Stobbe Consortia

Presentation by Stobbe Consortia

Upgrade to Green Estate level

Western Cape energy crisis

Energy supply problems in all South Africa are associated with old building traditions.

During a drive around Cape Town's wonderfull high-end districts it's visible to everybody that NO insulation is used!

Some interesting points

- One partially build brand new home on Val de Vie had 40 mm insulation in the roof
- No houses in the Arabella Country Estate, Pearl Valley and others have insulation of any kind!
- Some new houses on Benguela Cove have only 20 mm insulation in the roof

40 mm insulation is comparable to the Danish standardt in the 1950s!

Workshops like the "Sustainable and Energy Efficient Building in Africa" 2006 arranged by DME is known to all of us, but suffers from lack of affectivity in implementing these good intensions into every day practice.

At the "Building Well" seminar in Cape Town October 2007 Glynn Morris in detail explained the complex South African energy situation and tradition of house design.

Another interesting point

The online magazine Engineering News of South Africa refers, February 2008, to Phillip Harrison (executive director of development planning and Urban management) who says "All building plans and site development plans will, in future, be evaluated in terms of measures to promote low energy consumption buildings".

We understand that electrical power is now distributed on a non continued basis! We are also part of an European research team, which develop Solar Thermal Power Plants relevant to implement in South Africa. But, we believe that upgrading building traditions is a faster and readily available way of distributing electricity to all the people of South African. Though both techniques will reduce the use of fossil fuels and hereby reduce the rising energy prices and reduce the CO2 emission.

Estates needs new standards for energy consumption and home design

Insulation products are available from several manufactures inside South Africa. Thousands of workers are eager to be trained to implement the highly needed house design upgrade. If only they knew how to do it!

Excellent 30 page *"Guide For The Construction Of Enviromentally Comfortable Homes"* from 2005 is available from TIASA, "Thermal Insulation Association of Southern Africa".

Several articles in the international magazine "*Sun & Wind Energy*" January 2008 explain that solar power is hardly in use in South Africa! Despite the excellent weather!

John Ledger (chairman of SESSA) explains that ESKOM expects that 900,000 simple solar heaters will be installed on low-end to middle-class homes over the next five years. (though such will have limited effect on the general electrical power consumption)!

In the online magazine "*Engineering News*" Bruce Kerswill from "Spire Property Services" explains "What is lacking in South Africa at the moment are standards and benchmarks to assist with green building" among others.

Allow us to conclude

- Transfer of hands-on how-to-do know-how seems to be necessary – simply on-site training
- Transfer of higher standards for luxury homes / estates than the present ambition – is necessary

The following pages will explain our proposal.

John Ledger

Inspiration to all of us!

Department of Minerals
and Energy Minister
Mrs. Buyelwa Sonjica

DME – Department of Minerals and Energy Minister Mrs. Buyelwa Sonjica has explained that a campaign involving power rationing, which forms part of the integrated national response plan to the current power crisis involved power rationing, has already been implemented.

The urgent development of a “national response plan” to cope with the crippling power outages experienced throughout South Africa emerged as a prominent issue at the African National Congress’ National Executive Committee (NEC) over the weekend.

Comments from the online magazine
“Engineering News” April 24th 2008.

Its simply amazing

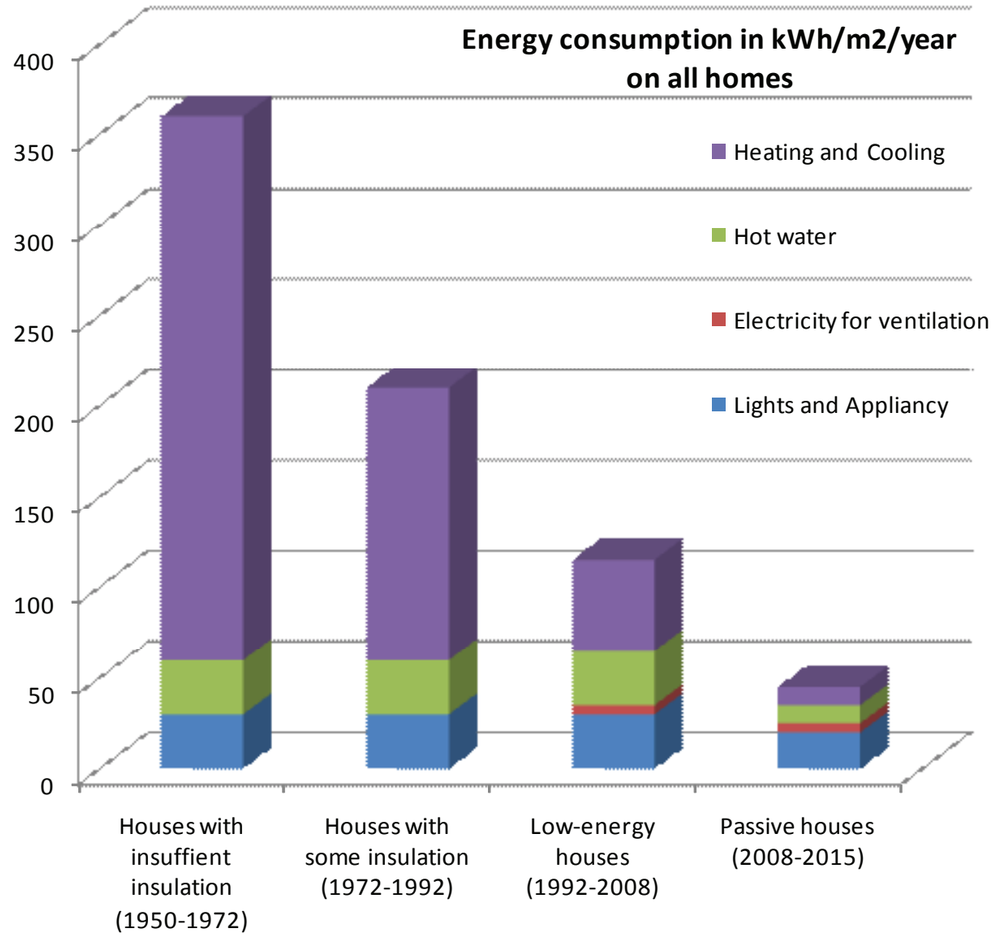
- Some communities in Europe have recently started introducing the latest technology passive homes – without any heating / cooling arrangements!

