a Ross
Lovegrove
Masterclass

SUNNY DELIGHT

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Compilation and Design: Arthur Schmitt
Published by Innovation Design Engineering

ISBN : 978-0-9561364-0-4

SWAROVSKI
ROSS LOVEGROVE

Royal College of Art
Postgraduate Art and Design

Imperial College
London

less than an hour's worth of all the sunlight falling on the Earth would satisfy the whole world's [energy] needs for a year.*

* Ian McEwan, The Guardian 19.11.08

Sunny Delight (Solar Living) is IDE's first masterclass by Ross Lovegrove and aims to explore an integrated solar future. Students from the school of design for production worked in interdisciplinary teams of Innovation Design Engineering and Vehicle Design for 5 weeks in March and April 2008.

History of the project

Sunny Delight originated from a lecture delivered by Ross Lovegrove as part of IDE's 'We could be heroes' lecture series in the spring of 2007. As Ross presented, students from all over the college crept into the seminar room (after being texted by their friends) until the entire space was packed with bodies. The lecture lasted two and a half hours as the students were enthralled by the passion and enthusiasm for Ross's view of design efficiency, lightness and the use of advanced technologies to unlock a sustainable future.

Talking afterwards, we decided to develop a masterclass to explore the integration of transport and housing via solar power. Over the next few months we invited a world class team of experts to work with the students. The results are documented here in the Sunny Delight (Solar Living) Ross Lovegrove masterclass book.

Ashley Hall, Senior Tutor IDE

Professor Tom Barker's doodle of the project while on a visit to the United Nations, January 2008

Module description

Welcome to the small suburban town of Sunny Delight.

Located in the near future, and on the outskirts of a Northern European city, Sunny delight will be home to a few lucky residents who will benefit from a town that uses the very latest solar power, and related technologies, to create the world's first ever integrated zero energy housing and transportation system.

It is your job as cutting-edge designers to make Sunny Delight. The challenge is to create a vision for a near future that works seamlessly in terms of both design and technology. In doing so, you will learn about the challenges of integrating design at many scales: urban, architectural, interior, transport, vehicle and product.

Solar power (photovoltaic and/or solar thermal) must form a key energy technology component, but other energy systems may also be included to achieve a zero energy rating – it is a huge challenge to achieve this with solar power alone.

Each team will be given a plot of land and a street that connects to a main road. The land must have a house, garden and a car port. Each home must also have a car. The energy systems and designs must cover all of these items. Although you will not build the main road, consideration must be given to the main road as well. For example, does your car feed power back into the grid when it brakes, in which case how can the main road allow this to happen?

In addition to creating elegant, provocative and convincing designs, each team will have to demonstrate that they have a zero energy system, summarised through basic calculations, diagrams and tables. Teams have the option of developing marketing, economic and business cases.
The project is challenging and requires multidisciplinary teams to be able to cover all the elements of the brief. So each team should include an engineer, a product designer, and a vehicle designer.
Shortly after the project proper starts off, there is a quick and dirty Skunkworks, where you will have a hands on workshop to assemble and explore some solar kits and get to know your team mates.

As a team, for stage 1 you will have to brainstorm your integrated design. You need to establish the user scenario: is it a family dwelling, a couple, or a single person? How many cars are there? What is the daily routine during the week and weekend? The scenario will have to be communicated as a narrative when you explain the project – using a 2 minute short film or digital mixed media self-running presentation (using the model, maybe with a closeup camera, illustrations/animations, voiceovers, etc.)

You will co-operate as a team to build the initial scale model in white. The scale is 1:50 and this allows you to concentrate on the overall concept rather than details. You may be better off resolving this stage of the design by making numerous physical form and massing studies, rather than detailed drawings. The system overview, supported by elementary energy sums, will also be required, and you may choose to include a marketing, business and economic case.

All of the models will fit together like a jigsaw and give us the town of Sunny Delight. We will mount this vertically on a wall of the building.

Following this, in stage 2 individual team members will each champion one or more of the Sunny Delight's components to resolve in more detail: house, garden / outdoor areas, car, car port / street, marketing / services, energy system, business / economic case.

These are functional aspects. It may be that your design merges or redefines these almost beyond recognition, and this is fine too. For example, you may drive a piece of your house into work!
A key to success in stage 2 is making solar surfaces work, both in their integration to product function and maximising solar technology requirements via access and orientation to natural light. The ratio of using and generating energy is fundamental where excess power could be sold back to the grid.

Although you will each be championing different parts, team co-operation will remain vital in terms of design language, form, economics, the user proposition and also systems integration.

The final presentation format will be in the form of tabletop models and pin-up drawings (no projection), including systems diagrams, charts and tables. Teams will be set-up for a reviewer walk-around. Each team will also need to produce a booklet about their project, making 3 wire-spiral bound copies, in A4 landscape.

Module team

Studio Master:
Ross Lovegrove

RCA Professors:
Tom Barker + Dale Harrow

RCA Tutors:
Ashley Hall, Senior Tutor IDE ashley@rca.ac.uk
Richard Winsor, Senior Tutor Vehicle Design richard.winsor@rca.ac.uk
Stephanie Chen, Graduate Tutor stephanie.chen@students.rca.ac.uk
Jon Sawdon Smith, Electronics / Solar Workshop jon@diykyoto.com
Panos Delilabros. Electronics / Solar Workshop panos.delilabros@rca.ac.uk

Experts and Reviewers:
Christie Franchi, New Energy Brokers (04/03/08 lecture + final review)
Laurie Abbott, Rogers Stirk Harbour & Partners (Tutoring & Final review)
Reinhardt Buchner, Sharp Europe (03/03/08 lecture + final review)
Mitz Kenada, Arup (Briefing & Final review)
Peter Van Manen, MD Electronic Systems, McLaren (7/3/08 lecture + final review)
Oliver Sylvester Bradley, Housing corporation (07/04/08 lecture)
Nick Leon, Director, DesignLondon, Innovation + Services (Tutoring & Final review)
Anthony Lo – Design Director Advanced, General Motors (Final review)
Marcus Swarovski – Swarovski (Final review)
Geoff Raw - Housing Corporation (04/03/08 lecture)
Marie O'Mahoney – Techno Textiles (12/03/08 Lecture)
Tim Mason & Mike Fairbrass – Rogers Stirk Harbour & Partners (March 13th)

Innovation Design Engineering

The IDE course provides a unique joint two-year double Masters with Imperial College London. Regardless of background (artistic or technical) graduates receive an MA (RCA) and an MSc plus a Diploma (both Imperial College London). Although many of our graduates work in consumer or industrial product design, others can be found in design management, architecture/building design and the digital industries. Some are entrepreneurs and have company start-ups.

Over the last 4 years, IDE has developed sponsored modules with Sony Playstation, Bank of America, Coutts, Proctor & Gamble, Unilever, 3 Mobile, O2 Mobile, B&Q, BenQ and Targetti Lighting. IDE is unique in being jointly hosted by the RCA and Imperial College. Imperial college is currently ranked No 5 in the world's top universities with approx 11,500 students, a third of whom are postgraduate. It also has 14 Nobel laureates and several world renowned research centres.

IDE sits within the Engineering department which has 3,500 students and 72 professors.

"I wanted to create this master class to open up possibilities of convergence and synergies between technology, sustainable solutions, innovation and the fundamentals of off grid living and new 21st Century communities.
The platform of the RCA IDE unit is a rich resource of great young minds who themselves represent an emerging generation of thoughtful, technocratic and educated individuals, ready to be free in the way that we can conceive and design new habits that intelligently take mankind forward into a sunny optimistic future.
Looking at the relationship between the home, its energy source and consumption, social ideals of sharing, the role of the automobile in the home and the community as well as the professions of the people living in such new communities; these are totally real and emerging future issues that need bright and joyful minds to deliver technically feasible solutions.
I believe that the role of the future designer is increasingly becoming a catalyst between advanced engineering, science, physics and fat free, super-economic industrial processes.
Logistics too are becoming more and more important in calculating the big picture taking the act of design to a very sophisticated point of dealing with global resource drawdown, distribution, use, reuse and so on.
The projects that emerged from the self-selected groups were startlingly innovative in that they defined a very free and non-elitist view of aesthetics and ideologies.
Such works go way beyond the need to impress with mere styling, and have been backed up with in depth research that is the real value of the RCA IDE course, becoming the polarizing environment for the creation of culturally and commercially valuable new ideas of planetary consequence.
I am proud of these students and touched by the belief of the sponsors who gelled beautifully in the creative magic of searching for an intelligent and modern future together."

Ross Lovegrove . MDes RCA FCSD FUWIC RDI

Ross Lovegrove

Philosophy :

Ross Lovegrove is a designer and visionary who's work is considered to be at the very apex of stimulating a profound change in the physicality of our three dimensional World.
Inspired by the logic and beauty of nature his designs possess a trinity between technology, materials science and intelligent organic form, creating what many industrial leaders see as the new aesthetic expression for the 21st Century.
There is always embedded a deeply human and resourceful approach in his designs, which project an optimism, and innovative vitality in everything he touches from cameras to cars to trains, aviation and architecture.

Biography :

Born 1958 in Cardiff, Wales.
Graduated from Manchester Polytechnic with 1st Class BA Hons Industrial Design in 1980. Master of Design of Royal College of Art, London in 1983.
In the early 80's worked as a designer for Frog Design in West Germany on projects such as Walkmans for Sony, Computers for Apple Computers, later moved to Paris as a consultant to Knoll International, becoming author of the highly successful Alessandri Office System.
Invited to join the Atelier de Nimes along with Jean Nouvel and Phillipe Stark, consulting to amongst others Cacharel, Louis Vuitton, Hermes and Dupont.
Returning to London in 1986 he has completed projects for amongst others Airbus Industries, Kartell, Ceccotti, Cappellini, Idee, Moroso, Luceplan, Driade, Peugeot, Apple Computers, Issey Miyake, Vitra, Motorola,Biomega, LVMH,Yamagiwa Corporation, Tag Heuer, Hackman, Alias, Herman Miller, Japan Airlines and Toyo Ito Architects in Japan.

Winner of numerous international awards his work has been extensively published and exhibited internationally including the Museum of Modern Art in New York, the Guggenheim Museum NY, Axis Centre Japan, Pompidou Centre, Paris and the Design Museum, London, when in 1993 he curated the first Permanent Collection.

"Since I can first remember the shape of the cars developed from the Trans Australia Solar Car Race have fascinated me.

This a world where nature and technology fuse with mans ambition to achieve ultimate performance levels and create a true sense of a sustainable future for us. The forms that have evolved from this particular science embody logic and beauty and stimulate visionary dreams of lighter structures, advanced materials innovation, ecologically harmonized transportation systems and a life of silence and clean air.

Such scientifically engineered entities are art forms of the highest order, and now that we have entered the 3rd Millennium with all our collective hopes and fears, they for me symbolize the potential mans creative thinking and help us refocus our collective ambition.

Instinctively I present this as a concept which converges the intelligence of solar innovation with the optical, scientific arm of Swarovski in order to investigate the potential of using crystal to amplify light."

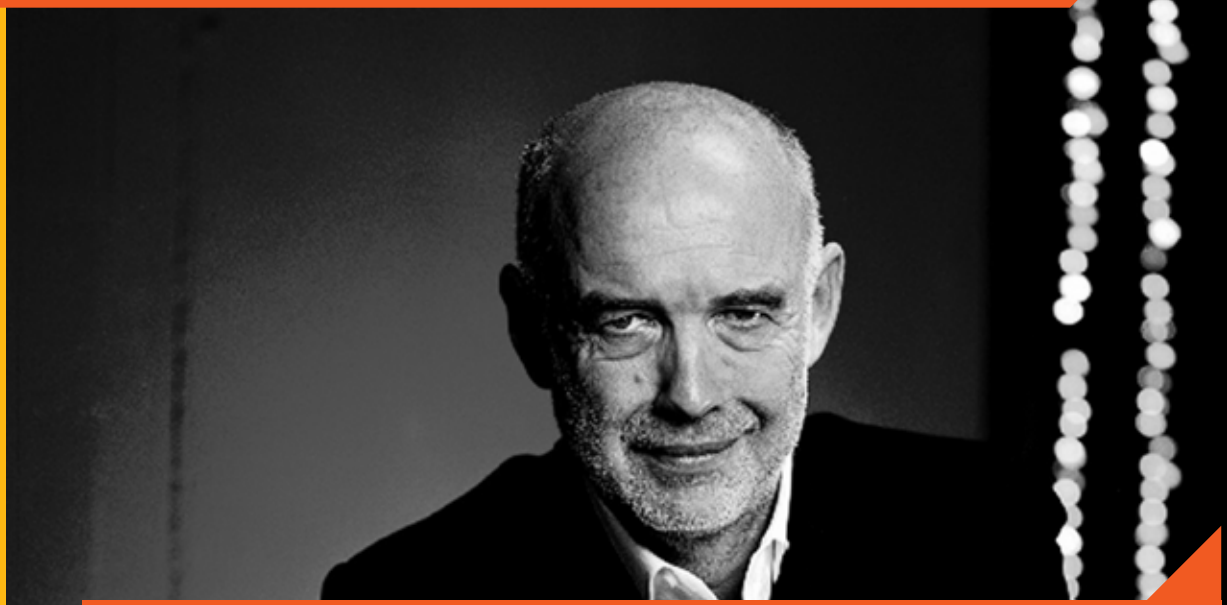
Ross Lovegrove

"A project stimulated by the MAK in Vienna that celebrates DESIGN, NATURE and ART. Therefore it represents the DNA of our times and the need to converge the most advanced technologies with that of the beautification of our collective environment. The SOLAR TREES communicate more than light..... they communicate the trust of placing beautifully made, complex natural forms outside for the benefit of all of society becoming a museum that if folded inside out, the museum as an incubator of change in society.....and with this the promotion of environmental science and the joy of the new aesthetics made possible by the digital process. They bring nature to the grey-ness of urban environments and optimistically lift our

senses towards the future and how the physicality of all the objects that surround us will inevitably change..... either through need, though enlightenment or simply just the celebration of new form in industrial art that compliments the new quest for biological forms in architecture. This was a fantastic collaboration initiated by Peter Noever from the MAK in Vienna with Ross LOVEGROVE, SHARP SOLAR and ARTEMIDE."

