Maîtrise de l'Energie
Centre de Sophia Antipolis, 06560 Valbonne
Tel: +33 4 93 95 7947
Fax: +33 4 93 65 3196
e-mail:pierre.herant@ademe.fr

GERMANY
Mr Jürgen Gehrmann
Forschungszentrum Jülich, Projektträger Biologie, Okologie, Energie
Postfach 1913
D 52425 Jülich
Tel: +49 2461 614852
Fax: +49 2461 613131
e-mail:j.gehrmann@fz-juelich.de

GREECE
Mr Dimitrios Nomidis
Head, Energy Saving Division, Ministry of Development, Michalacopoulou str. 80
GR-101 92 Athens
Tel: +30 1 7709100
Fax: +30 1 7717612
e-mail: nomidisd@ypan.gr

ISRAEL
Mr Joseph Nowarski
Director – Energy Conservation
Ministry of National Infrastructure, P O Box 13106 , Jerusalem 91130
Tel: +972 2 5316115
Fax: +972 2 5316081
e-mail: jnow@mni.gov.il

ITALY
Dr Marco Citterio
ENEA SIRE HAB
C.R. Casaccia
Via Anguillarese 301
00060 S. Maria di Galeria
Roma
Tel: + 39 06 3048 3703
Fax:+39 06 3048 6315
citterio@casaccia.enea.it
www.enea.it

JAPAN
Prof Yuichiro Kodama
Kobe Design University, Gakuen-nishi 8-1-1 Nishi-ku , Kobe
Tel/Fax: +81 78 796 2571
e-mail: y-kodama@kobe-du.ac.jp

NETHERLANDS
Mr Piet Heijnen
Account Manager Sector Bouw, NOVEM BV, Swentiboldstraat 21, Postbus 17, 6130 AA Sittard
Tel: +31 46 4 202268
Fax: +31 46 4 528260
e-mail: p.heijnen@novem.nl

NEW ZEALAND
Mr Michael Donn
School of Architecture
Victoria University of Wellington
PO Box 600, Wellington 1
Tel:+64 4 463 6221
Fax:+64 4 463 6204
email: michael.donn@vuw.ac.nz

NORWAY
Dr Jørn Brunsell (Vice Chairman)
Norwegian Building Research Institute
PO Box 123 Blindern, N-0314 Oslo
Tel: +47 22 96 55 46
Fax: +47 22 96 57 25
e-mail: Jorn.Brunsell@byggforsk.no

POLAND
Prof Stanislaw Mierzwinski
Silesian Technical University
Faculty of Environmental and Energy Engineering, Dept of Heating, Ventilation & Dust Removal Technology, ul Konarskiego 20
44 101 Gliwice
Tel: +48 32 2 37 1280
Fax: +48 32 2 37 2559
email: kowito@kowito.ise.polsl.gliwice.pl

PORTUGAL
Mr Pedro Figueiral
CCE - Centro para a Conservaçao de Energia
Estrada de Alfragide, Praceta 1
2720-537 Alfragide
Tel: +351 2147 22814
Fax: +351 2147 22898

SWEDEN
Mr Conny Rolén
Formas
Box 1206
Birger Jarls torg 5
S-111 82 Stockholm
Tel: +46 8 775 4030
Fax: +46 8 775 4010
email: conny.rolen@formas.se

SWITZERLAND
Mr Mark Zimmermann
EMPA-ZEN, Uberlandstrasse 129
CH 8600 Dübendorf
Tel: +41 1 823 4178
Fax: +41 1 823 4009
email: mark.zimmermann@empa.ch

TURKEY
Prof Dr Rüknettin Oskay
METU Mech Eng Dept, Makina Mühendisligi Bölümü, Orta Dogu Teknik Üniversitesi
06531 Ankara
Tel: +90 312 2102539
Fax: +90 312 2101266
e-mail: mecheng@rorqual.cc.metu.edu.tr

UK
Mr Steve Irving
FaberMaunsell Ltd
Marlborough House, Upper Marlborough Road, St Albans AL1 3UT
Tel: +44 (0)20 8784 5784
Fax: +44(0)20 8784 5700
steve.irving@fabermaunsell.fsnet.co.uk

Mr Barry Austin
Ove Arup & Partners, 13 Fitzroy Street
London W1P 4BQ
Tel: +44 020 7465 3063
Fax: +44 020 7465 3669
e-mail: barry.austin@arup.com