- Heat your home with 10 candle lights – even when it’s minus 15°C outside!

- Proper insulation and energy management makes the difference!

Energy consumption in Denmark

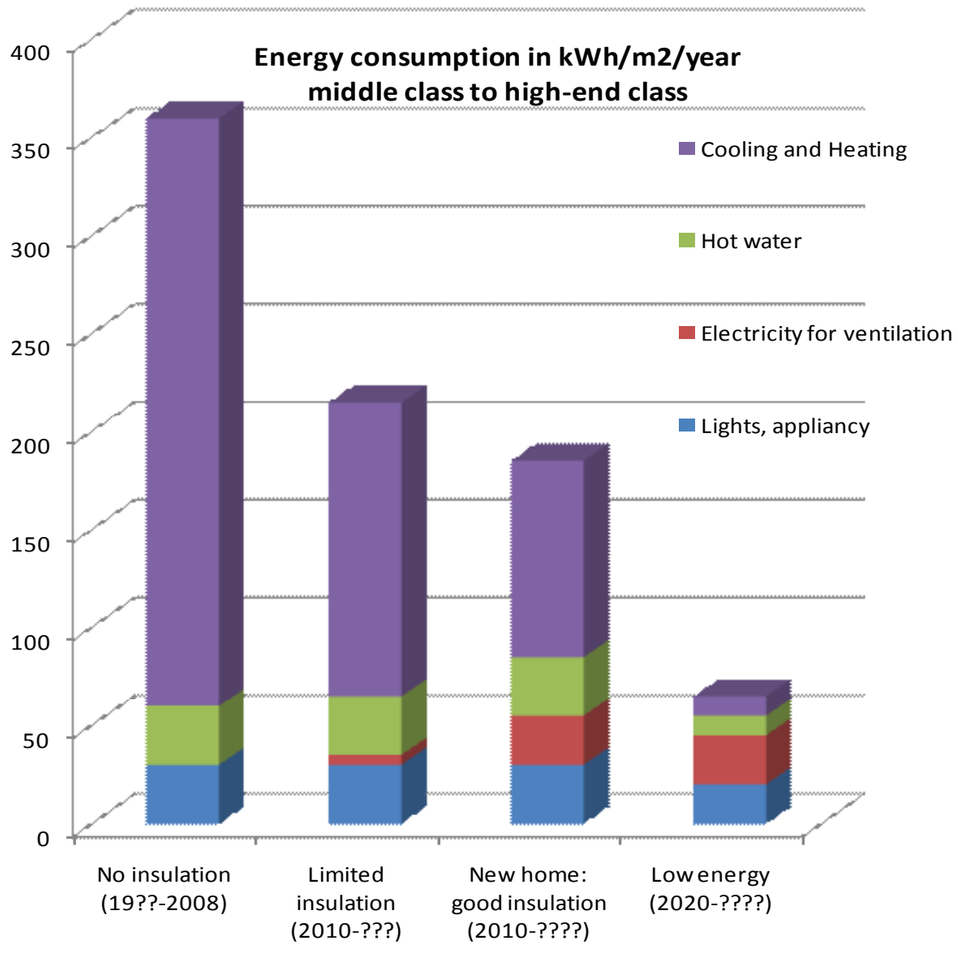
On global latitude 56° north



	No insulation	Limited insulation	Present standard	Future standard
Year	1950-1972	1972-1992	1992-2008	2008-2015
Heating/cooling demand, kWh/m²/year	300-400	100-150	40-50	<15
Standards	No insulation, difficult to heat/cool comfortable	Thermal insulation of existing homes	Low energy homes of today	Passive homes
Outer cavity wall heat transfer value, Wm²/k	1-2	0.4	0.2	0.13
External wall insulation thickness, mm	0	60	160	300
Roof heat transfer value, Wm²/k	1-2	0.22	0.15	0.1
Roof insulation thickness, mm	0-30	200	300	400
Foundation in contact with soil, Wm²/k	1-2	0.4	0.25	0.15
Foundation insulation thickness, mm	0	60	100	250
Windows	One layer glass	2 layer air filled, wood frame	2 layer energy, wood frame	3 layer energy, special frames
Window heat transfer value, Wm²/k	5-6	3	1.8	1
Ventilation	Non tight home natural wind	Open windows	Forced ventilation system	Forced ventilation system with energy exchange
C02 emission, kg/m²/year	60	30	10	2

Energy consumption in South Africa

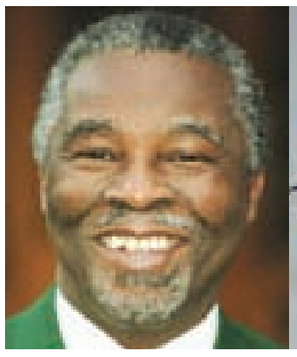
On global latitude 34° south



	No insulation Present standard	Limited insulation	Resonable insulation	Potential new high standard
Year	19??-2008	2010-????	2010-????	2020-????
Heating/cooling demand, kW/m²/year	300-400	150-250	100-150	40-50
Standards	No insulation, difficult to heat/cool comfortable	Thermal insulation of existing homes	Thermal insulation of new homes	Low energy homes
Outer cavity wall heat transfer value, Wm²/k	1-2	0.6	0.4	0.2
External wall insulation thickness, mm	0	50	60	160
Roof heat transfer value, Wm²/k	1-2	0.22	0.22	0.15
Roof insulation thickness, mm	0-30	200	200	300
Foundation in contact with soil, Wm²/k	1-2	1-2	0.4	0.25
Foundation insulation thickness, mm	0	0	60	100
Windows	One layer glass, alu frame	2 layer air filled, wood frame	2 layer gas filled, energy type, wood frame	2 layer gas filled, energy type, wood frame
Window heat transfer value, Wm²/k	5-6			
Ventilation, air con system	Non tight home, lots of air con, not comfortable	Ventilation / air con system with energy exchange	Ventilation / air con system with energy exchange	Ventilation / air con system with energy exchange
C02 emission, kg/m²/year	60	30	20-30	10

Target for energy consumption

Don’t we all want to show Minerals and Energy Minister Mrs. Buyelwa Sonjica and President **Thabo Mbeki** that a luxury home estate can cut energy consumption significantly?