Ross Lovegrove

Dr Andreas Braun



"In 1895, Daniel Swarovski I, the company founder, left Bohemia and moved to Wattens, Tyrol in Austria. He, an inventor and visionary, had developed a machine for cutting and polishing crystal jewellery stones.
Five years later he was the first to supply the public areas of his new hometown with electricity. Until this day Swarovski has maintained the technological tradition for 113 years.
Daniel Swarovski I also had clear humanistic values, which even nowadays are still very present in the company's genes with topics like Ecology and Corporate Social Responsibility.
With this past it seemed to be a logical step for Swarovski to support this project, which provided avant-garde, aesthetic and energy saving futuristic solutions. We were also amazed by the multicultural and divers professional backgrounds of the participating students.
Overall it was amazing to experience the high quality of the presented concepts!"

Markus Langes-Swarovski, Member of the Executive Board

Andreas Braun, CEO d. swarovski tourism services gmbh

Tom Barker

"The recent global turmoil has brought the problem of energy into sharp focus. Everything seems to be running out or costing too much. And yet, as we burn fossil fuels we also seem to bask forgetfully in the most abundant of natural energy sources: the sun, wind, and tide. Solar power has incredible potential: Just 1% of the sunlight falling on planet earth in a day is enough to power all our planetary energy needs for a day. Our project focused on harnessing the sun's energy for new design solutions to living and traveling. By projecting into the near future, Sunny Delight gave our multidisciplinary team of graduate students the chance to create their own visions for solar design. Sharp, McLaren Formula 1, Swarovski, and many others contributed to the adventure and Ross Lovegrove's enthusiastic involvement in particular made the project a magical experience. The project ideas are provocative, creative, intelligent and - most importantly - optimistic. With optimism in their armoury, these designers have a chance to fix some of the problems that have made this glorious planet shudder on its axis. To these students, we need your help: in lumine tuo videbimus lumen."

Professor Tom Barker

Anthony Lo

Anthony Lo was named director of advanced design for GM Europe in August, 2004. In this capacity, he heads the GM Europe Advanced design organization, responsible Opel, Saab and Vauxhall advanced design activities.

He was born in Hong Kong, China, on December 26th, 1964. Lo studied Industrial Design at the Hong Kong Polytechnic University and holds a Master's degree in Transportation Design from the Royal College of Art in London, England.

Before joining General Motors, Lo served as chief designer at DaimlerChrysler's Mercedes-Benz Advanced Design operation. He was the principle designer for the M-B F200 Concept presented at the Paris Motor Show in 1995 and the M-B Maybach Concept presented at the Tokyo Motor Show 1997.

He joined Saab Automobile AB in October, 2000, as chief designer for Advanced Design. Lo has lead the design of the Saab 9X, 9-3X, 9-3 Sport Hatch, and Aero concept cars from concept to build.

" To be honest I really didn't know what to expect from the Sunny Delight Ross Lovegrove Masterclass project as I was not present at the earlier reviews. However, when I attended the final review I was taken aback by the sheer dedication of the team members, to each other and the project.

Each team was very focused and produced in depth research and convincing presentations while maintaining a high level of creativity. It was refreshing to see some surprising solutions come out of the masterclass, but I have to say that the final project that I was most impressed by was 'Folding', a sort of 'origami style transformable' set of solar panels that morph from a horizontal position into a dome in a surprisingly simple way in order to optimize solar efficiency. It was the full size mock up that really sold the idea!

Also, something that particularly struck me, was that each team was made up of students from such diversed disciplines as transportation designers, chemical engineers, and science students from the neighboring Imperial College. Most of all it was great to be back at my old school and spend quality time with friends and tutors during that day. "

Pierre Jusselme

" One focus of industrial design should be efficiency in industrialisation, the usage of resources and energy efficiency. In the case of designing housing and transportation, thinking about efficiency and the generation of energy is essential and should be at the essence of developing new concepts.

Solar energy has never been so present in the media, widely published and now an accessible technology on the verge to become fashionable, still there is a lack of opportunities for innovative sustainable /environmental projects. Creating opportunities is essential for innovation and thanks to Ross Lovegrove, the RCA IDE department and Swarovski, the Sunny Delight Masterclass was a true opportunity to set up a think tank with prominent experts and students to experiment with innovative ideas.

The Masterclass was targeting housing, transportation and studying these subjects from a sustainable design point of view, bringing optimism and vision for a more responsible future. It was truly exciting to be involved alongside Ross and the RCA IDE students contributing to this project. The students showed great understanding and competences generating a consistent body of work whilst enriching the output of the Masterclass through common shared beliefs. "

pierre jusselme
senior designer / Ross Lovegrove Studio

Ashley Hall

"From the beginning it was clear that the Sunny Delight masterclass had a special energy of its own. During the early conversations with Ross Lovegrove and Professor Tom Barker we began by discussing a solar car. Realising the importance of its link to other energy systems we proposed a complete solar environment of house, garden & vehicle. An integrated living system. To achieve our aim we enrolled a consortium of equally enthusiastic world class experts from Swarovski, Sharp, McLaren, Rogers & Partners, Global Cleantech, Solar Century and The Housing Corporation. Alongside giving advice through tutorials and lectures this was an opportunity for our experts to exchange ideas.

The creative response from the students was both diverse and pragmatic, ranging from expanding solar roofs to sophisticated system designs based on donating spare energy. In typical fashion they quickly found the edges of the design brief and jumped straight over to look for alternative technologies, concepts and living systems to propose new innovations. Many of the teams hybridised solar power with emerging and established technologies to create systems that maximised energy flow and storage.

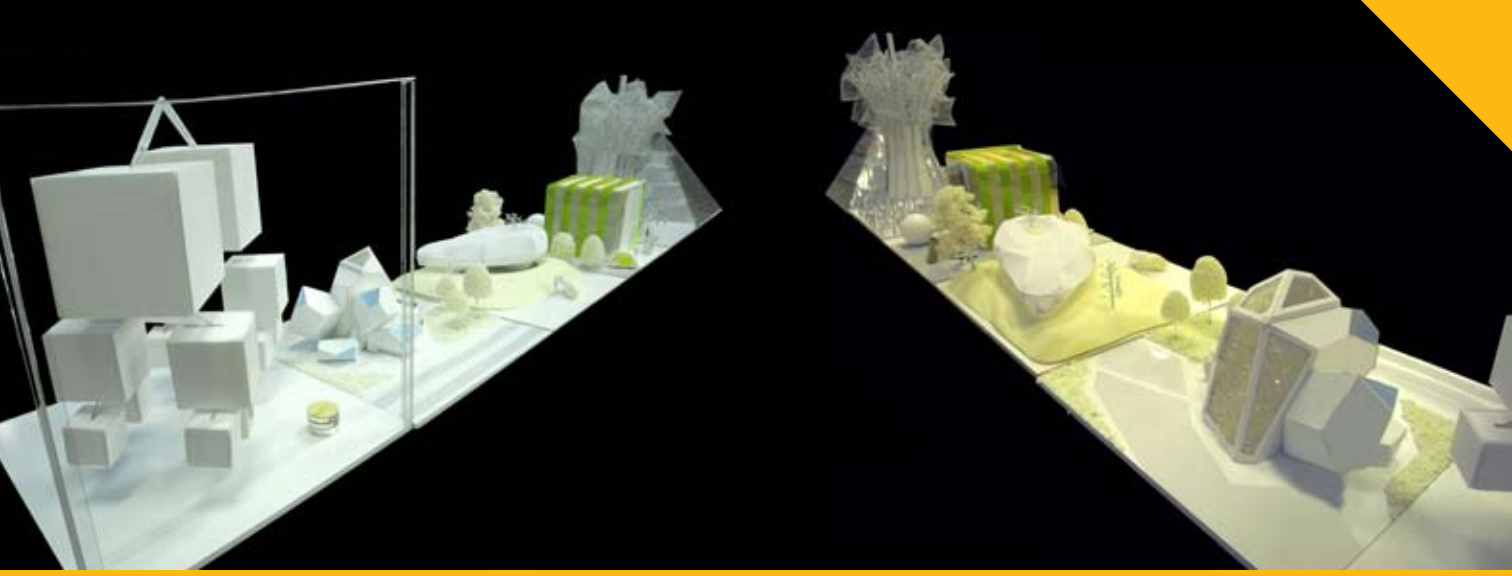
The fact that so many of the projects worked at a systems level illustrates the changing role of the industrial designer. It suggests that its increasingly pointless to fill the world with new products without understanding and influencing the complex umbrella of systems that support them."

Reinhart Buchner

"It was a great honour for me to be part of the Sunny Delight project. As a representative of one of the main players in solar business, I was curious to see how the students would address the challenge to come up with innovative solar-powered solutions. The results exceeded all my expectations.

All involved teams demonstrated a high level of creativity in using the potential of solar power. With their designs, both for transportation and housing, the students set new frontiers for the employment of solar cells. It goes without saying that some of their ideas exceed today's application limitations. However, each true innovation has to push the limits and I could not identify one nomination that would not be realisable within near future. In fact, projects like this encourage industry to advance research and development in order to make the required technology available within short time.

Sharp for example is right now investing two billion Euro into new production facilities near Osaka to deliver from 2010 onwards a new generation of solar cells. Making this devices available for creative people such as the participants in Sunny Delight will place them in the position to make their dreams come true."



Stage 1:
The scenario will have to be communicated as a narrative when you explain the project – using a 2 minute short film or digital mixed media self-running presentation (using the model, maybe with a closeup camera, illustrations/ animations, voiceovers, etc.)

Design and build a 1:50 scale model of your solar scenario that looks at the integration of domestic and vehicle power.

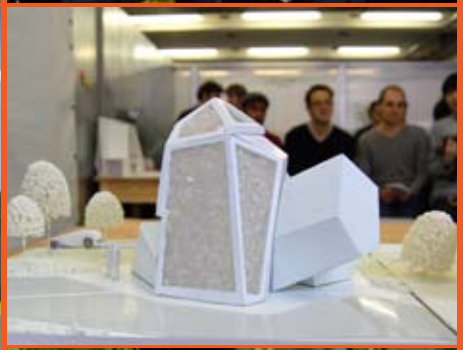
Model Rules:

1.YOU MUST PURCHASE A SCALE RULER WITH 1:50 SCALE ON IT!!!
2.20m x 20m plot at Scale 1:50 (ie: 400 x 400mm)
3.Built on a 9mm white MDF.
4.All model parts to be in white and/or transparent only.
5.A 4 metre wide strip along one whole side has to be kept clear for a road.
6.All the models will be clustered together to form our near future solar town.
7.Any people used must be purchased and for architectural model use



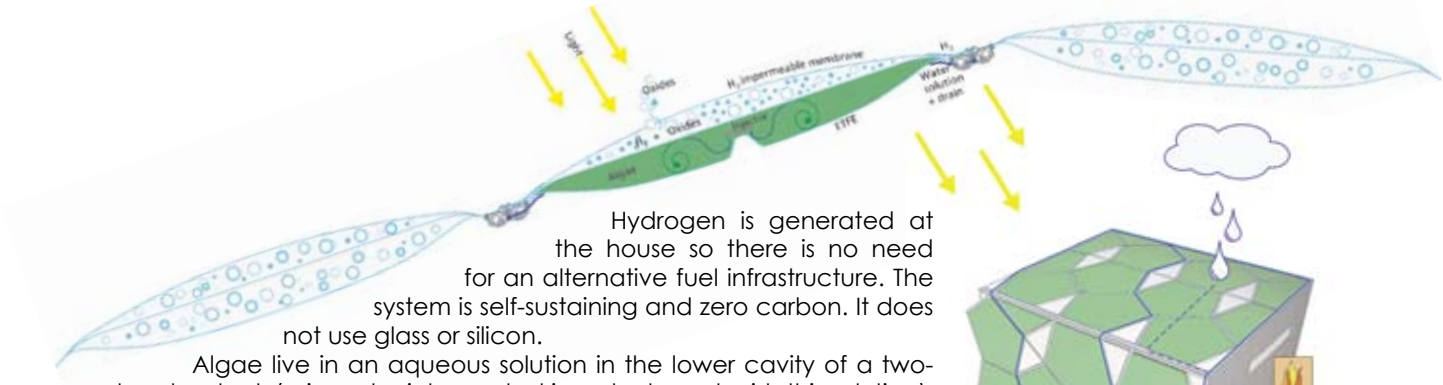





Algae Skin

Much solar energy research is focused on its direct conversion to electricity in photovoltaic devices or on its direct conversion to heat in solar thermal devices. A major barrier to rolling out these technologies is their prohibitive cost. Here, we use an alternative and cost effective method for generating hydrogen fuel from Algae with solar energy and propose a scheme for its integration into the energy production and storage system for a family-sized house in the UK. The energy generation technology that underpins our proposal is very real and based upon research at Imperial College London. The technology is visually rich and we embraced the associated themes of fluid motion, diffusion of light and industrial and natural forms.

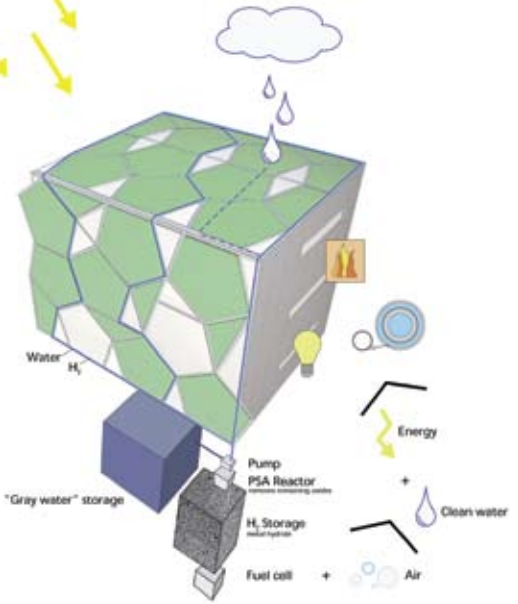


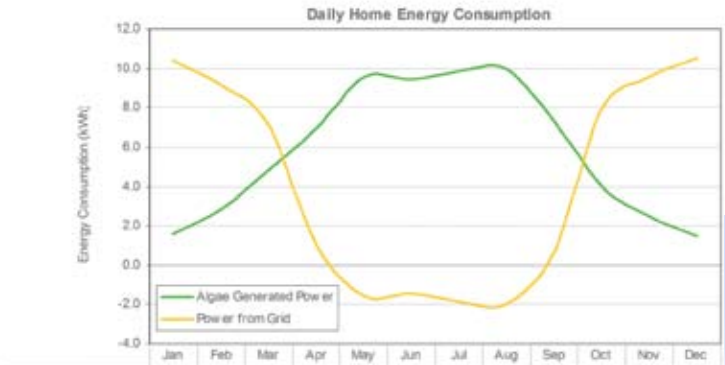
Hydrogen is generated at the house so there is no need for an alternative fuel infrastructure. The system is self-sustaining and zero carbon. It does not use glass or silicon.

