WISIONS
of sustainability

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PREP

Promotion of Resource Efficiency Projects

Resource Efficient Construction

I. Issue 2004

www.wisions.net

WISIONS

Sustainable development is possible

WISIONS is an initiative of the Wuppertal Institute for Climate, Environment and Energy, carried out with the support of the Swiss-based foundation Pro-Evolution to foster practical sustainable energy projects.

Sustainable development is possible. Numerous innovative and valuable contributions from different countries, fields and institutions have shown that an appropriate reconciliation of economic, ecological and social factors need not be unrealistic.

Although we have made a promising start, the greatest challenge still facing us in the 21st century is to learn how to use the world's resources in a more efficient, ecologically sound and socially balanced way. It is therefore necessary to foster projects of potential strategic global importance by supporting them so that they can be implemented locally. Examples of good practice need to be actively promoted to a wider audience.

WISIONS promotes good practice in resource efficiency through its publication of relevant successful projects in its Promotion of Resource Efficiency Projects: PREP

WISIONS also provides consulting and support to ensure the potential seen in visions of renewable energy and energy efficiency can be converted into mature projects through its Sustainable Energy Project Support: SEPS

SUSTAINABLE ENERGY PROJECT SUPPORT - SEPS

Realistic visions and concepts of effective projects for sustainable energy do exist, but the necessary implementation sometimes fails. SEPS has the key objective of identifying projects with the real potential to be of strategic importance in renewable and efficient use of energy.

By providing technical and other forms of support, SEPS seeks to overcome existing barriers and will help clean and efficient energy become commonplace. The most promising renewable energy and energy efficiency concepts are selected using transparent analysis based on internationally recognised criteria. Once a project is selected, SEPS can provide additional guidance and support, for example:

- Practical expert advice and knowledge transfer for an effective implementation
- Potential financial support to assist with project implementation
- Guidance and support for obtaining additional funding
- Promotion to relevant institutions, decision makers and scientists
- Publication on www.wisions.net

Resource Efficient Construction

One of the most important issues in achieving sustainability

In efforts by the global community to achieve real sustainability, building and construction is one of the most important issues. This sector accounts for around one-tenth of the world's GDP, for at least 7 per cent of its jobs, for half of all resource use, and for up to 40 per cent of energy use and greenhouse gas emissions. According to research by the Wuppertal Institute, industrialised countries use about 60 tons of non-renewable natural resources per person and per year for building and construction purposes. The continually growing "need" for space per capita is also leading to increased use of heating and air conditioning. Last but not least, larger buildings and growing cities require more and more space. As UNEP's Global Environment Outlook 3 notes, the growth of cities, roads and other infrastructure will entail the disturbance or outright destruction of habitats and wildlife on over 70 per cent of the planet's land surface by 2032 if swift action is not taken now. These facts turn the use of efficient and renewable energy in the construction sector into a critical issue.

With the first of our brochures, we focus on the significance of the construction sector and aim to collect world-wide innovative project approaches that have already been implemented to promote the concepts. Using a key number of internationally accepted criteria, the main considerations have been the energy efficiency and in a broad sense also the resource efficiency of the projects.

All projects that fulfilled our application criteria have been independently reviewed, and four of them which have the potential to have a significant impact on global energy and resource efficiency are published on the following pages. We are pleased to present not only good practice examples from industrialized countries but also ambitious projects successfully realized in South Africa and Brazil. Although all projects are unique they all carry replicable experiences and information that could be adopted by others in other places (bearing in mind the appropriate adaptation to the local and regional circumstances). The selected projects cannot represent the only correct direction for sustainable construction but they represent promising approaches in the field of sustainable construction.

The upcoming second brochure following the same objectives, namely to collect, evaluate and promote good practice examples, will highlight the issue of "Water and Energy".