President Thabo Mbeki

Department of Minerals and Energy Minister Mrs. Buyelwa Sonjica

Reduction from present electricity consumption of 200-400 kW/m2/year to only one fourth or less than 100 kWh/m2/year will illustrate its highly relevant and set new standards for building traditions in South Africa.

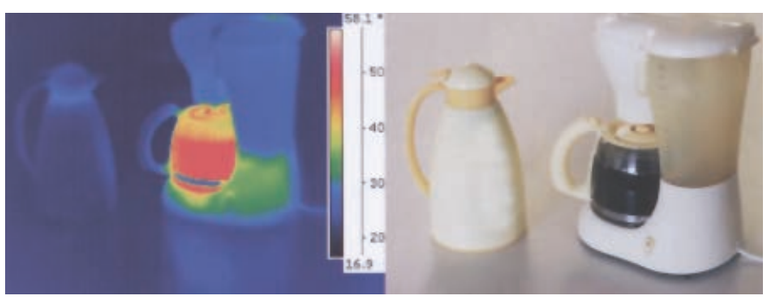
Why don’t we integrate the needed skills, know-how into the South African people?

Techniques and legal thoughts

Careful and in depth house design based of the following:

- Insulation of the roof
- Insulation of the wall
- Optimum window design
- Insulation of the floor and foundation
- Solar shading
- Building integrated solar heating and solar power systems
- Clever air conditioning and ventilation
- Home energy management
- Estate energy management
- Healthy building materials
- Optimised indoor climate conditions
- Minimised cooling needs makes the difference!

All the above should be possible to integrate into high-end estates in all South Africa.



The insulated coffee container allow a huge temperature difference!

It will take some dedicated effort and 3-5 years depending on the size of the project. And off cause require resources, skilled and committed people, support from the community, the estates, architects, energy consultants, etc.

Do the new building offer similar features at very low electrical power consumption?

Its all about training!

Legal presentation – phase A

A phase divided proposal from the consortia with a 3-5 year completion period

- **Phase A – feasibility study including the offer for Phase B and Phase C**
- **Phase B – new home design and demo houses**
- **Phase C – existing house renovating**

According to the presented contract the consortia propose:

An addendum / feasibility study in association with the receivers guidelines specifying constructions which specify:

I. the new rules for house re-design focuse in specific on reduced electrical power consumption by as much as 75% (phase B)

II. substantially increase comfort levels in the home by avoiding the inconveniences related to traditional air conditioning (phase B)

III. such benefit with an increase of the building costs corresponding to around 10-15% extra of the ordinary home costs (phase B)

IV. furthermore rules for reduction of the electrical power consumption associated with existing house design in as described in the relevant receivers guidelines by around 25% (phase C)

V. such benefit based on associated cost to be described detailed

Legal presentation – phase B

A detailed feasibility study, offer according to which the consortia in full acceptance by the receiver will transfer the complete KNOWHOW and the complete SHOWHOW needed for building houses living up to the specifications in the design guidelines addendum in the following way:

I. The consortia shall provide the receiver with all the relevant detailed descriptions with drawings and specifications of materials showing how to put the constructions into practice. The descriptions and time frame to be provided shall be listed in the offer. The descriptions will be provided by means of a structured homepage which shall be accessible to the receiver and those who the receiver authorize to have access only – e.g. the architects, engineers, etc.

II. The consortia shall buy a plot on the estate and the consortia shall build a suitable house based on the new design guidelines including the addendum and in every mean fulfil the expectations of reducing the power consumption by as much as 75%.

III. The offer shall specify the means of measurements of the power consumption of the house, online measurements of which the consortia shall make available on the associated website

IV. The receiver shall on reasonable terms be entitled to use the house as a show house with respect to the power saving solutions implemented in the house on the plot and the increased comfort obtained thereby.

V. The offer shall specify the technology transfer, which shall allow the receivers controlling architect to apply the addendum to the design guidelines when approving the building plans in accordance with the design guidelines.

VI. The offer shall specify that the controlling architect shall be capable of controlling the processes on the estate according to the present guidelines.

VII. The consortia will operate the associated website for the period of 3 years and hereafter hand over the site to the receiver

Legal presentation – phase C

A detailed offer according to which the consortia on acceptance by the receiver will transfer the complete KNOWHOW and the complete SHOWHOW needed for re-building, re-insulating existing houses living up to the specifications in the design guidelines addendum mentioned in the following way:

I. The consortia shall provide the receiver with all the relevant detailed descriptions with drawings and specifications of materials showing how to upgrade the present existing homes on phase one. The descriptions will be provided by means of a structured homepage, which shall be accessible to the receiver and to those who the receiver authorize to have access only – e.g. the architects, contractors, customers.

II. The consortia shall re-build at no cost for two home owners with a suitable house on the receivers estate based on the old design guidelines and in every mean fulfil the expectations of reducing the power consumption by as much as 25%.

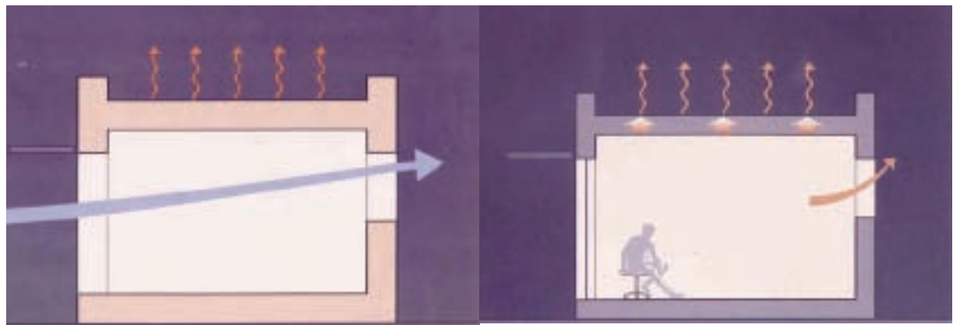
III. The offer shall specify the means of measurements of the power consumption of the house, which measurements the consortia shall make available on the associated website.