Algae live in an aqueous solution in the lower cavity of a two-chamber tank (rain water is harvested in order to replenish this solution). When exposed to sunlight and chemically stressed, the algae produce hydrogen and oxygen.

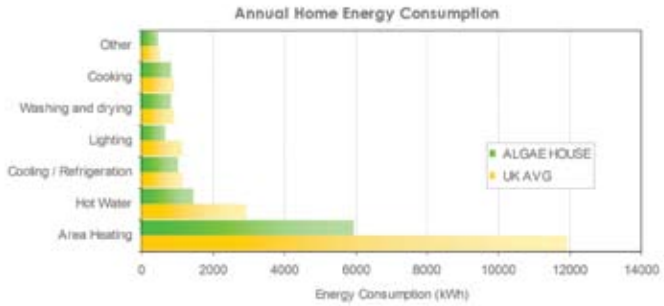
The algae are actually swimming and their constant movement prevents over exposure to direct sunlight. A jet stream introduced to the tank to facilitate the natural movement of the algae.

The hydrogen and oxygen gas passes through the partition membrane into the upper cavity. The outer foil allows oxides to escape but traps the hydrogen.





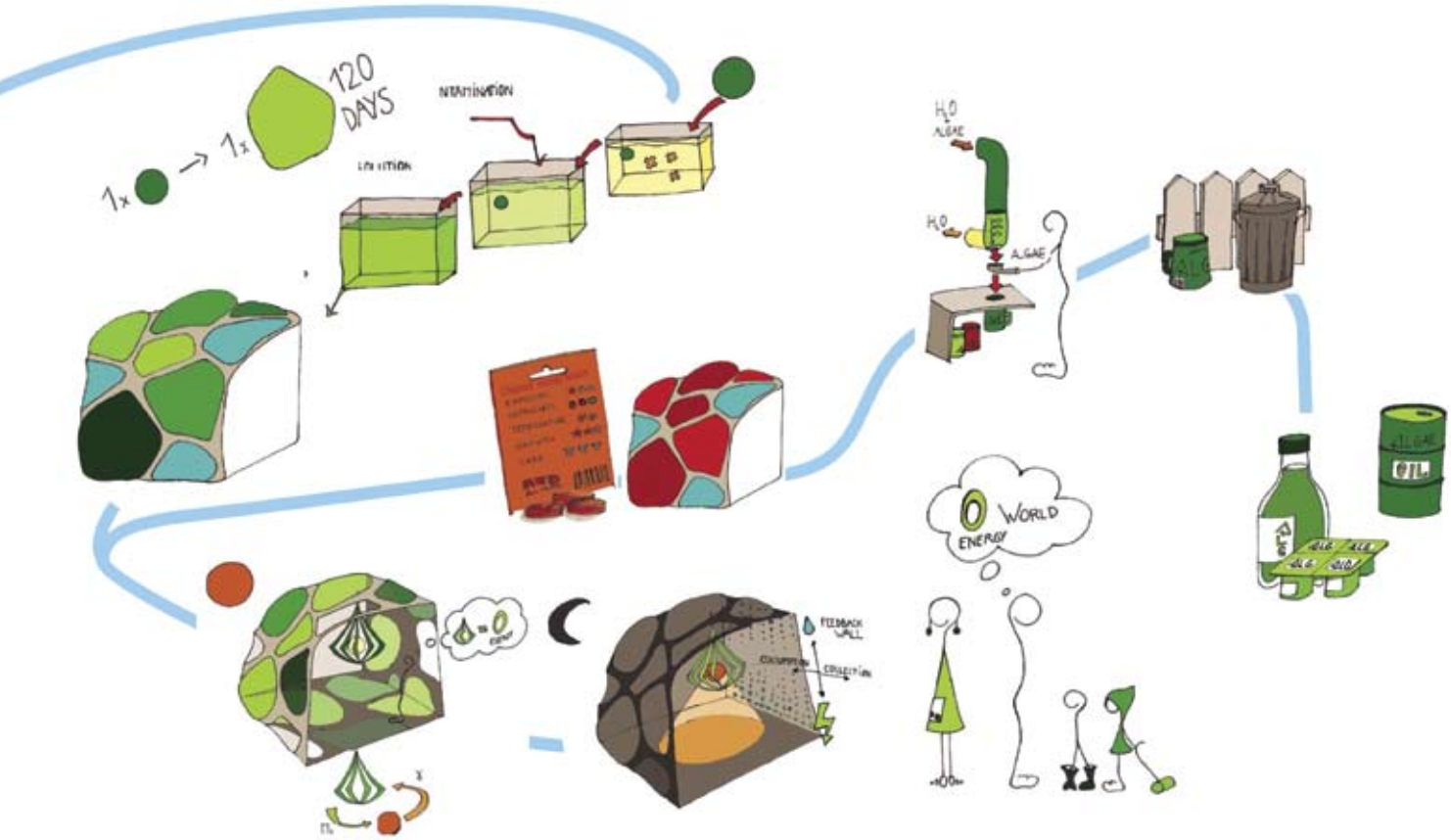
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Algae Generated Power	1.6	2.8	4.8	6.9	9.6	9.5	9.9	10.0	7.3	4.0	2.5	1.5
Power from Grid	10.4	9.2	7.2	1.1	-1.6	-1.5	-1.9	-2.0	0.7	8.0	9.5	10.5



Some oxides remain in the hydrogen gas. These are removed by a pressure swing absorption reactor.

The pure hydrogen is dissolved into a metal hydride store. It is then converted into electricity by a proton exchange membrane (PEM) fuel cell. The only by-product is warm water, from which the heat can be recovered and the water stored for drinking. Indeed, we estimate this system will produce approximately 10 litres of pure drinking water each day.

The distinctive architectural form demonstrates both the uniqueness of the technology and the house's renewable energy system. The natural colours and tones of the algae are celebrated and made visible to the outside world.



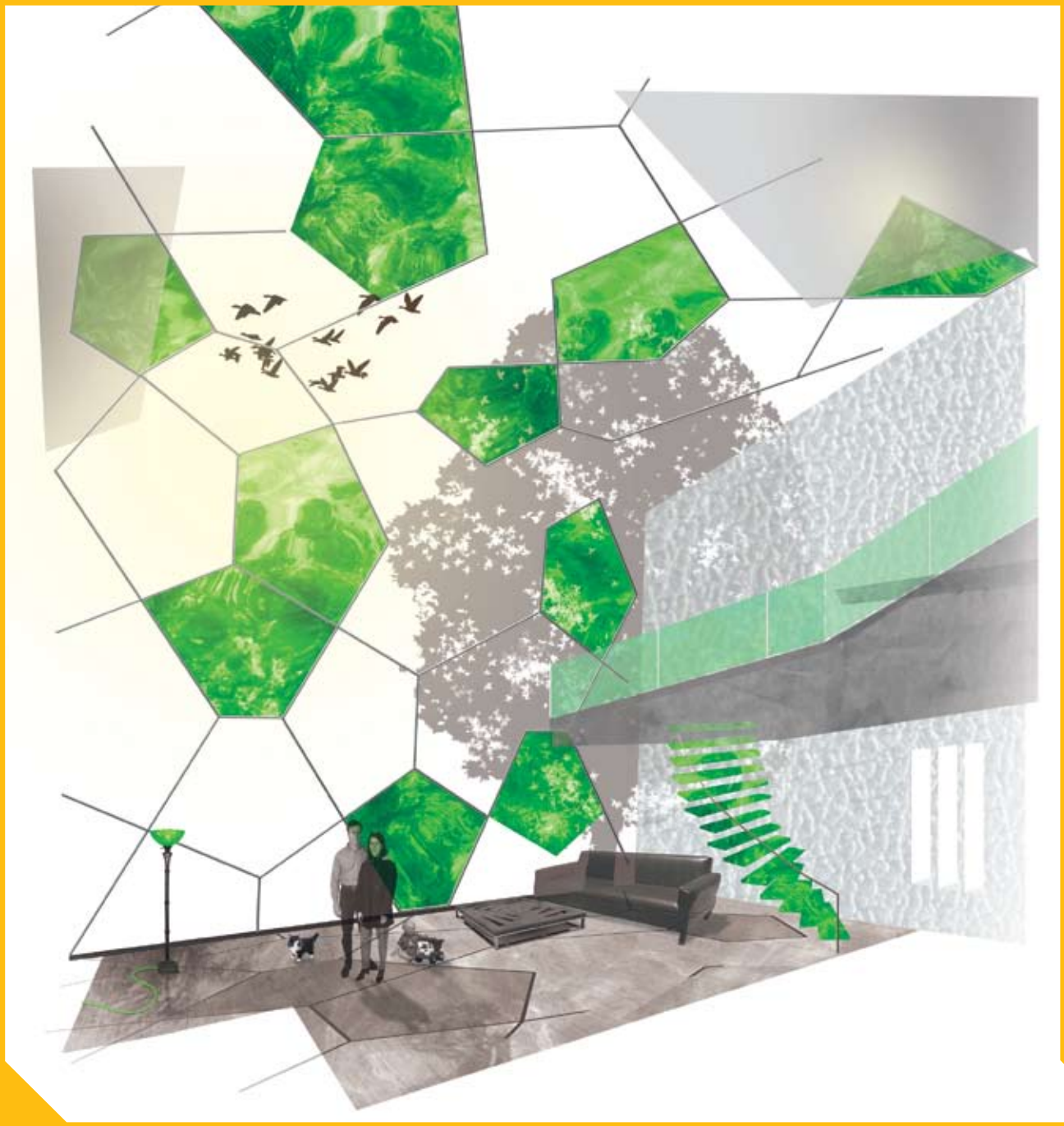
The house achieves energy efficiency by employing passive solar design strategies. Construction is modular and so the house can be modified to induce natural ventilation and air-flow and enhance daylight. The south facing façade and roof comprise windows and algae tanks. The structure breathes as hydrogen fills and is then removed from the algae tanks.

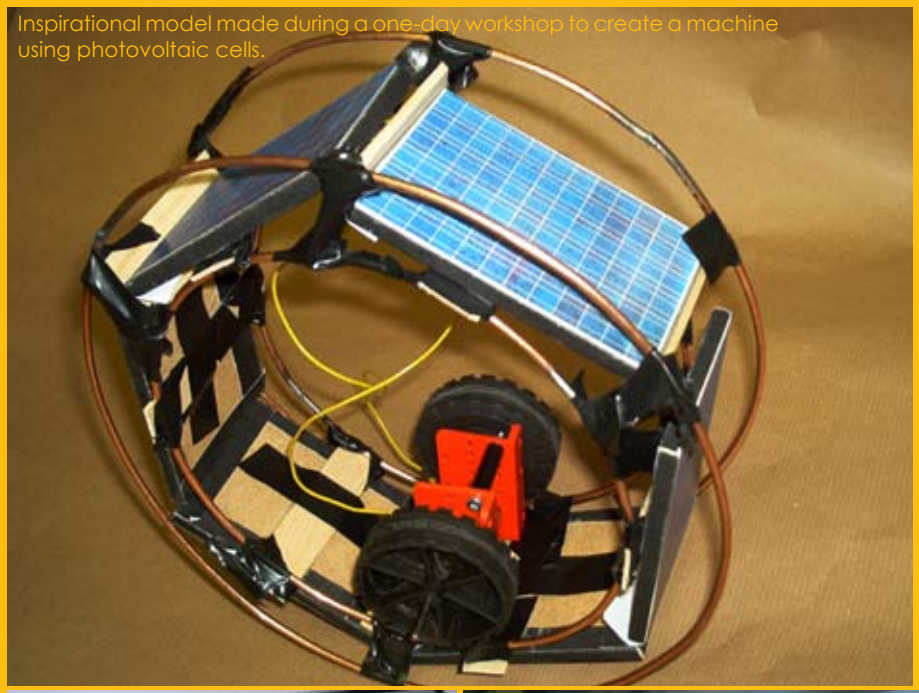
An algae-energy universe would be a fun place to live! Algae can be grown by local or industrial producers. It can be bought on the internet or from shops. The algae are packaged in hand-sized pills which are placed into the house's energy system interface much like your washing machine. The algae tire after ninety days and no longer produce hydrogen in an efficient manner. After period, algae are removed from their tank and enter a recycling system.

Water and algae are separated by a centrifuge and compacted into algae bricks, which in turn can be used to produce bio-diesel and even food. Algae produce hydrogen under artificial light and so self-sustaining discrete products such as chandeliers and table lamps are available. Algae start to appear in fashion, too – the integration of algae-energy systems in products becomes a global trend!

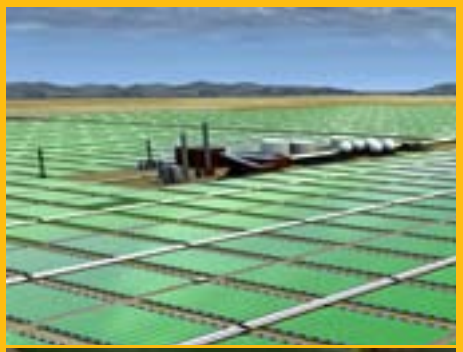
The Solar Monowheel accommodates two people and is made of concentric rings allowing it to collapse and be lowered into a docking station in the street or house. In its docking station, the Monowheel recharges using electricity generated from the hydrogen (which has been produced by the algae).

The transparent rings of the Monowheel are combined with photovoltaic cell matrices much like the conducting elements in a heated front windscreen. During transit the solar cells produce additional energy for acceleration and extending the Monowheel's range. Integration of the Monowheel and Algae house presents a truly decarbonised living and transport system that does not rely on an alternative fuel infrastructure.





Inspirational model made during a one-day workshop to create a machine using photovoltaic cells.