Reconstruction of the old building complex

"Bremer Höhe" and provision of modern central energy stations

Location:
Berlin, Germany

Project's Aim:
Cost-effective, secure and environmentally friendly energy management

Technical Answer:
Central energy supply and combined generation of heat and power

Bremer Höhe is the name of three building complexes, completed in 1913 and located in Prenzlauer Berg, Berlin. In the beginning of the year 2000, the residents of the 455 residential units and 12 business units founded a cooperative, that reconstructed the building blocks in own responsibility. Not only is the involvement of tenants exemplary but also the energy supply of the buildings. In a nation-wide invitation to tender, the Berliner Energieagentur was awarded the contract for the energy supply of "Bremer Höhe".

The 455 residential units and 12 business units on a total floor area of 32,400 sqm, divided into three phases of construction, are supplied with heat and power by the Berliner Energieagentur. Three roof heating stations with boiler systems and Combined Heat and Power (CHP) modules provide heat and power. They are installed directly above the flats (bedrooms) and comply with the most exacting sound insulation standards.

BENEFITS

The Berliner Energieagentur provides energy management which is more cost effective than individual heating installations in each building. The resulting low cost of heating is around 0.66 Euro per sqm per month. The annual amount of primary energy saved due to the central energy supply by means of combined heat and power generation compared to conventional supply is around 1,100 MWh (corresponding to approximately 110,000 litres of fuel oil), while the reduction of carbon dioxide emission is around 450 tons annually.

TECHNOLOGY

The total heat demand on completion of all construction phases is 2.6 MW. Energy is supplied by three roof heating stations with three condensing boilers and six CHP modules with utilisation of calorific value. Their operation is heat-controlled and in parallel with the network. A low-voltage network installed in the basement provides electricity directly to the tenants in each construction block. Drinking-water of a high hygienic standard is provided using the flow-and-rinse principle. The plant is monitored by means of remote data transmission and recording, automatic malfunction reporting and around-the-clock on-call duty.

SUSTAINABILITY

With regard to financial as well as technological issues this project can be considered as sustainable. The contract period of 15 years ensures long-term cost-effective energy supply for the customers and allows the Berliner Energieagentur to operate the plants most efficiently. Furthermore, the Berliner Energieagentur as a contractor has taken over the responsibility for the planning, construction, financing and maintenance of the plants.

FINANCIAL ISSUES

The Berliner Energieagentur took over the financing of the project, supported by the German Reconstruction Loan Corporation and invested in the energy supply plants. This investment will be refinanced by selling electricity to the tenants.

OBSTACLES

One important obstacle was the necessity to install the three heating units under the roofs and directly above the bedrooms of the tenants and to find a solution which avoids any disturbing noise from the energy supply plants.

Since there are only a few technical obstacles, the project can easily be replicated. Replication is also supported by the use of a standardised contracting model developed by the Berliner Energieagentur.