Roof techniques

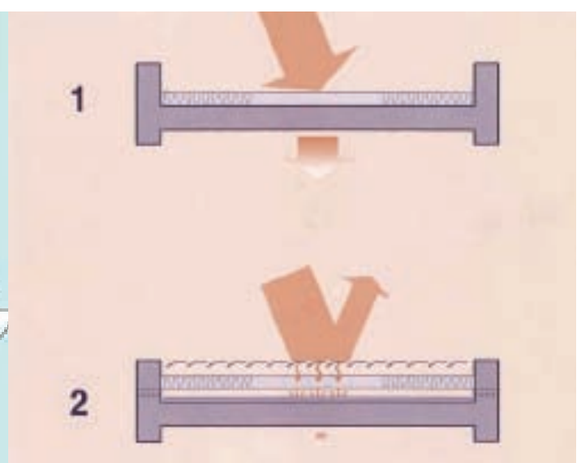
The more insulation the better you feel

Insulating the roof space are the only effective way of reducing heat gains during daytime hours. Anyone can figure out the 70°C on the slate roof during the day do increase the indoor temperature dramatic. When the roof is insulated with more than 200 mm carefully mounted insulation this effect is eliminated.

Natural ventilation utilising wind, which controlled and during the night pushes cold air through the house, is an effective way of reducing general power consumption.
A massive roof construction can, through exposure to cold air during the night, emit a cooling effect during the day.



The photos below shows the quite often seen roof standards from the inside and it is simply unspeakable!

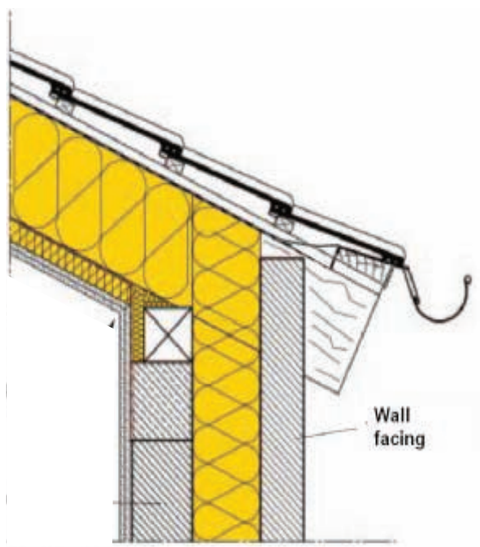


Wall techniques

Carefull insulation with 150 mm and clean double wall is needed

The introduction of double stone wall with fibre insulation half a century ago is one of the great contributions from our consortia. The awareness and training of the perfect wall insulation is critical for the green house.

Through insulating all outer walls, warm air and radiation can better be held out, whilst cooler air can better be held in. Massive internal walls can likewise hold and maintain constant cool air inside, this occurs because a wall with a high density can better maintain a stable temperature.



Another means of maintaining a cool inner climate would be to extend the roof line beyond the exterior walls. By creating shading on the outer wall surface, overheating of the house is prevented.

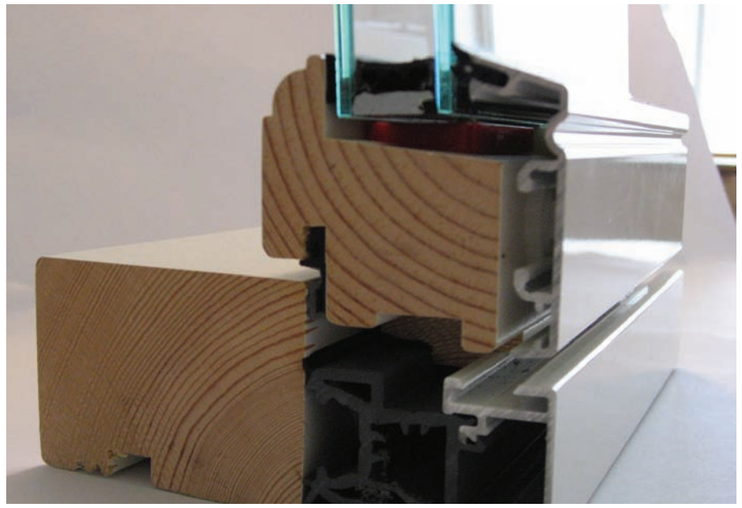
Use the wall for dumping trash and rubish is not to be associated with luxury homes!

Window techniques

Insure generous wood frames and 2-3 layers of glass

If large window panes are placed towards north, roof verandas including solar ceels should be established, in order to cast shade on the building glass surface. But at the same time give pleanty of light inside.

In order to maintain a cool inner climate, it is important that windows units have absolutely not heat losses, are carefully sealed, so as to produce a tighter and more controllable building envelope.



For windows which are difficult to shade, special glazing can be useful in preventing unwanted heat gains whilst retaining the view and light.

Absorbing glass reduces the overall transmission of solar radiation through the window by cutting down on direct transmission and increasing re-emission towards the exterior after absorption.

Reflecting glass is coated with a thin layer of highly reflective metal oxide. The film is normally placed on the inside face of the outer layer of glass or the outside face of the inner layer of a double glazed unit to protect it.