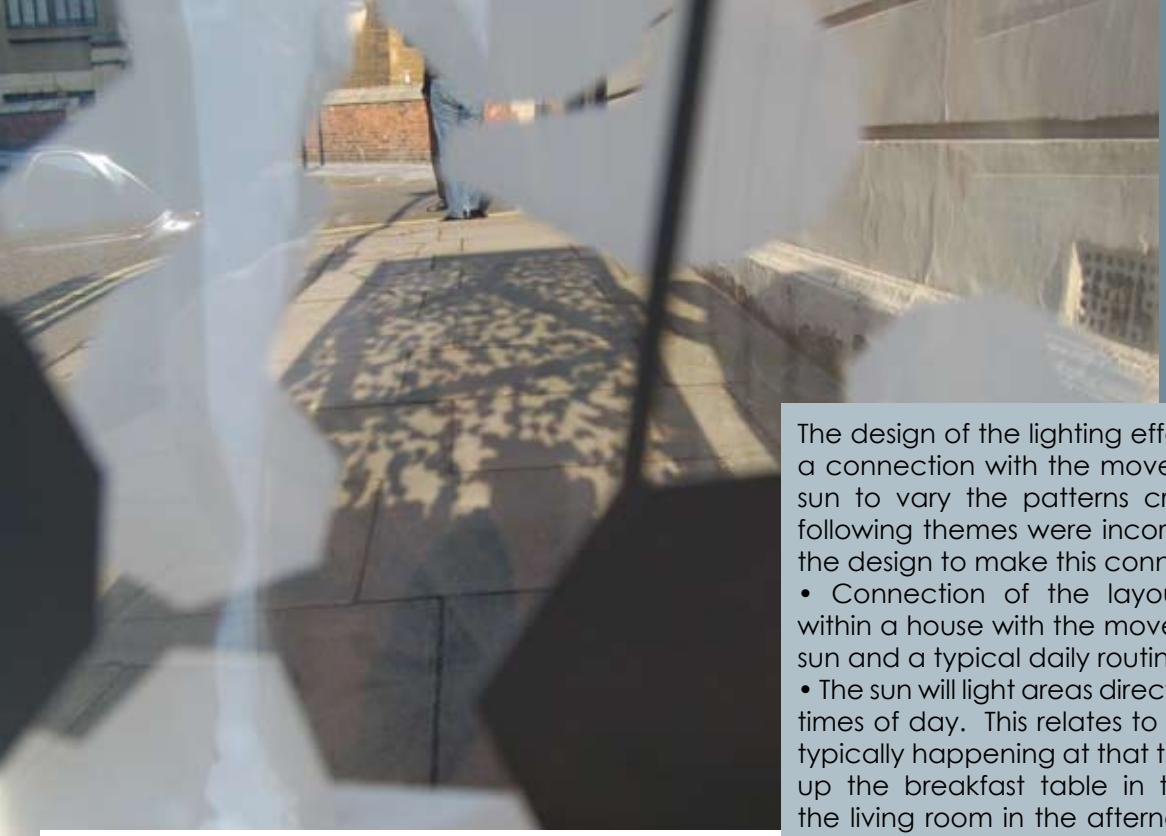


1:6 scale model showing a complete and section through an algae tank

1:25 scale model showing a cutaway of the house and illustrating the algae-energy system.

Folium

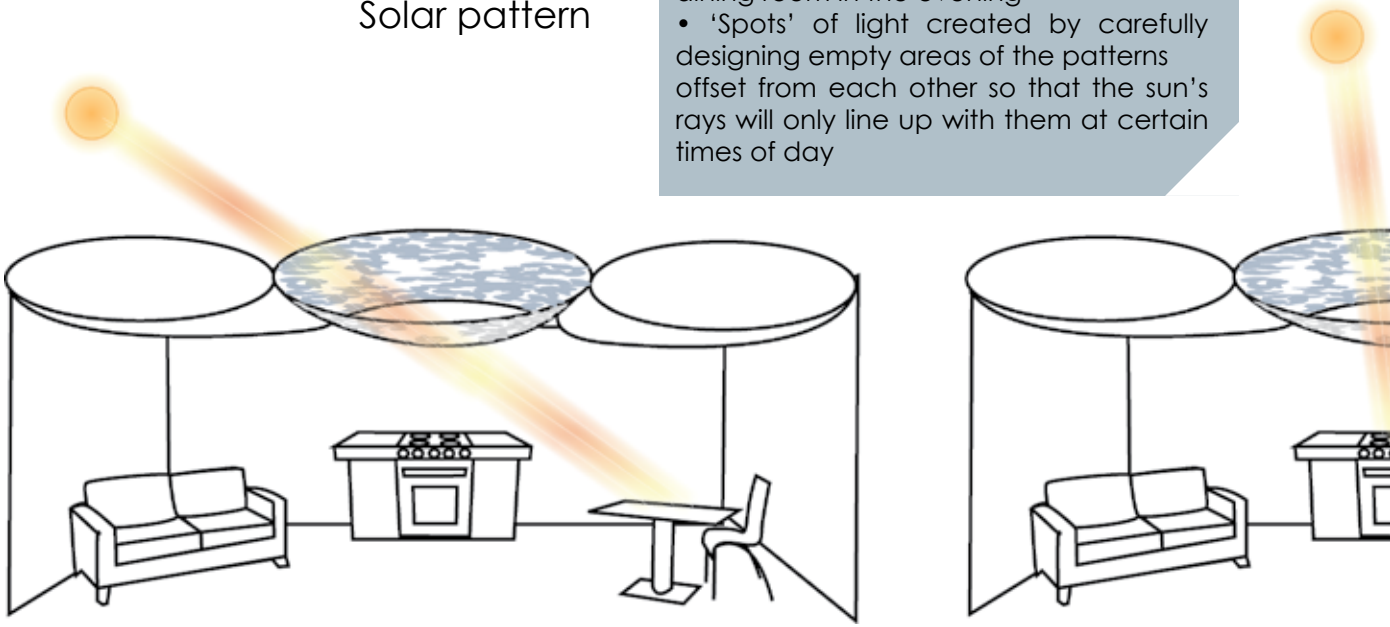
Light guides the pattern of our lives; the movement of the sun is reflected in our daily routines, the places we inhabit entrap the natural light, and the energy the sun creates is harnessed for our own uses. Folium encapsulates all of these aspects. Inspired by the dappled lighting effect created on a forest floor, Folium creates a lighting environment which changes both the lighting intensity and the lighted area with the movement of the sun. 'Solar ink' patterns printed onto ETFE panels not only allow the lighting effect to be tailored to individual needs, a proportion of the energy needs of the building can also be collected from the sun, creating a natural and passive lighting design and a renewable energy architectural system.



The design of the lighting effect included a connection with the movement of the sun to vary the patterns created. The following themes were incorporated into the design to make this connection:

- Connection of the layout and light within a house with the movement of the sun and a typical daily routine
- The sun will light areas directly at specific times of day. This relates to the activities typically happening at that time e.g. light up the breakfast table in the morning, the living room in the afternoon and the dining room in the evening
- 'Spots' of light created by carefully designing empty areas of the patterns offset from each other so that the sun's rays will only line up with them at certain times of day

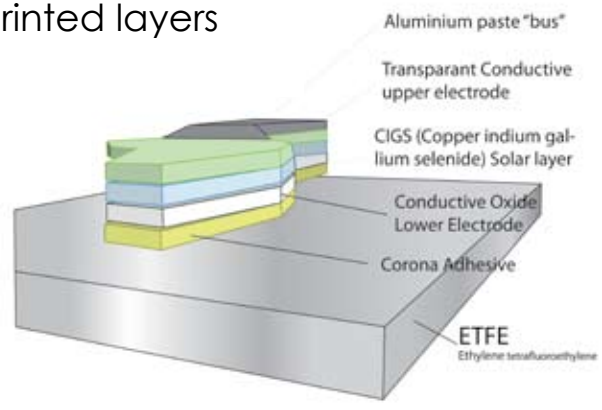
Solar pattern

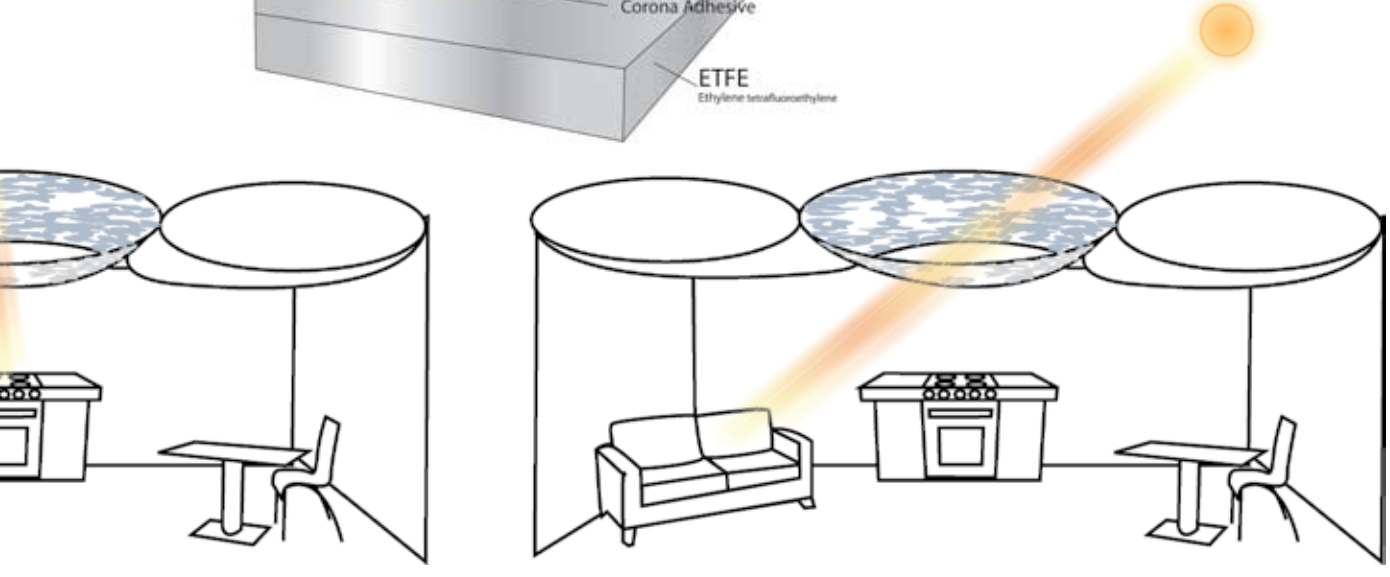


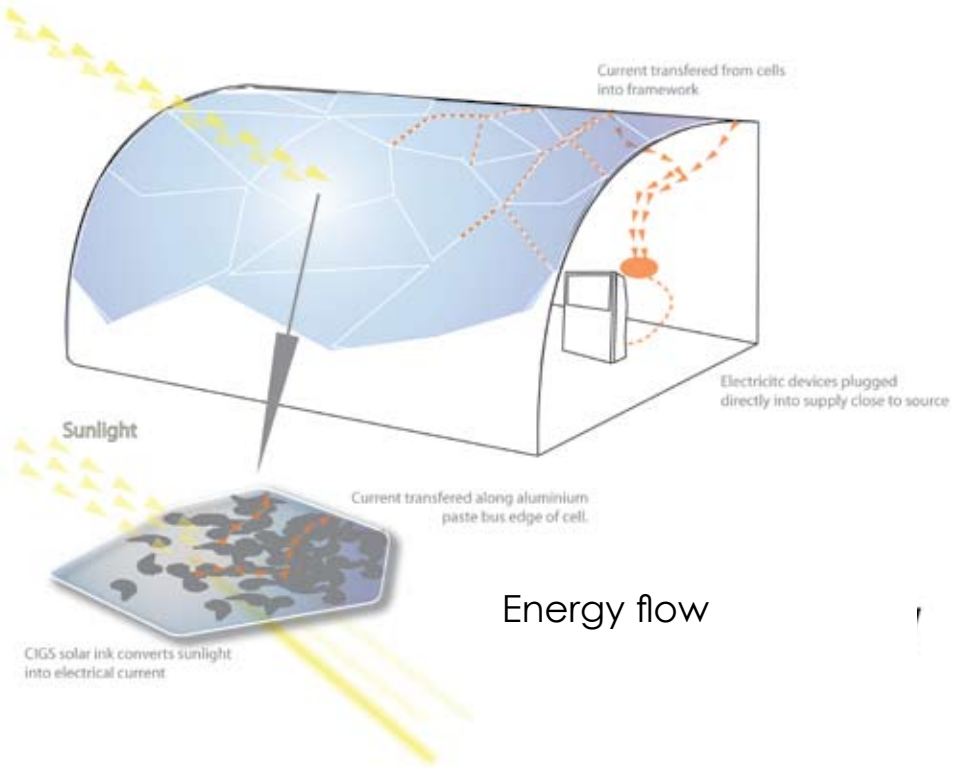
The design of the pattern was related to the collection and distribution of the energy within the house. Particular areas of design included:

- Graduation of pattern related to the layout of the house and the distribution of energy needed within it e.g. more energy is needed in the kitchen and so the solar pattern is more dense here
- The distribution of the energy network inspired by tree structures
- The links between the solar 'leaves' in the pattern become small 'branches' of energy flow
- The branches link together and connect with the branch-like external structure
- The branches collect at the walls of the house and become energy focal points i.e areas where energy consuming items, e.g. TV and fridge, can be plugged in
- Application of the pattern over an 8 x 10 m2 window would enable 2kWp of solar energy to be produced (the amount required for an average 3 bedroom household)