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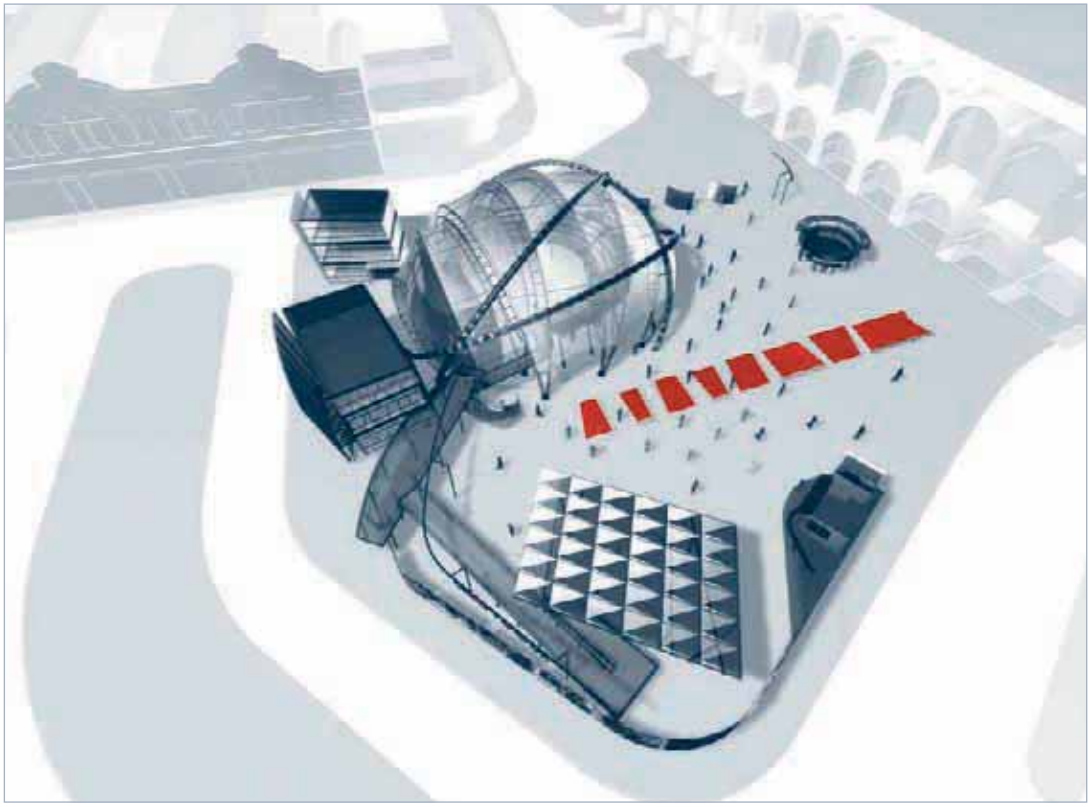
The Flying Circus – Low-Cost but High-Tech

Bio-Climatic Architecture in the Tropics

Location:
Rio de Janeiro, Brazil

Project's Aim:
Good thermal comfort under varying parameters

Technical Answer:
Air conditioning system based on a bio-climatic approach



The Flying Circus - Circo Voador - is a famous stage in Rio de Janeiro, Brazil. The main pavilion can hold up to 1,400 people and is equipped with professional stage lighting systems, both of which cause a high thermal load. High external temperatures and a semiopen pavilion created a very challenging situation for any air conditioning system. Comfortable temperatures for the audience under varying conditions had to be achieved: from classical concerts to rock concerts, from the high temperatures and high relative humidity of tropical summer nights to relatively low temperatures in winter nights. The solution was a combination of an architecturally well designed building for public use (project by DDG Arquitetura) and an intelligent low cost air conditioning system, based on a bio-climatic approach.

BENEFITS

Currently Brazil receives its electric energy from hydroelectric power plants. Considering the expected increase in energy demand, other additional resources such as fossil fuels will need to be included in the future. The current advantage of relatively clean energy will be lost. Therefore projects like the Flying Circus are important, because they demonstrate how a contribution to lower energy consumption is possible.

The Flying Circus can also be regarded as an important marketing tool for the dissemination of the bioclimatic, highly resource efficient approach in architecture. The alternative air conditioning system reduces the physical volume of installation and does not require CFCs or other harmful substances for the cooling cycle.

TECHNOLOGY

Low material input is combined with simple maintenance: 7 ventilators of 4.6 kW, a high pressure pump of 0.4 kW, 100m of 1 inch nylon tubes, 45 fog nozzles, and 6 sensors. The ratio between heat load and air conditioning system is 132:1. The bio-climatic approach, the intelligent use of the external climatic conditions and construction parameters, consisted of five different measures:

1) The cooling of the external areas in order to reduce infrared radiation: watering the surrounding granite covered areas transforms the stored heat into vapour in a short time.

2) Change of the geometry of the pavilion: a semicircular opening from the bottom to the top for exhaust was achieved by creating two shells which overlap in the horizontal plane, but are separated in the vertical plane.