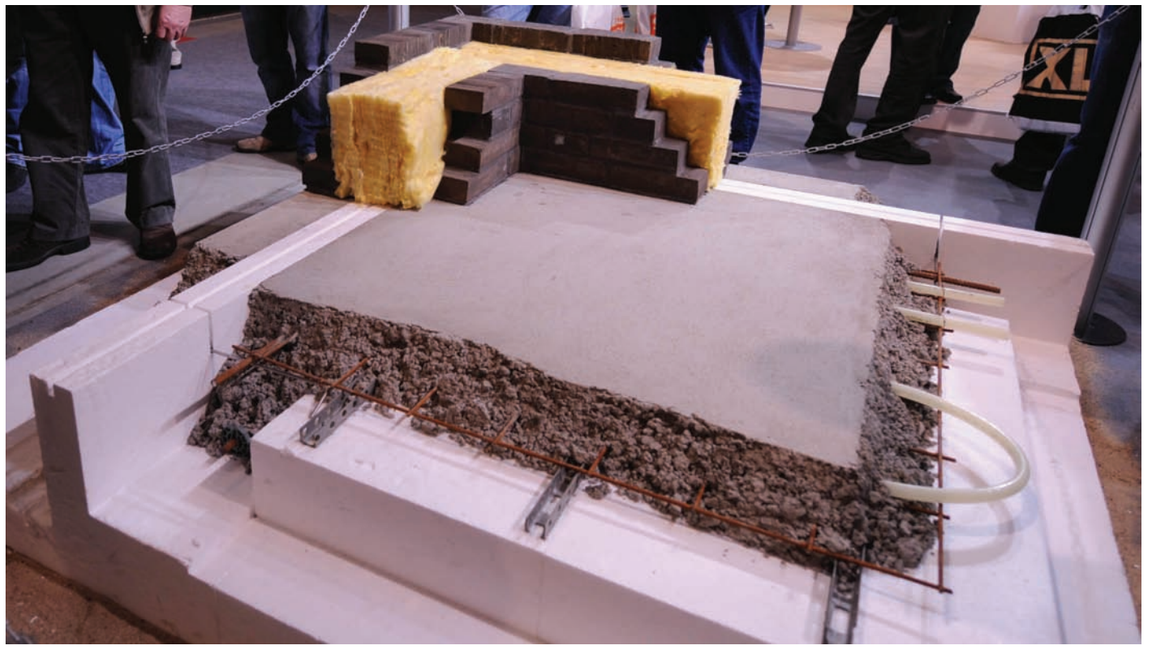
Foundation techniques

Heavy insulation and careful orientation

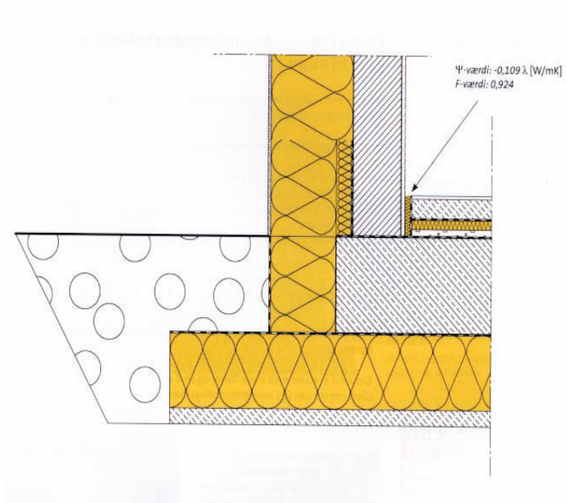
Avoiding every heat loss / heat gain areas in association with thick insulation around “the foot of the house” is furthermore one area of significant importance.

In luxury home comfort is of high importance and underfloor heating should be utilised in every room. But only practicle possible with low power consumption if the foundation is heavily insulated. For the perfect re-designed luxury home incoorporated with energy managemant system the floors can be kept at comfetable 26°C while the room temperature is kept at 20°C. And no conventional air-conditions is needed!

The placement of the house on the plot is important in relation to north and south. If large windows are placed primarily towards south, then little heat can be gained in the house. Should the house be built around an open courtyard, windows can be shaded and a manageable climate can be more easily achieved. Or take advantage of the fauna to establish shade.



Typical South African foundation standards with absolutely no insulation.



Typical European foundation standards with lots of insulation.

Solar Shield Techniques

Avoid mechanical cooling and expensive use of the scarse resources of electricity

Solar radiation can be prevented from reaching all or part of the walls, roof or windows of a building by the use of shading. Shading can be provided by natural vegetation, neighbouring buildings or the surrounding landscape. Shading devices can prevent direct, reflected and diffuse radiation reaching critical parts such as windows. Awnings can reduce heat gain by up to 65% in summer on north facades.

Movable Shading Systems

Externally mounted and movable shading is highly recommended. Control can be either manual or power-assisted and may by automated to respond to changing conditions such as dynamic radiation, day lighting or thermal requirements.

Fixed Shading Systems

Fixed shading systems include structural elements such as balconies and projecting fins or shelves and non-structural elements such as canopies, blinds louvers and screens. Shading systems may preferably incoorporate solar cells as seen on photo to the left and thus provide shading while at the same time producing electricity.

Design of Openings

The balance between heating, cooling and day lighting is a critical consideration for the choice of orientation and sizing og openings. The design of openings will usually depend on the building type and may be influenced by building regulations, particularly with regards to maximum or minimum glazed areas. The use of devices such as overhang and shutters or high performance glazing may allow the designer some scope to correct or limit adverse effects of unfavourable orientations or large glazed areas.

Integrated Solar Cells

Solar panels can be used to provide both electricity and simultaneously provide shading if they are placed directly on the window pane. If there are large windows facing direct north, then solar panels can be used when mounted on window shutters or louvers.

Building integrated solar collectors

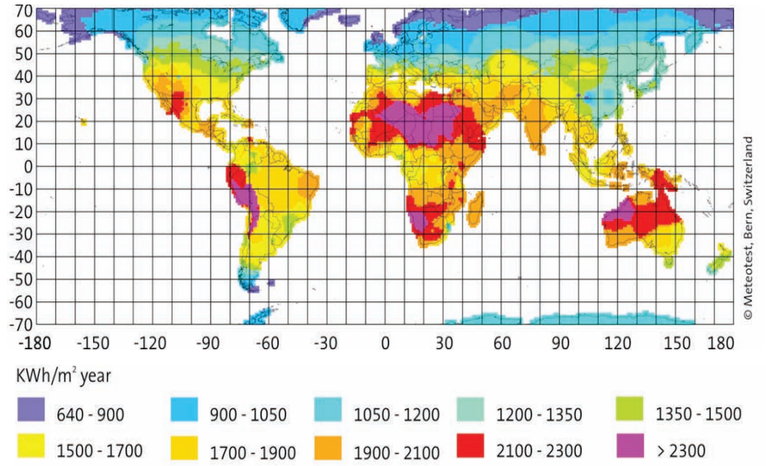
South Africa are one of few regions with very high solar power usage

The main components in an active solar heating system are the solar collector, which converts the solar energy into heat, the solar heating circuit, which transports the solar heat in liquid or gaseous state and the storage, which can store the solar heat for later usage.

There are many applications for a solar water heating system.

- Heating of domestic water
- Space heating like heated floors for higher comfort also in the summer time
- Outdoor swimming pools is simple to heat up 10 degree
- Invisible solar cooling is an alternative way of loosing heat through the roof over nigh time by reversing the collector functions.
- Visible solar cooling usually through the application of the technical advanced absorption cooling system. This system is especially interesting where the intensity of the sun and the need for cooling is high like in South Africa.

Global radiation



A huge number of suppliers around the world offer visible high efficiency solar collectors. Often difficult to integrate invisible into conventional luxury homes.

Though South Africa have a production of invisible solar collectors designed specifically for luxury homes being very easy to integrate into the building without any change of the apperance of the roof.