Printed layers



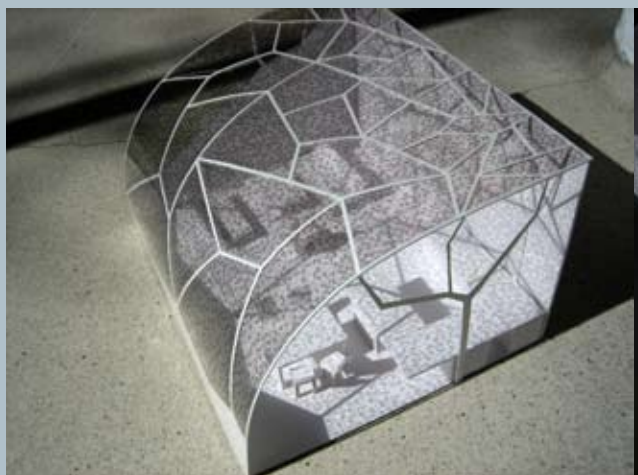


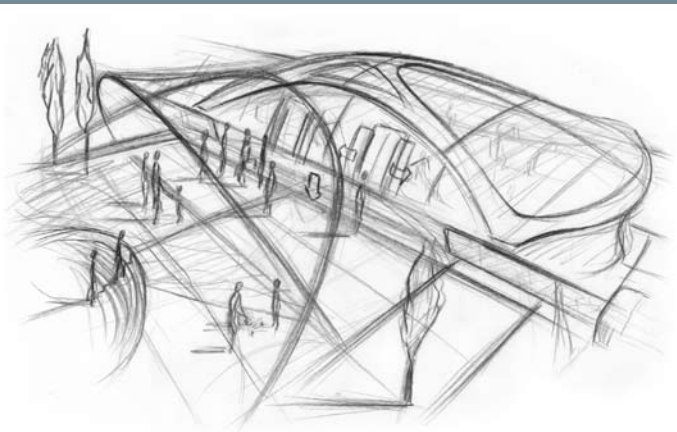


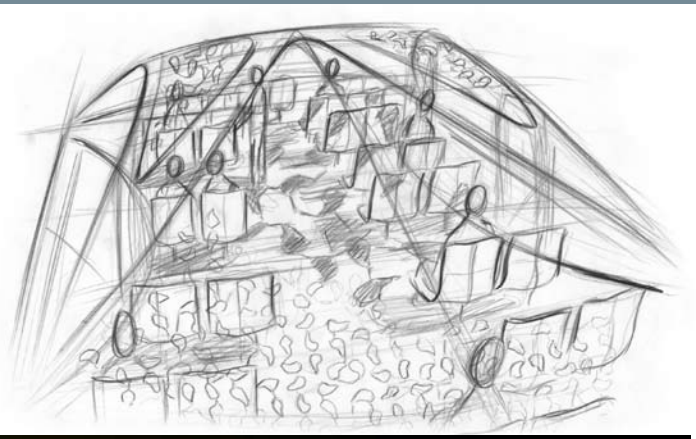
Energy flow

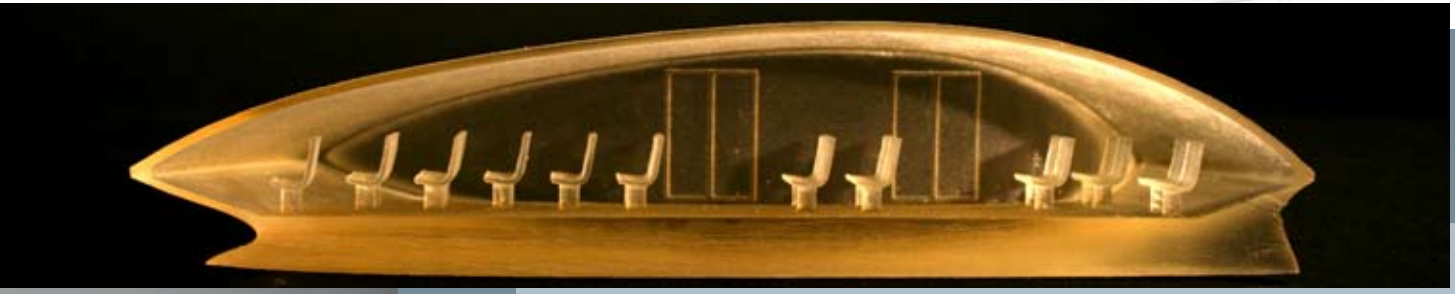
Research into architectural materials such as ETFE and alternative photovoltaic materials inspired much of the design. The technology considered in the project included:

- Panels constructed from three ETFE (ethylene tetrafluoroethylene) layers
- ETFE inkjet printing technology allows pattern design to be applied directly to building component
- NanoSolar have developed a technology allowing them to 'paint' solar panel components
- Proposal of combining the inkjet ETFE printing with the solar ink to produce printed solar patterns





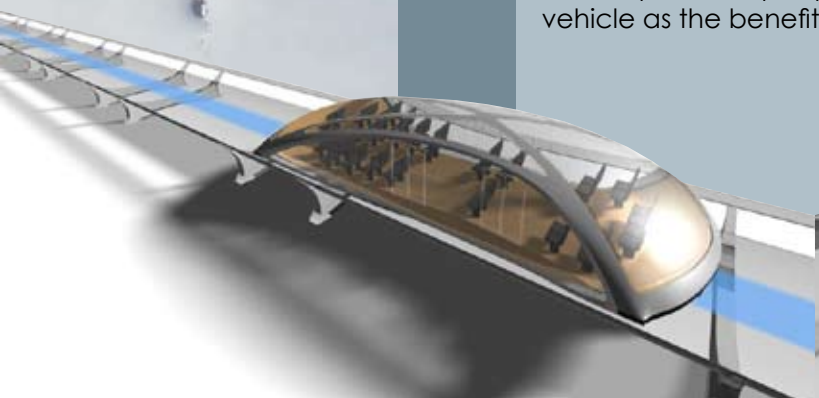


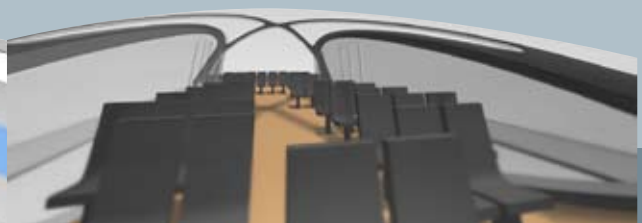


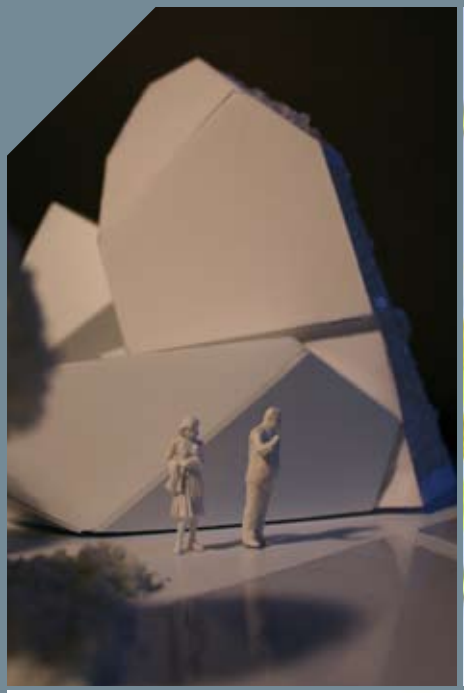
Aqua-plane vehicle

The mass transportation vehicle uses reduced friction aqua-plane infrastructure for improved efficiency.

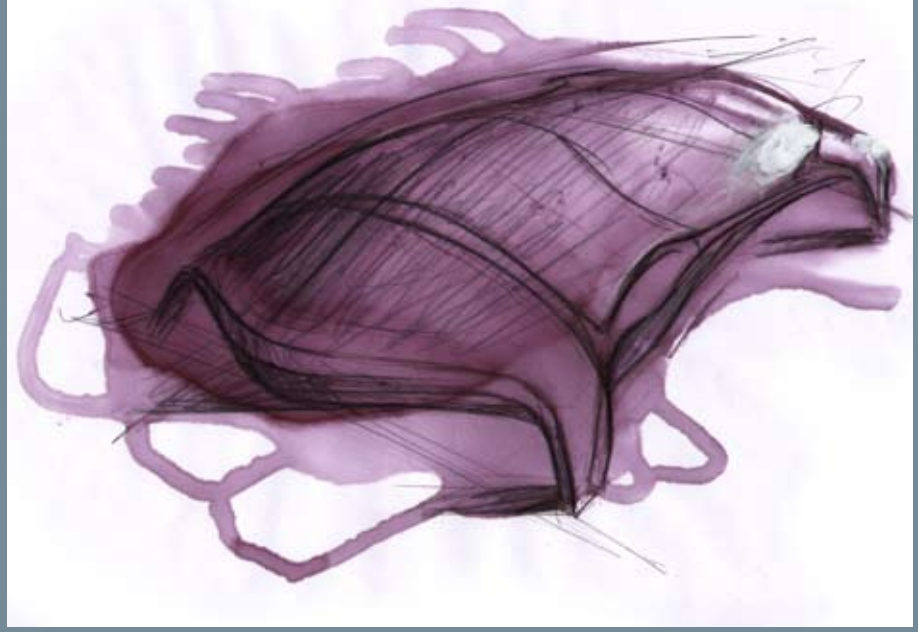
- Hydro-dynamic form inspired from Waterboatman insects
- Control system uses rollers on a track to initially propel the vehicle from rest and slow it down and stop
- Application of solar printed ETFE to external structure to create ambient lighting environment for passengers
- Principle of aqua plane and ETFE more suitable to large scale vehicle as the benefits of the technology are greater

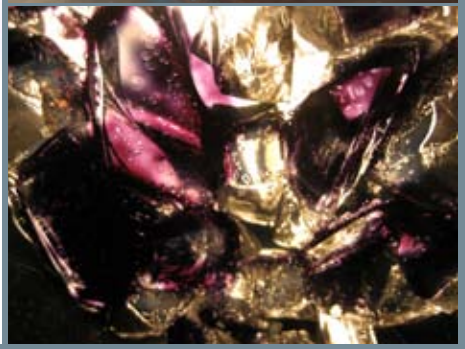






Prototype / Brainstorming / Foam model / material tests





Fold It

Fold-it is a solar membrane designed to expand and contract in reaction to different light levels, maximising the surface area of the structure collecting more light when required. It uses different types of photovoltaic panels, opaque for maximum efficiency and transparent to allow light to pass through.


238
288

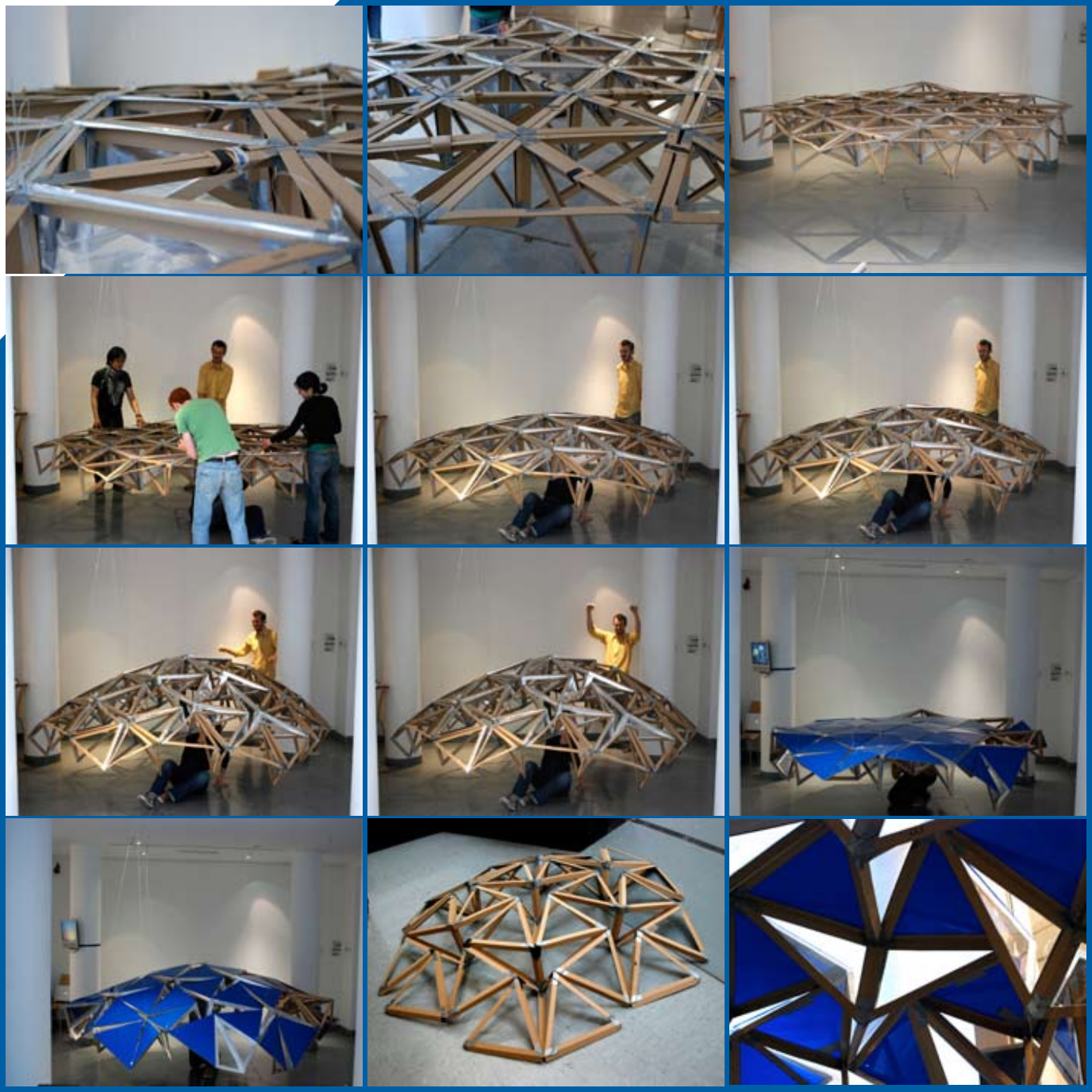




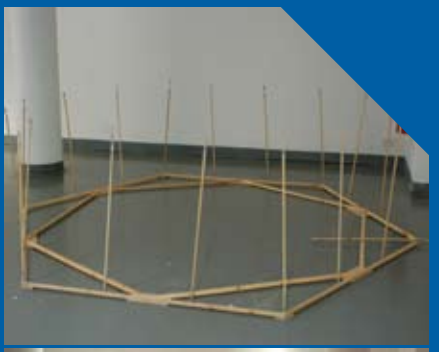


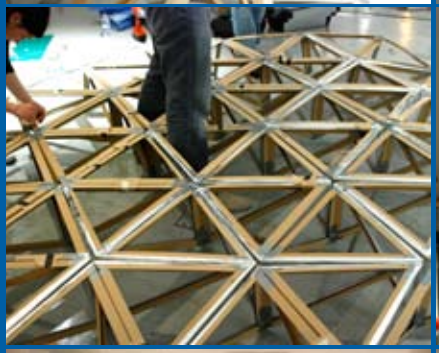






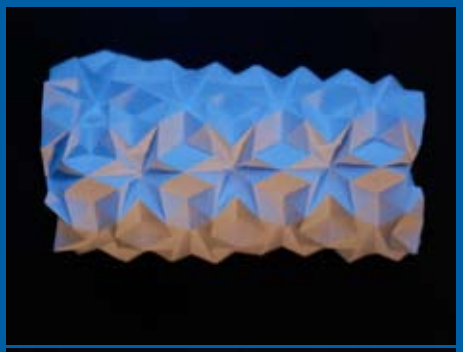
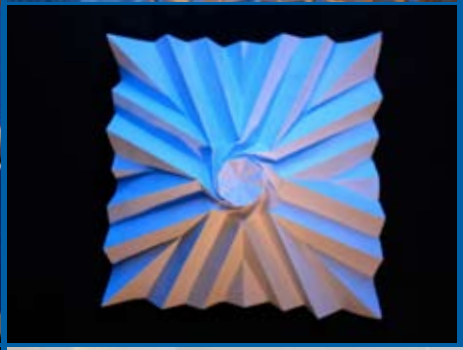
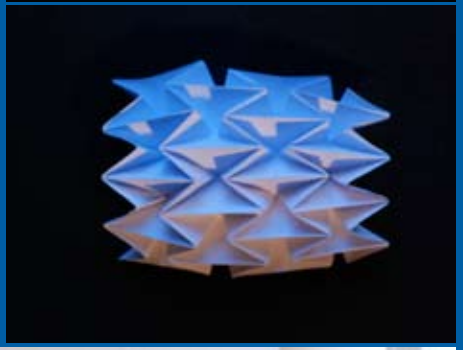