3) Double-layer membrane with thermal insulation material: provides high acoustic insulation and together with the low thermal absorption by the white fabric, reduces the thermal load through solar radiation to a minimum.

4) High volume ventilators: seven high volume ventilators create a pleasant airflow in the pavilion. The speed of the ventilators can be reduced individually in order to influence the direction of the airflow.

5) Evaporation by a fogging system: in order to reduce the air temperature, water is dispersed under high pressure through "Fog nozzles", which create superfine water droplets. A system of air temperature and humidity sensors adjust the amount of water dispersed, thereby avoiding the "shower effect" in the case of high relative humidity of the ambient air.

SUSTAINABILITY

The Flying Circus can be regarded as financially and technologically sustainable, due to low investment and running costs, and simple maintenance. The low maximum input for the alternative system also allows a future use of photovoltaic panels as a back up system.

FINANCIAL ISSUES

The initial investment was at least 96 per cent lower compared to conventional air conditioning systems. The implementation costs accounted for 1 per cent of the total construction costs, compared to traditional air conditioning systems for office buildings which account for around 25 per cent of total costs. The running costs were low: a maximum of 15 kWh of electric energy and 1 cubic meter of water is needed for a 3 hour concert.

OBSTACLES

The most important obstacle to overcome was the doubts about modern bio-climatic systems. It was problematic to convince the owner to implement simple, but sophisticated systems. Stakeholders such as architects and clients often do not know the potential of the bio-climatic approach in the Tropics, due to a lack of realized projects. Furthermore, specialists in air conditioning systems are paid according to the size of the air conditioning system they have installed. If these obstacles can be overcome, the system can easily be replicated, because of the simplicity of the basic concept.

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Reducing energy demand in public buildings

by implementing Energy Performance Contracting

Location:
Kranj, Slovenia

Project's Aim:
Reducing energy costs and energy consumption

Technical Answer:
Energy Contracting

Like in many other economies in transition, Slovenia has a considerable energy saving potential but lacks the money for investment and also skilled people. In 1999 the project "Support for the Promotion of Third Party Financing of Energy Efficiency Investments in Slovenia" within the TRANSFORM programme supported by the German Reconstruction Loan Cooperation was launched. The project was coordinated by the Slovenian Agency for Efficient Use of Energy (AURE) and the Berliner Energieagentur.

The project included the identification of possible pilot projects in municipalities, the realisation of a pilot project in the municipality of Kranj and the qualification of local competence centres.

Within the project a model contract for performance contracting under Slovenian framework conditions was developed. A project for performance contracting was realized with a building pool in the municipality of Kranj. A tendering process was carried out and the Steirische Fernwärme GmbH (District Heating Company) in cooperation with its Slovenian partner EL-TEC MULEJ was awarded the assignment to carry out the project.

BENEFITS

Performance contracting projects like the one in Kranj show that efficiency measures in public buildings can be taken even without the use of public budget resources.

The project led to a decrease in non-renewable energy supply as well as to a reduction in direct and indirect greenhouse gas emissions due to the reduced energy consumption by the public buildings.

TECHNOLOGY

To achieve a reduction in energy costs, the following energy saving measures were carried out:

- Exchange of boilers and thermostats
- Installation of new control centres
- Adjustment of heating systems
- Renovation of heat distribution systems
- Fitting of thermostats to radiators

SUSTAINABILITY

The project is sustainable with regard to financial as well as to technological implications. Energy contracting is a win-win strategy in a public-private partnership where the private contractor guarantees the energy savings and is responsible for the financing, the planning and the installation of energy efficiency measures.

Another target of the project was to develop the energy contracting market in Slovenia. Therefore a considerable know-how transfer to Slovenian partners (AURE and the Jozef Stefan Institute as local competence centre) was included.