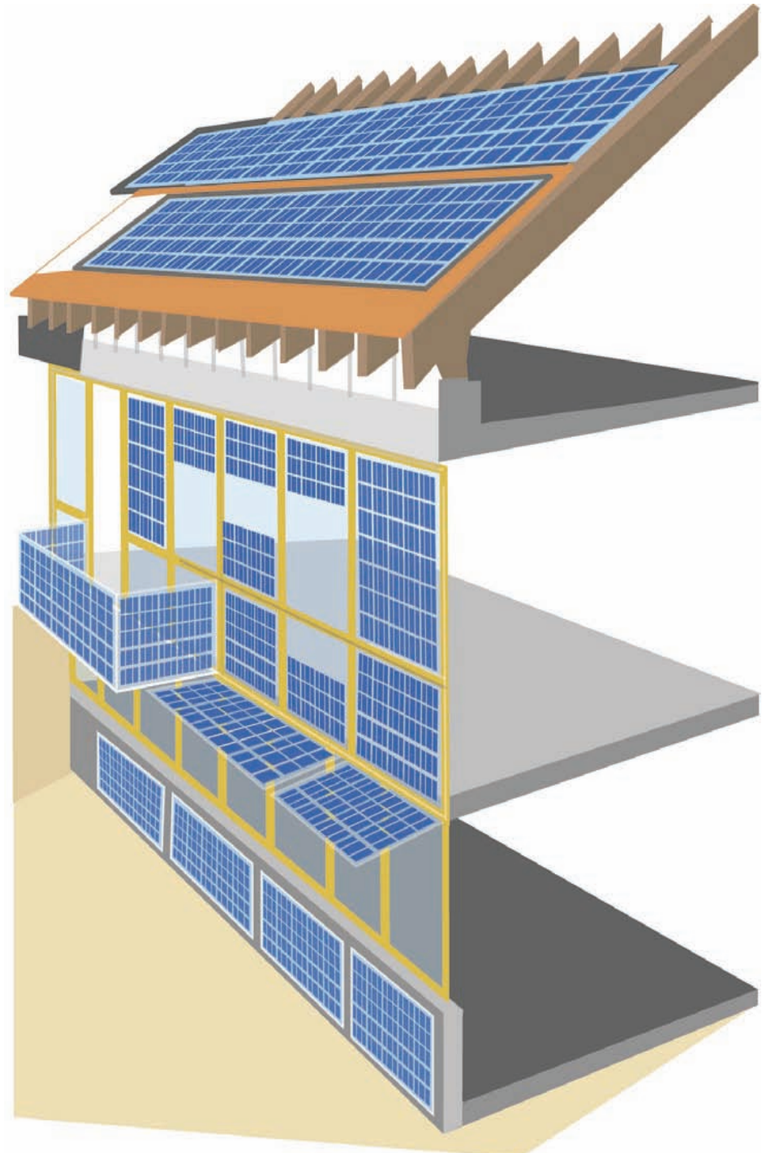
Solar cell integration techniques

Photovoltaic systems directly convert solar irradiation into electric current without any intermediate thermal, chemical or mechanical steps. No harmful materials such as CO^2 are released and no noise is produced. Furthermore solar energy is inexhaustible and available everywhere.

2,200 kWh irradiation per square metre results in solar cells producing impressive 220 kWh of electrical energy per year per m^2 in South Africa.

Carefull integration of solar cells with a high level of architectural effects can eliminate the visual effect to an acceptable level. Solar cell systems are typically placed on or in facades in different ways, like:

- Integrated and not really visible
- Built-on, somewhat visible and not really wanted
- In windows, glass roofs, sky lights or as movable shading systems
- In parapets, low building parts
- In glass facades offering a visul effect, but still acting as a screen
- As static sun screens or direct shielding on terraces



Air-condition and ventilation techniques

The more insulation the less air condition – it's as simple as this!

Air-conditioning

In general air-condition is highly needed in hot countries where ever the building standard is from the 1950s! And in luxury home estates all over South Africa several or as much as 5 air-con units is noisy, architectural negative, inside windy and in general offering very low comfort.

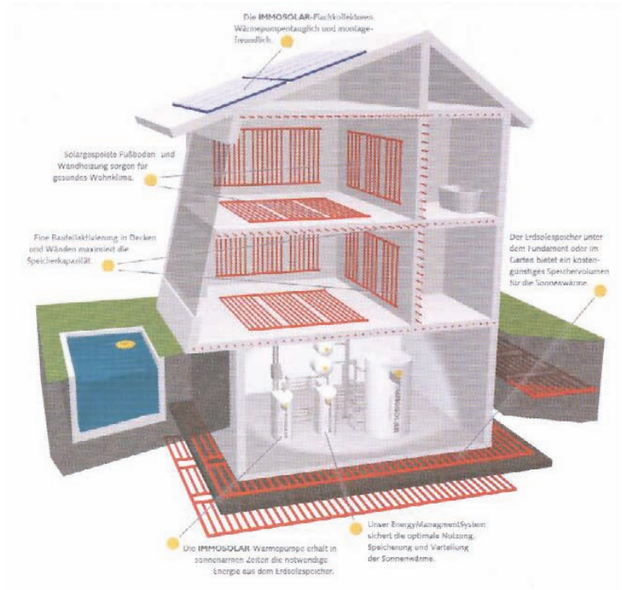
With the thermodynamic laws as back ground two bodies will try to insure even temperature over a wall. So if the black slate roof is 70°C hot on a beautiful day and the family need 20°C inside the home – then enormous energy is needed to establish and keep this temperature difference constant.

So by increasing the technical insulation level the corresponding need for air-condition is reduced.

Ground Cooling

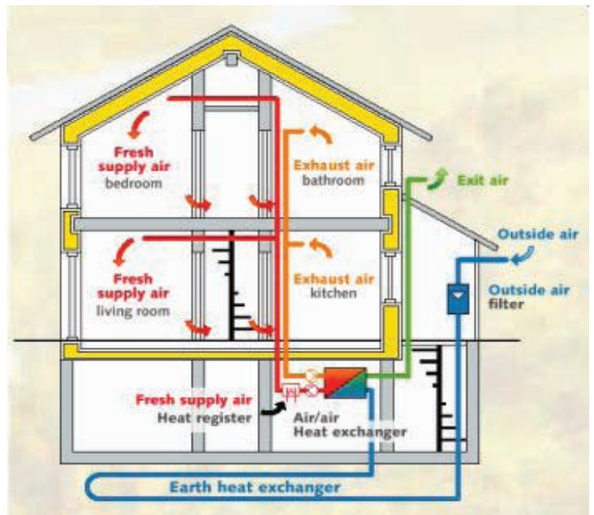
During the summer, soil temperatures at certain depths are considerably lower than the ambient air temperature, thus offering an important sink for the dissipation of a building's excess heat.