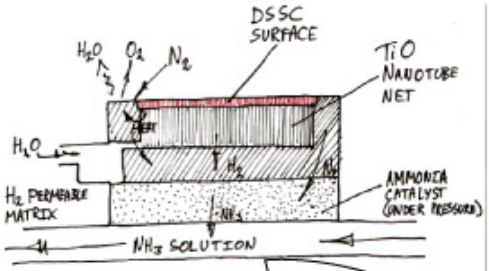


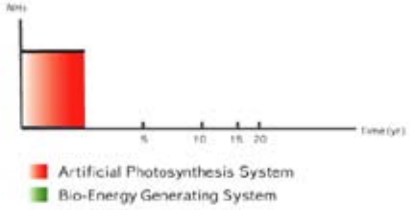





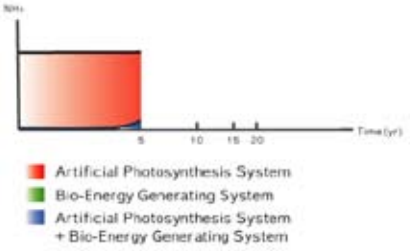

Solar Ivy

Solar Ivy is a DIY kit incorporating both living plants in a hydroponics system, and Die ensetised Solar Cells (DSSCs), designed to augment the energy system of your home with a local supply from a solid oxide fuelcell operating with concentrated ammonia solution as the energy source.

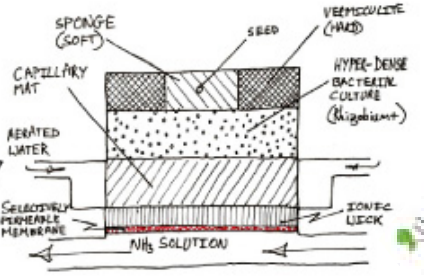
The system is easily assemblable, simply plugging together and sticking to the exterior of your house. The key is the use of Nitrogen to store energy, linking into the natural cycle of this innert non-toxic substance (which makes up approximately 80% of the Earth's atmosphere).

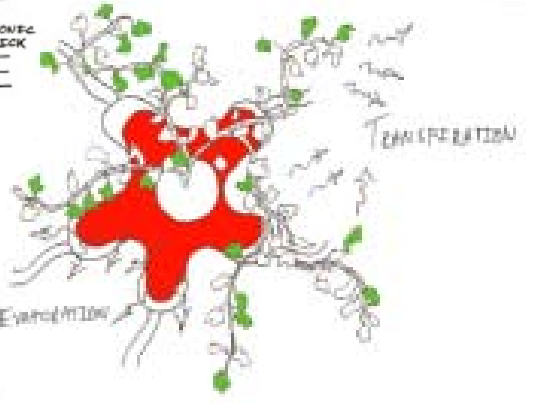


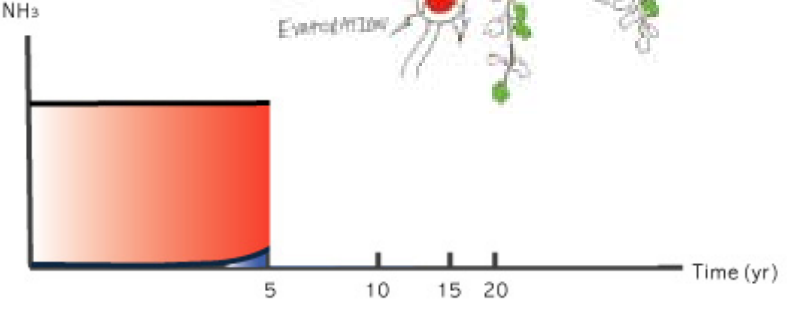




1 - Gathers rainwater while raining
2 - Store water in tank
3 - Due to transpiration and capillary phenomenon water goes up through connection from tank
4 - Chemical actions are progressed through module
5 - Result of chemical action (ammonia) is moving though connection
6 - Stored into tank



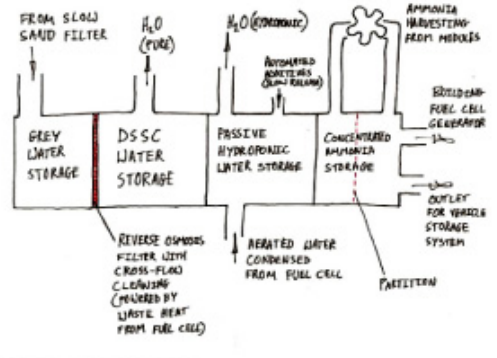


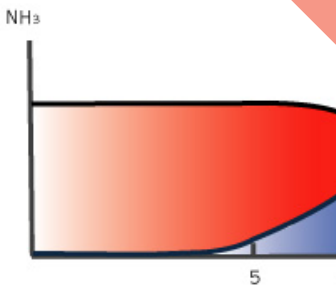


Artificial Photosynthesis System

Bio-Energy Generating System

Artificial Photosynthesis System
+ Bio-Energy Generating System

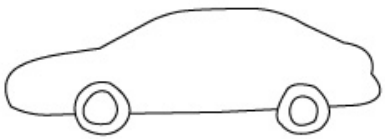




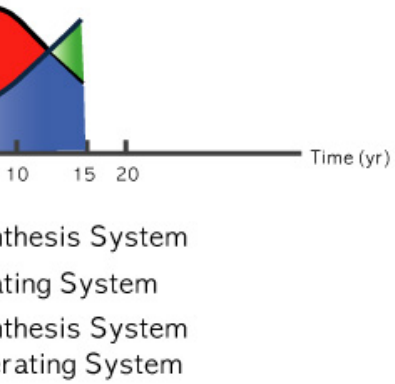
Artificial Photosyn

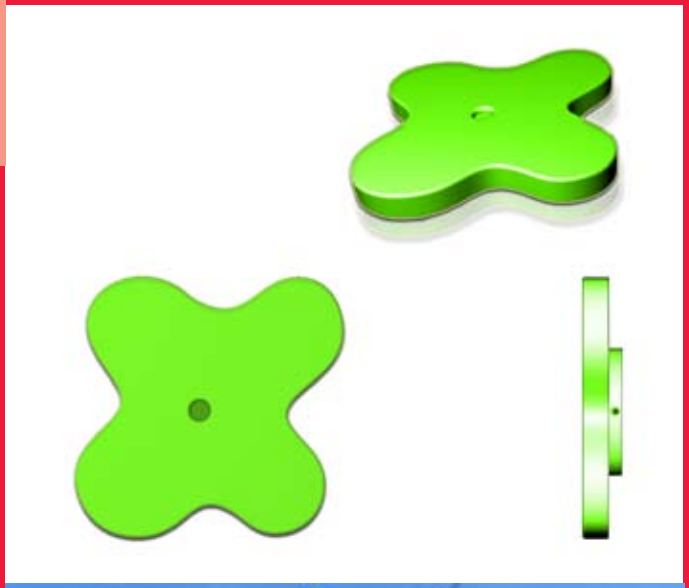
Bio-Energy Genera

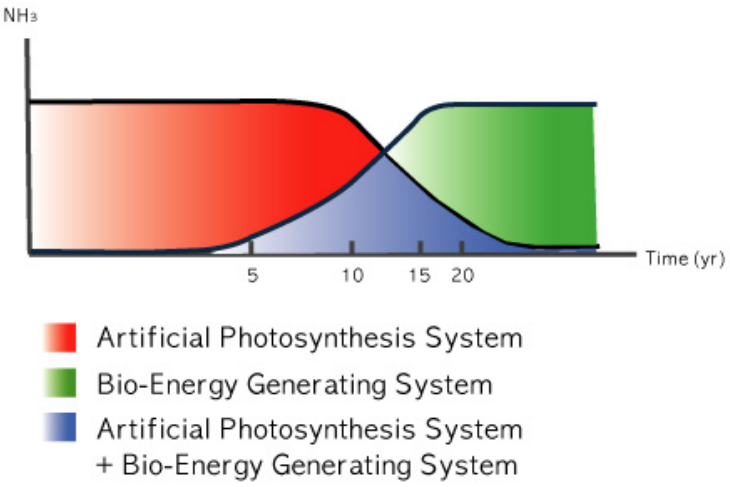
Artificial Photosyn
+ Bio-Energy Gene

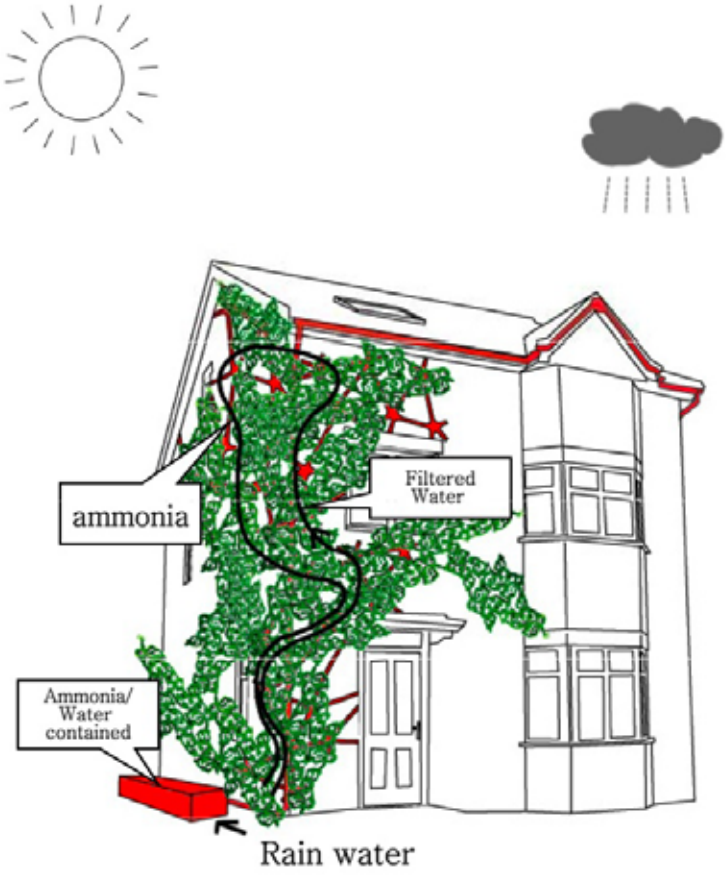


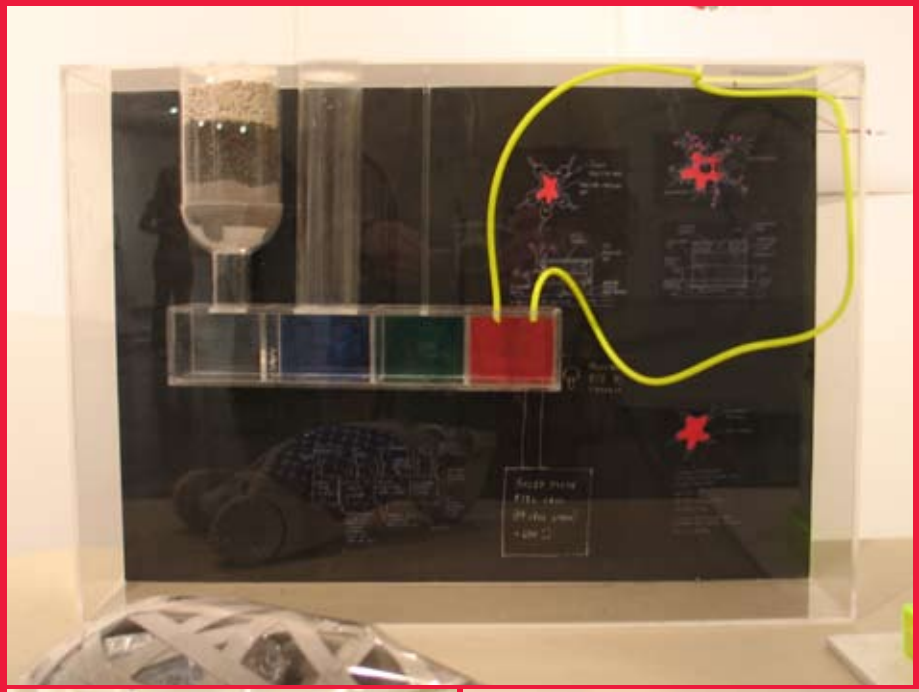
1 - Buy system kit in mart nearby your house
2 - Try to observe perfect surface to get lots of sunshine
3 - Arrange modules and stick under consideration of overall pattern
4 - Plug-in connections between modules
5 - Put tank in adaptable place
6 - Connect guttering and tank