FINANCIAL ISSUES

The municipality of Kranj, an industrial centre about 30 km north of the capital Lubljana, annually consumes about 0.5 million Euro worth of energy in a pool of 14 buildings comprising administration buildings and schools. Within the 15 years of contract duration, the annual energy costs for the municipality of Kranj will sink from 514,000 Euro to 455,000 Euro; a total of 11.4 per cent of guaranteed savings (58,500 Euro annually), which were achieved after the first full accounting period on 1st Sept. 2003.

Investment costs accounted for roughly 324,000 Euro. The total investment is paid back out of the saved energy costs, resulting from overall savings in the 14 buildings of 15.1 per cent.

OBSTACLES

The most serious obstacles are the know-how deficits, the financing conditions from banks for long-term financing and the on-going adaptation of the legal framework to European rules.

Despite these problems, this energy performance contracting project can be easily replicated to other public buildings owned by municipalities, countries, states and institutions. A model contract (Energy Saving Guarantee Contract), developed by the Berliner Energieagentur exists, as well as other examples of projects in German municipalities.

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Retrofitting of low-cost urban housing –

many benefits for local population

Location:
Kuyasa, Khayelitsha,
Cape Town, South Africa

Project's Aim:
Reduction of GHG emissions and contribution to sustainable development

Technical Answer:
Energy efficient lighting, insulated ceilings, solar water heating

Kuyasa is a low-income housing settlement in Khayelitsha, which is a township located in the south-eastern side of the City of Cape Town. This township settlement consists of 30 sqm housing units which have been state subsidised by the governmental Reconstruction and Development Programme (RDP). The Kuyasa project is a retrofit project, to improve energy efficiency as well as to use renewable energy in existing RDP houses. The project is initiated by a partnership of the City of Cape Town and SouthSouthNorth, a non-profit developmental organisation. The project is designed as a Clean Development Mechanism (CDM) activity and aims to be certified with the high quality Gold Standard that guarantees benefits for local population together with to emission reductions. The demonstration phase of the project has been finished with ten successfully retrofitted houses.

BENEFITS

The Kuyasa project leads to environmental as well as to social benefits. With the switch-over to renewable energy (solar water heaters), and a decrease in non-renewable resources (coal for electricity generation) a reduction of greenhouse gas emissions (5,600 t CO2/a) has been achieved.

Additionally, there are annual energy savings of 3,115 kWh (Solar Water Heater: 1,443 kWh, Compact fluorescent light bulb: 268 kWh, Insulated Ceilings: 1,404 kWh) per household. The insulated ceilings contribute towards health cost benefits by a reduction in household dust. An improvement in the ambient temperature of the houses reduces the need for paraffin stoves and other heat sources which hold fire-related dangers and negative respiratory health impacts.

TECHNOLOGY

During the demonstration phase 10 existing RDP houses have already been provided with solar water heaters (3 KW input power), insulated ceilings and compact fluorescent light bulbs (two in each home, 11W and 16W).

SUSTAINABILITY

The project activity leads to an increase in local employment of about 139 person years of jobs during the 21 year life cycle of the project and thus to an increase in capacity amongst local artisans. All technologies are manufactured locally.

FINANCIAL ISSUES

The cost of resources so far amount to approximately 175,000 Euro. Further upfront capital of about 1.5 million Euro is needed for the whole CDM project. Financial returns of approximately 6.3 million Euro of energy savings and 1.8 million Euro of Certified Emission Reductions (CERs) are expected over the whole project lifetime of 21 years.

It has to be mentioned that without being designed as a CDM project and therefore generating tradable certificates, this project would not be cost effective.

OBSTACLES

The main obstacle for the Kuyasa project is financial. The demonstration phase was sponsored by SouthSouthNorth through donor funding. The implementation of the whole CDM project depends on further financing, but there are restrictions to using Official Development Assistance (ODA) in CDM projects. Therefore, work is underway to find a bridging finance source.

Despite financial problems, the Kuyasa project has huge replication potential in South Africa - with regard to the government's further housing objectives, as well as those in other developing countries - depending on the financial success of this kind of CDM project.

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