USA
Mr Richard Karney (Chairman), Senior Technical Advisor, Office of Building Technologies, State and Community Programmes, US Department of Energy, Mail Stop EE-421
1000 Independence Ave, SW, Washington DC 20585
Tel: +1 202 586 9240
Fax: +1 202 586 1628
e-mail: richard.karney@ee.doe.gov

Current Projects and Operating Agents

5 Air Infiltration and Ventilation Centre (1979-)

Dr Peter Wouters
INIVE EEIG
Boulevard Poincaré 79
B-1060 Brussels
Belgium

Tel: +32 2 655 7711
Fax: +32 2 653 0729
e-mail: aivc@bbri.be
Web: www.aivc.org

27 Evaluation and Demonstration of Domestic Ventilation Systems (1993-)

Mr Lars-Göran Månsson
LGM Consult AB
Adler Salvius Vag 87
S-14653 Tullinge
SWEDEN

Tel: +46 8 778 5006
Fax: +46 8 778 8125
e-mail: lg.mansson@lgm-consult.se

34 Computer Aided Fault Detection and Diagnosis (1997-2001)

Dr Arthur Dexter
Dept of Engineering Science
Parks Road
University of Oxford
Oxford OX1 3PJ
UNITED KINGDOM
Tel: +44 (0)1865 273007
Fax: +44 (0)1865 273906
e-mail: arthur.dexter@eng.ox.ac.uk
and
Dr Jouko Pakanen
VTT Building Technology
P O Box 18021
FIN 90571 Oulu
FINLAND
Tel: +358 8 551 2033
Fax: +358 8 551 2090
e-mail: jouko.pakanen@vtt.fi

35 Control Strategies for Hybrid Ventilation in New and Retrofitted Office Buildings - HybVent (1998-2002)

Per Heiselberg
Indoor Environmental Engineering
Aalborg University
Sohngårdsholmsvej 57
DK-9000 Aalborg
DENMARK

Tel: +45 9635 8541
Fax: +45 9814 8243
e-mail: ph@civil.auc.dk
http://hybvent.civil.auc.dk

36 Retrofitting in Educational Buildings – Energy Concept Adviser for Technical Retrofit Measures (1998-2002)

Hans Erhorn
Frauhofer Institute of Building Physics
Nobelstr.12
D-70569 Stuttgart
GERMANY
Tel: +49 711 970 3380
Fax: +49 711 970 3399
e-mail:erh@ibp.fhg.de
www.annex36.bizland.com

37 Low Exergy Systems for Heating and Cooling of Buildings (1999-2003)

Markku Virtanen
VTT Building and Transport
PO Box 1803
FIN-02044 VTT
FINLAND

Tel:+358 9 456 4700
Fax:+358 9 455 4815
e-mail: markku.virtanen@vtt.fi
http://www.vtt.fi/rte/projects/annex37

38 Solar Sustainable Housing (with Solar Heating and Cooling Task 28) (2000-2005)

Hans Erhorn
Frauhofer Institute of Building Physics
Nobelstr.12
D-70569 Stuttgart
GERMANY

Tel: +49 711 970 3380
Fax: +49 711 970 3399
e-mail:erh@ibp.fhg.de

39 High Performance Thermal Insulation Systems (2001-)

Markus Erb and Hanspeter Eicher
Dr H Eicher and Pauli AG
Kasernenstrasse 21, CH-4410 Liestal
Switzerland
Tel: +41 61 921 99 91
Fax: +41 61 923 00 25
Markus.Erb@eicher-pauli.ch

40 Commissioning of Building HVAC Systems for Improving Energy Performance (2001-)

Jean Christophe Visier
CSTB, Head of Automation & Energy Management Group
84 Avenue Jean Jaurès, BP 02
F-77421 Marne la Vallée Cedex 02
France
Tel: +33 1 64 68 82 94
Fax: +33 1 64 68 83 50
email: visier@cstb.fr

Future Buildings Forum

Dr Jorn Brunsell
Norwegian Building Research Institute
PO Box 123 Blindern
N-0314 Oslo
Norway
jorn.brunsell@byggforsk.no

IEA Secretariat

Mr Clas-Otto Wene
Office of Energy Efficiency, Technology, R&D,
9 Rue de la Fédération
75739 Paris Cedex 15
FRANCE
Tel: +33 140 576622
e-mail: Clas-Otto.WENE@iea.org
www.iea.org

Lynette Rogers-Goderum
IEA Legal Office
9 rue de la Fédération
75739 Paris Cedex 15
France
email: lynette.rogers-goderum@iea.org

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