Two meter in the ground, basically below the basement floor, the temperature is constant around 17° all year round. It is not rocket science to wish advantage of this resource. But its rocket to make its happen.



Ventilation

Ventilation in hot climates provides no cooling and doors, windows should be kept closed to allow the intelligent ventilation control the indoor comfort.



Combined air-con and ventilation

Combining the available resources with the latest technology heat exchange ventilation and ground cooling eliminate the need for air-con in the perfect insulated luxury home.

Energy Management Techniques

It is desirable if energy usage in the home is to be reduced, that the occupants understand how the technical elements installed in the home function.

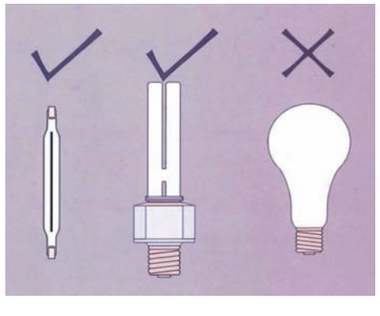
Though the new home owner interface features also a fully automated Monitoring & Targeting system that monitors actual energy consumption and utility use against the desired target. Like correct temperatures on the floors, in the rooms, in the room air, in the water, for comfortable living.

Much energy can be saved by, for example, maintaining an ambient temperature in the living room of 21°C, whilst unused rooms are held at a maximum five degrees higher. Like shutters which will be closed during the day controlled by the intelligent house.

The users of these energy optimised houses will be provided with an on-line intuitive user manual, which will safeguard a sustainably low energy use.

Each home will feature:

- room lightning turns on and off automatically
- motion sensors in every room monitors the behaviour of the family
- low energy bulbs or LED bulbs to be installed only
- window area sliding doors to be opened and closed by automatic means
- automatic shutter doors
- controlled temperature individually on floors and walls
- sensing contacts on every door and window
- controlled water temperature and use of hot water



Energy Distribution Techniques

Every home in the estate is optimised and able to supply electrical power to the local grid

The consortia propose that all houses share at no cost energy production from within the estate and pay for energy resources from outside, like from Eskom.

Load and production sharing

In the modern world with increasing environmental awareness the green estate will eventually demand that every luxury home produce several thousand of watts of solar power. When every super insulated house at the same time use very limited power, then the local 400 VAC estate grid may be of reduced capacity and corresponding lower cost.

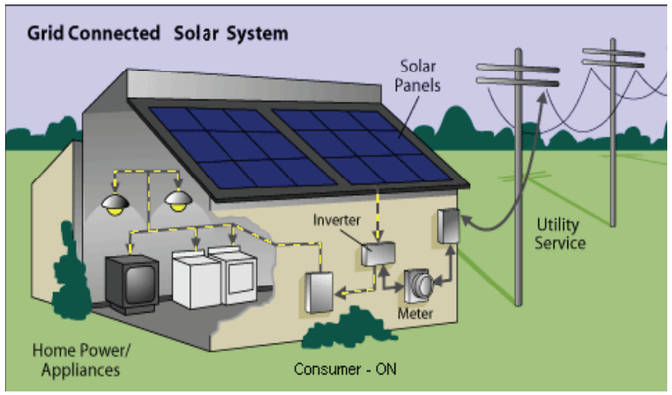
One may consider external load sharing and internal load sharing principles. If the within the estate load sharing is highly optimized then external load sharing become of much less importance.

Internal load sharing is based on the fact that most of the houses are not I use most of the time. But all the houses with building integrated solar cells do produce electrical power all over the year. All the houses produce power for a limited number of houses in use!

Energy export

In some periods the energy production from the estate will increase the energy needs. This means that either the energy may be sold to surrounding users like Eskom or it may be stored in large insulated heat storages or in electrical batteries for later use. On an annual basis the estate will in this way be independent of external energy supply.

In order to fulfill other energy needs it may also be an option to establish a local solar based power plant. This may be an even more interesting and enable to estate to be a plus energy estate.



Intranet connection

It obvious to the interested reader that every PLC (home control system) mandatory in every home is connected to the intranet of the estates. From the centrally located server load sharing among the houses may easily be controlled and monitored. And not to forget optimization of every house may be supported centralized.

DEMO houses

The consortia is willing to take the responsibility of building one or two houses according to the ambitions of the present presentation, the improved guide lines being the result of the collaboration with the estate architects, the completion of phase A and acceptance of phase B.

The consortia offers supply of a reasonable amount of European highly skilled craftsmen, technicians, architects and engineers to be present efficiently in South Africa before, during and after the construction of the DEMO homes.

These persons will all act as teachers in order to transfer the complete amount of know-how to the locals and associated South African committed work force.

During erection of the homes a full time associated photographer and jounalist will document the whole process. For widespread presentation in schools, local forums and universities.

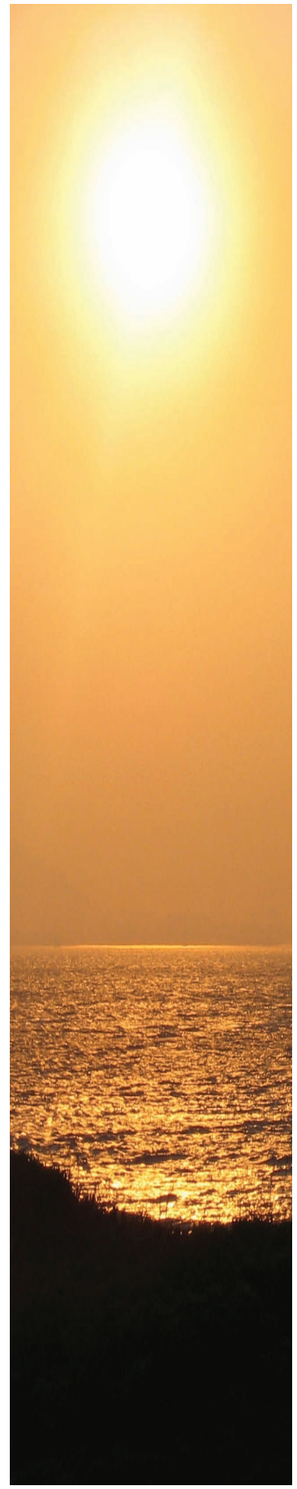
During the whole process a full time professional physiologists will support the process, the training of the local work force and documentation of the whole process.