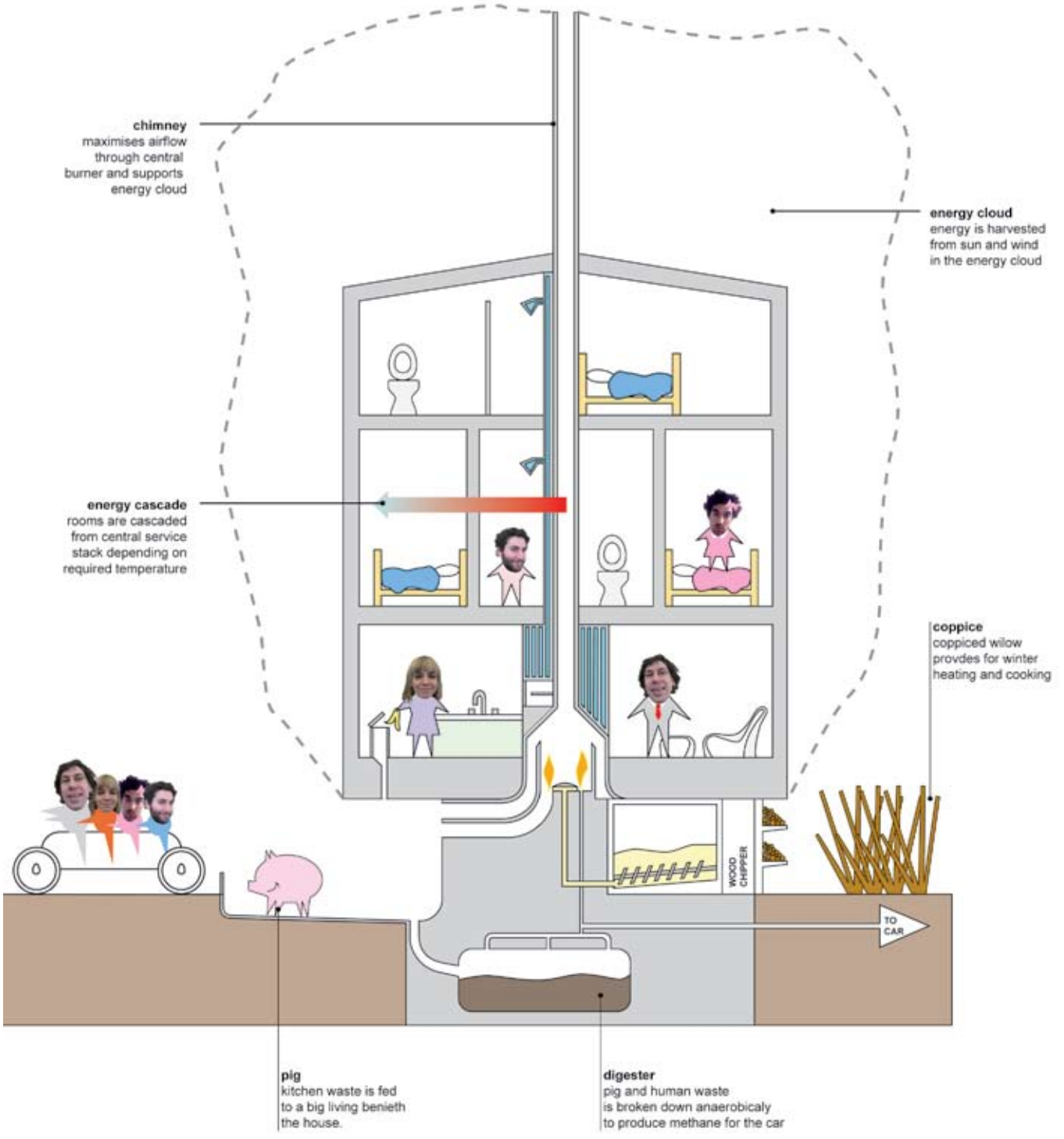

ammonia
Filtered Water
Ammonia/ Water contained
Rain water



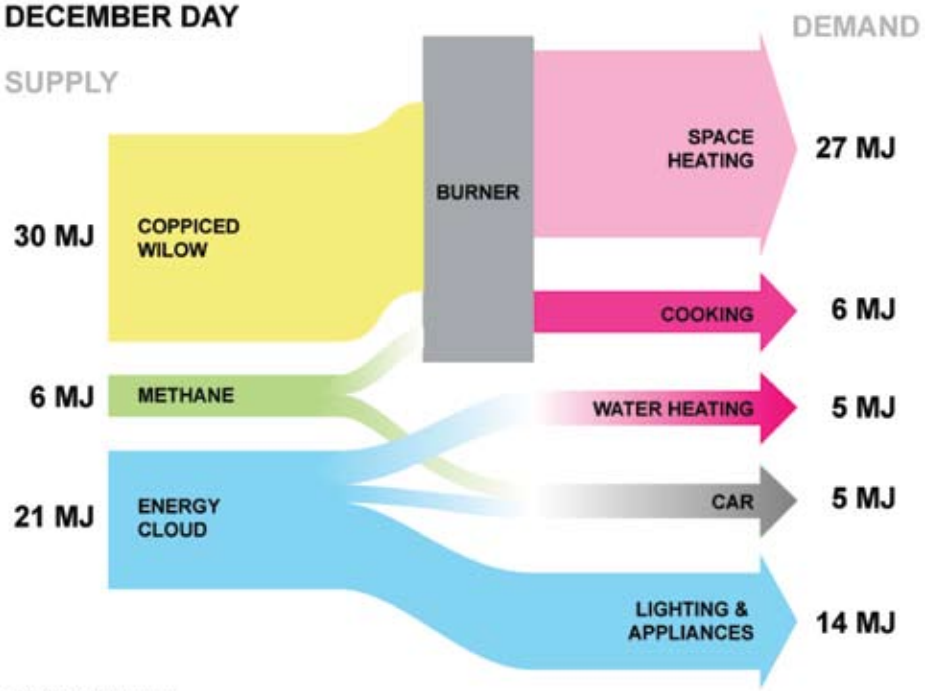
Colod

The Colod house harnesses the maximum energy from its environment and its inhabitants. Energy is provided by coppiced willow grown on site, from methane produced by digestion of the inhabitants waste, that of a pig and from the Energy Cloud.

The Energy cloud is made up of thousands of leaves. Each leaf performs both solar energy collection, using thin film technology, and wind energy collection, using piezo-electric membranes to harvest energy from fluttering. The modular structure of the energy cloud allows for its flexible application in many architectural settings.

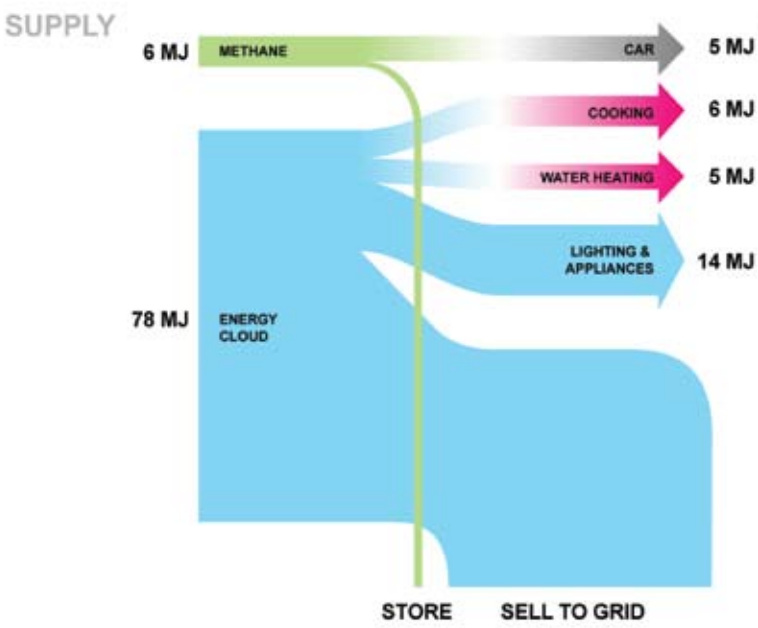

chimney
maximises airflow
through central
burner and supports
energy cloud
energy cloud
energy is harvested
from sun and wind
in the energy cloud
energy cascade
rooms are cascaded
from central service
stack depending on
required temperature
coppice
coppiced wilow
provdes for winter
heating and cooking
WOOD CHIPPER
TO CAR
pig
kitchen waste is fed
to a big living benieth
the house.
digester
pig and human waste
is broken down anaerobicaly
to produce methane for the car

DECEMBER DAY

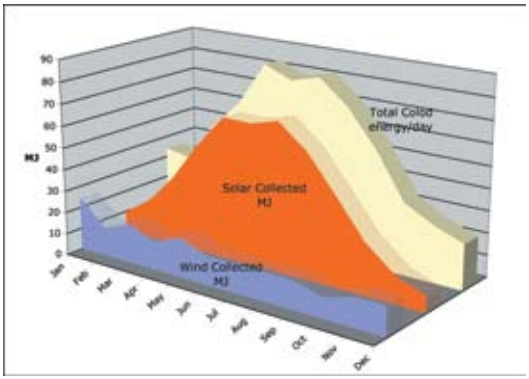


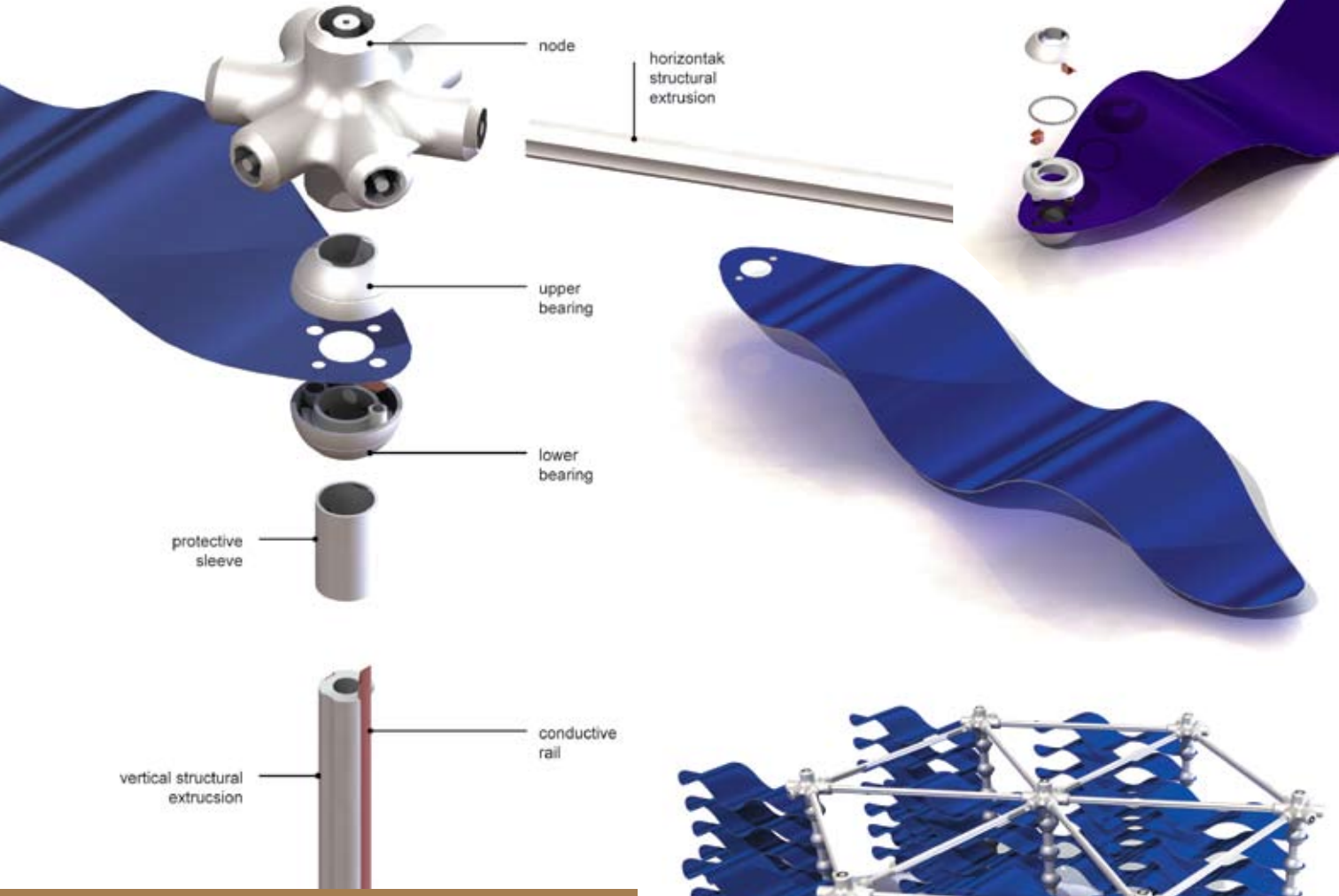
Daily energy flow (winter) based on London climate.

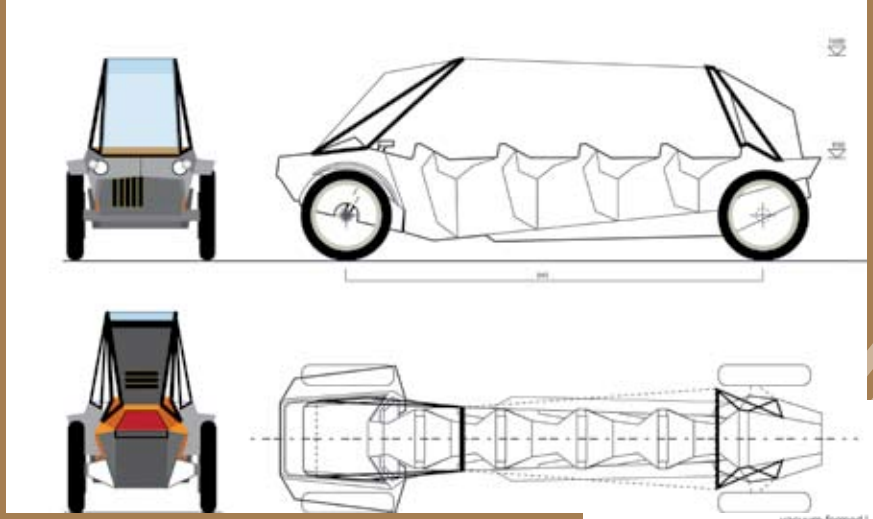
JUNE DAY

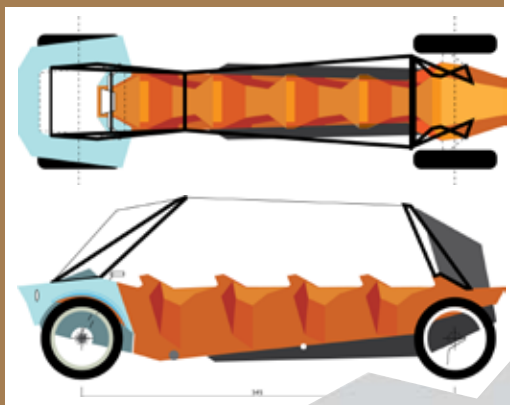


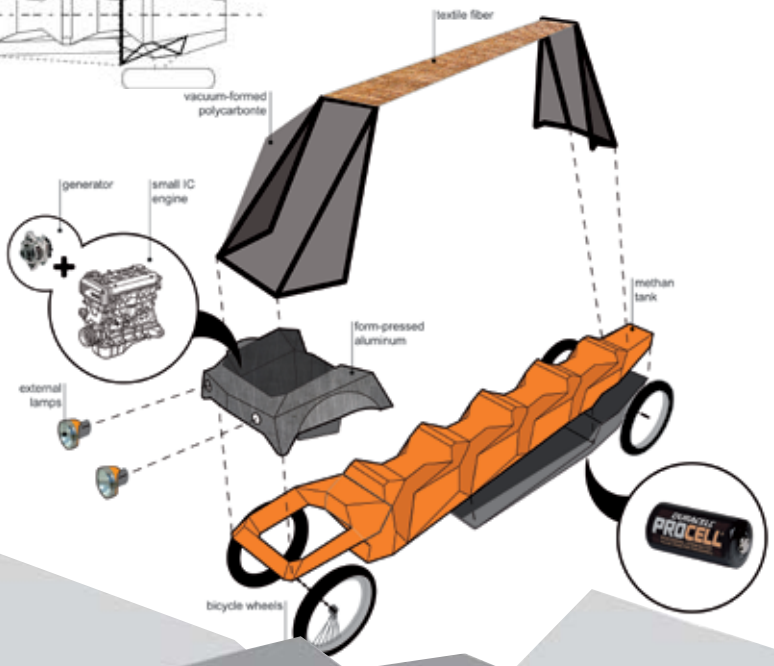
Daily energy flow (summer) based on London climate.