The consortia will deliver a fully detailed completed house ready for the average high-end home owner. The house will have the latest technology Programmable Logic Control for the lowest possible power consumption and user friendly management. The house will offer the home owner an as yet unknown level of comfatable living utilising the latest European standards of information level of power usage (no cold winds inside the home, even temperaure all over the home, warm floors).

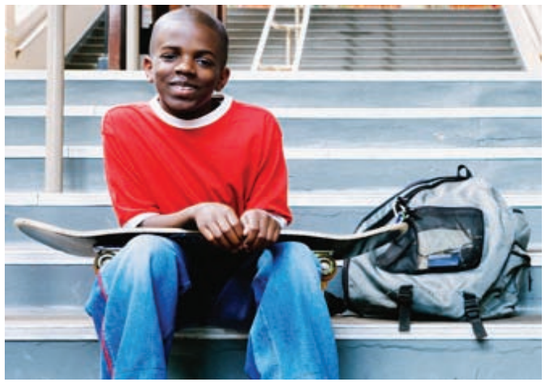
The house will act extremely environmental friendly and not allow excessive usage or unnecessary power consumption according to the programmed plans and interaction with other houses on the estate.

The house will perform intelligently and will actively help the home owner to act more environmental friendly in such a intelligent way that the home owner's family will adjust their behaviour.

The consortia will ensure the houses and property will be perfect in every means.



Training of locals



Consortia vision

The idea behind the presented project is the ambition of exporting technology and knowledge from Europe to wide spread use in South Africa within the BEE program. When the project is completed within a 5 year period, it is our expectation that a relevant number of building companies including hundreds of locals have accessed the skills to continue constructing high performance homes with low energy consumption.

We plan to bring a reasonable amount of European highly skilled craftsmen, technicians, architects, engineers in South Africa before, during and after the construction of the DEMO homes. These persons will also act as committed teachers in order to transfer the complete amount of know-how.

Development of skills

Locals qualified by age and interest should be invited to learn, upgrade their skills in order to find jobs in construction companies then qualified to build better houses with low energy consumption.

Enterprise Development

A relevant number of construction and supply companies of various professions will be attracted and invited into the project, which opens for training within financial management, personal management, technical management, supervision, etc.

Qualifying Small Enterprises

A relevant number of construction and fabrication companies of various professions will be attracted to the project, which opens for training with the ambition of being qualified, certified and hereby have access to participate in erecting high quality homes.

Involvement of local schools and universities

Children and students qualified by age and interest will be invited to learn how low energy homes are designed and build.

The consortia

The leading group of the consortia are specialized in Solar Thermal Power Plant development, energy- and environmental friendly building design and participatet in international research and development projects primary concerning renewable energy, daylight, insulation integration, controlled ventilation and indoor climate.

- Senior Architect **Henrik Suhr** – 20 year expertise and practical know-how in low energy houses, house construction and energy management
  www.plan1.dk

- Professor **Bernhard Hoffschmidt** – 20 year expertise in Solar Thermal Power Plant development, energy management and solar water heating systems
  www.sij.fh-aachen.de

- Senior Architect **Olaf B. Jørgensen** – 20 year expertise and practical know-how in low energy houses, house construction and energy management
  www.esbensen.dk

- Financial controller **Flemming Petersen** – 20 year expertise in European project management

- Professor **Spencer C. Sorenson** – 30 year expertise in power management conculation, presently at the Danish Technical University
  www.mek.dtu.dk/English.aspx

- Senior Architect **Klaus Lange** – 20 year expertise and practical know-how in zero energy houses, house construction and energy management
  www.energy-home.eu

- Senior Professor **Vagn Korsgaard** – 50 year expertise in roof construction and actually the inventor of the insulated double brick wall house
  www.byg.dtu.dk/English.aspx

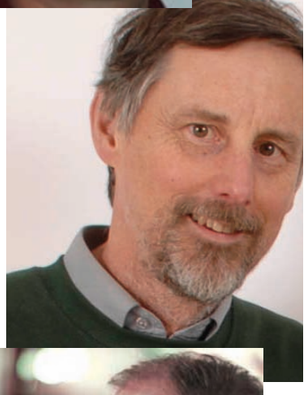
- Senior Scientist, Mechanical Engineer **Per Stobbe** – 25 year expertise in solar power, house building and research projects in the area of environmental protection
  www.stobbe.com

- Developer **Peter Hestehave** – 10 year expertise and practical know-how in building luxury homes in South Africa
  www.hestehave.co.za

Stobbe Consortia

Henrik Suhr

Olaf B. Jørgensen



Spencer C. Sorenson

Per Stobbe

Peter Hestehave

The Vision – a green estate!

Example as of today
One estate with 220 independent houses each with a max installed (230 VAC, 60 amp) potential power consumption of 18 kW continues. This is equivalent to 220 x 18 = 4 MW = required installed power when all houses are fully occupied all the time. 50 estates is then 50 x 4 = 200 MW = a medium sized power plant!

Example with new designed homes
One estate with 220 new independent houses built to the proposed low energy house standard will reduce the required power consumption from present 18 kW to only 5 kW. 220 houses will then require 1.1 MW installed.

Example with new designed homes, integrated solar and distributed energy
One estate with 220 new houses built to the proposed standard with building integrated solar cells (>25 m^2) and all homes fully integrated into the estate overall power management system will reduce the power consumption from present 18 kW to only 2.5 kW – or less than 1 MW total. A solar cell power battery back-up system is needed.

Example with integrated solar and distributed energy and 75% of the homes part time used
One estate with 220 new houses build to the proposed standard and all fully integrated into the estate power management system, but only part time occupied will reduce the power consumption from present 18 kW to only 1 kW – or less than 0.25 MW total. A centrally located solar cell power battery back-up system is needed.

A combination of 3,000 m^2 dedicated solar cell system rated at (3,000x120=0.36MW) and two <0.3 MW combustion engine power back up systems will potentially make the estate fully independent of external power sources!