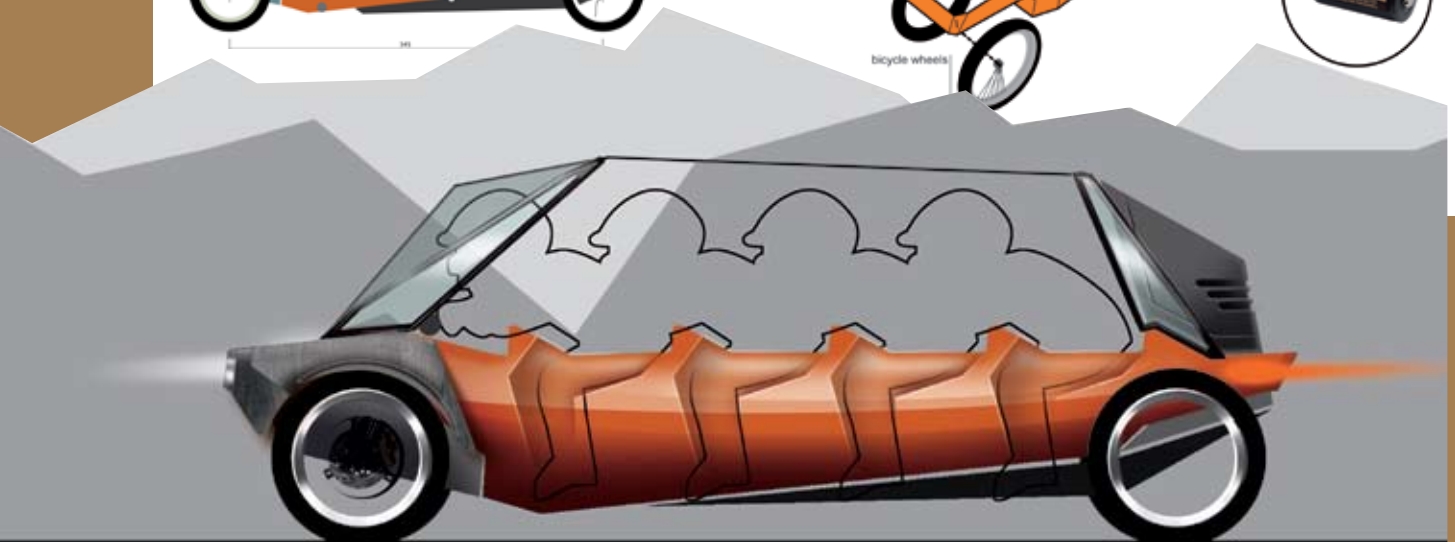


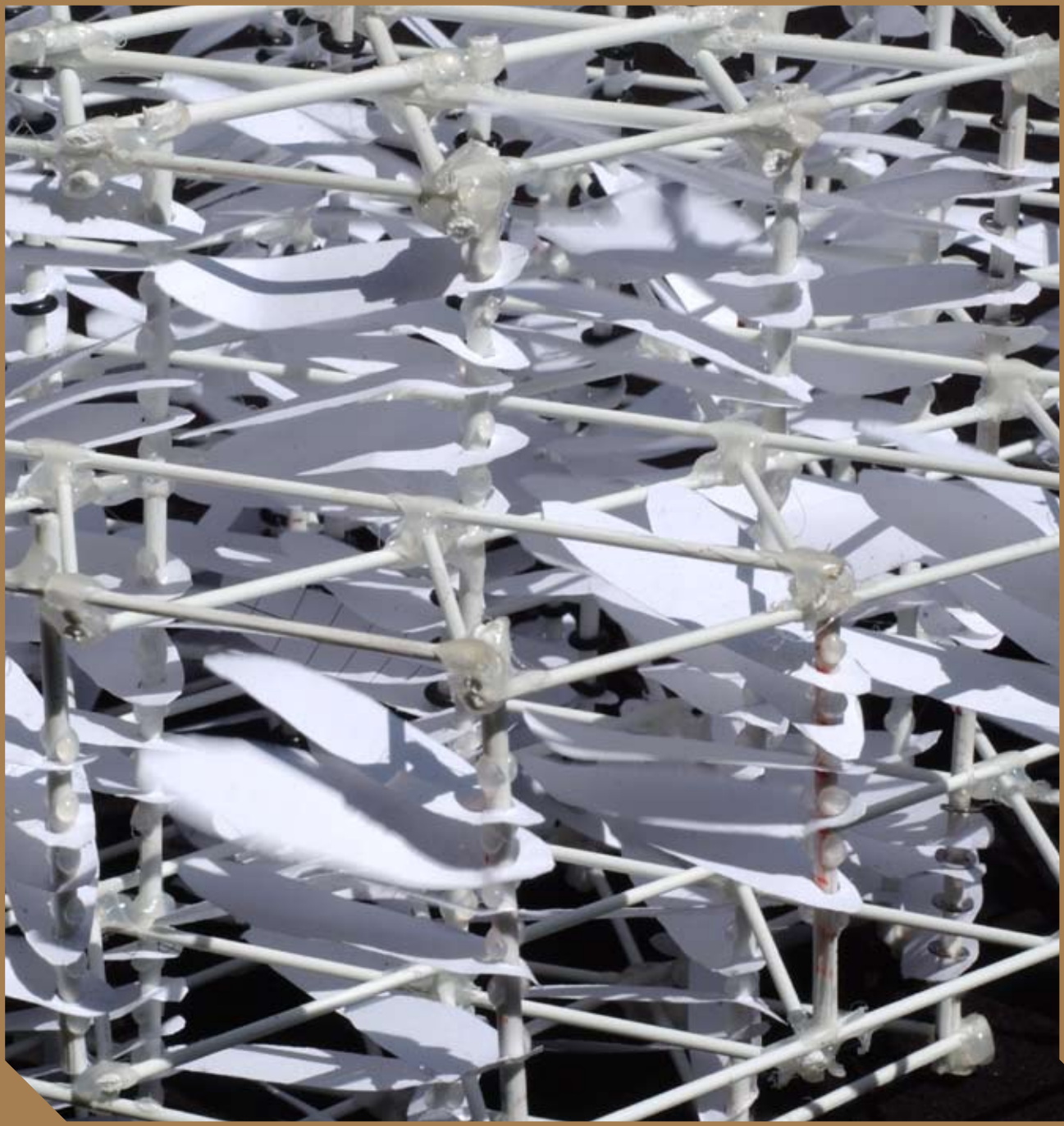

node
horizontak
structural
extrusion
upper
bearing
lower
bearing
protective
sleeve
conductive
rail
vertical structural
extrucsion






textile fiber
vacuum-formed
polycarbonte
generator
small IC
engine
methan
tank
form-pressed
aluminum
external
lamps
bicycle wheels

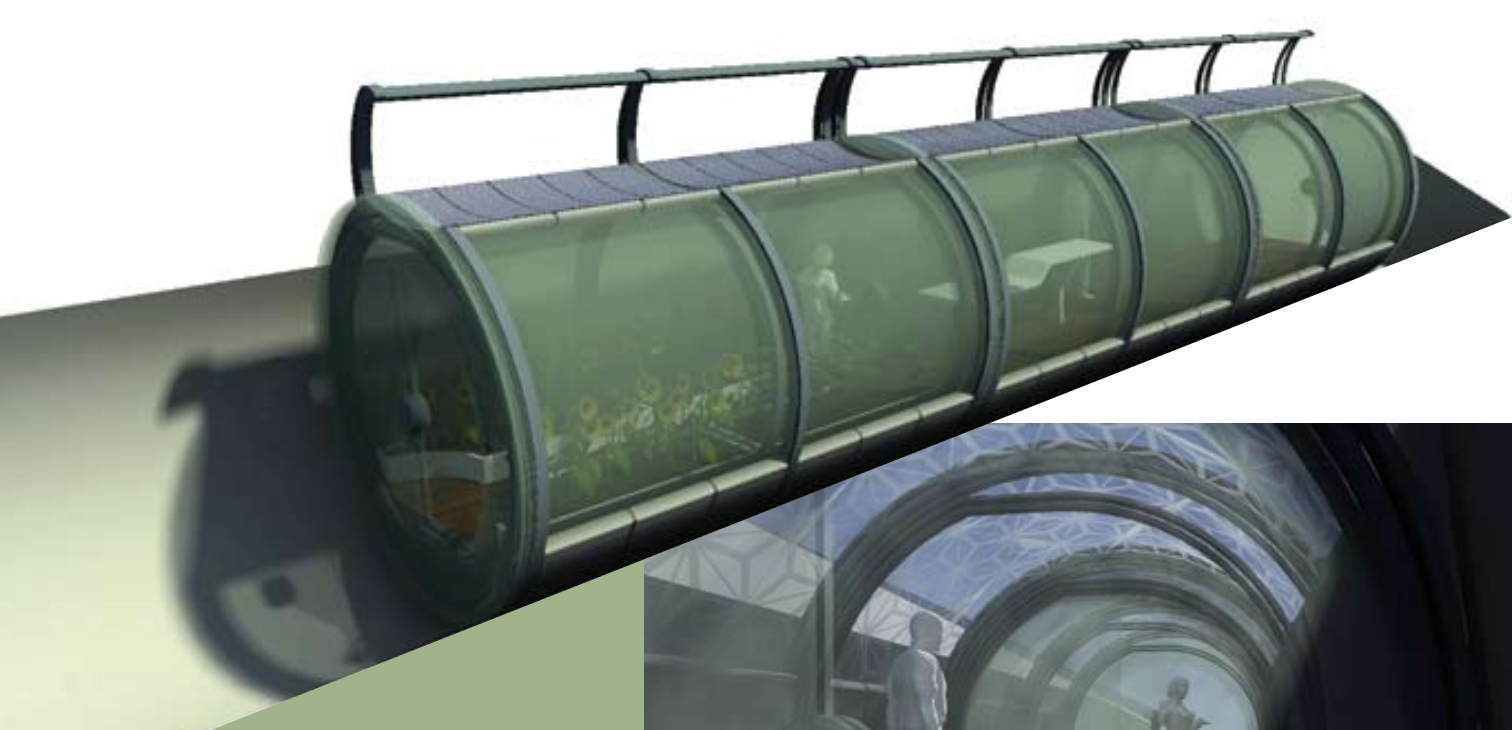




Starlight

What we propose is a worldwide system of modular 'living' capsules. These industrial purpose built capsules can be used for both plants and people to make us benefit and enjoy the most from the benefits that natural vegetation offers to us!

The capsules are circular and based on a single axis rotating concentrated photo voltaic system. Liquid cooled, highly efficient solar panels are used to process the reflected light from the parabolic dish. The rotational tracking system, part of the outer shell of the capsule, allows for an even further increased efficiency. At the same time the rotating outer shell creates a changing and therefore very interesting environment to live in. The solar panel blocks part of the direct sunlight, keeping your head in the shade while flooding the room with atmospheric light.

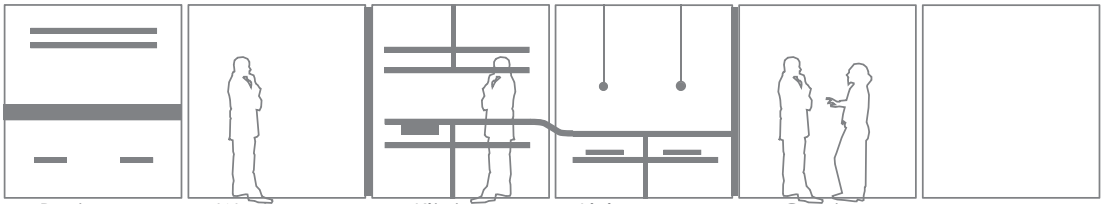


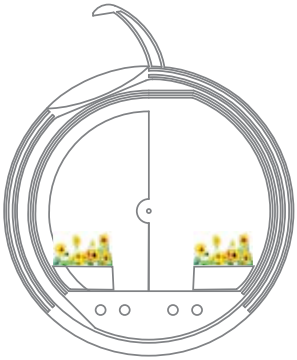
STARLIGHT module is a scalable, self-sustaining living capsule which incorporates uniaxial solar concentrators along its length. The module can be connected and installed on any surface with an incline from 0~45° (e.g., mountain, building, ship).

The rotational tracking system in the outer shell creates an ever changing and interesting living environment. The moving reflector partially blocks direct sunlight, keeping your head in the shade whilst flooding the room with atmospheric light.

The inner (insulating) and outer (laminating) glass layers create a large static air gap which provides excellent thermal insulation. The transparent construction gives a panoramic view (135° vertical) , receives natural lighting both day and night, and behaves like a greenhouse that traps warm air inside, reducing the energy requirement for the heating system in winter.

Customizable Module Configuration



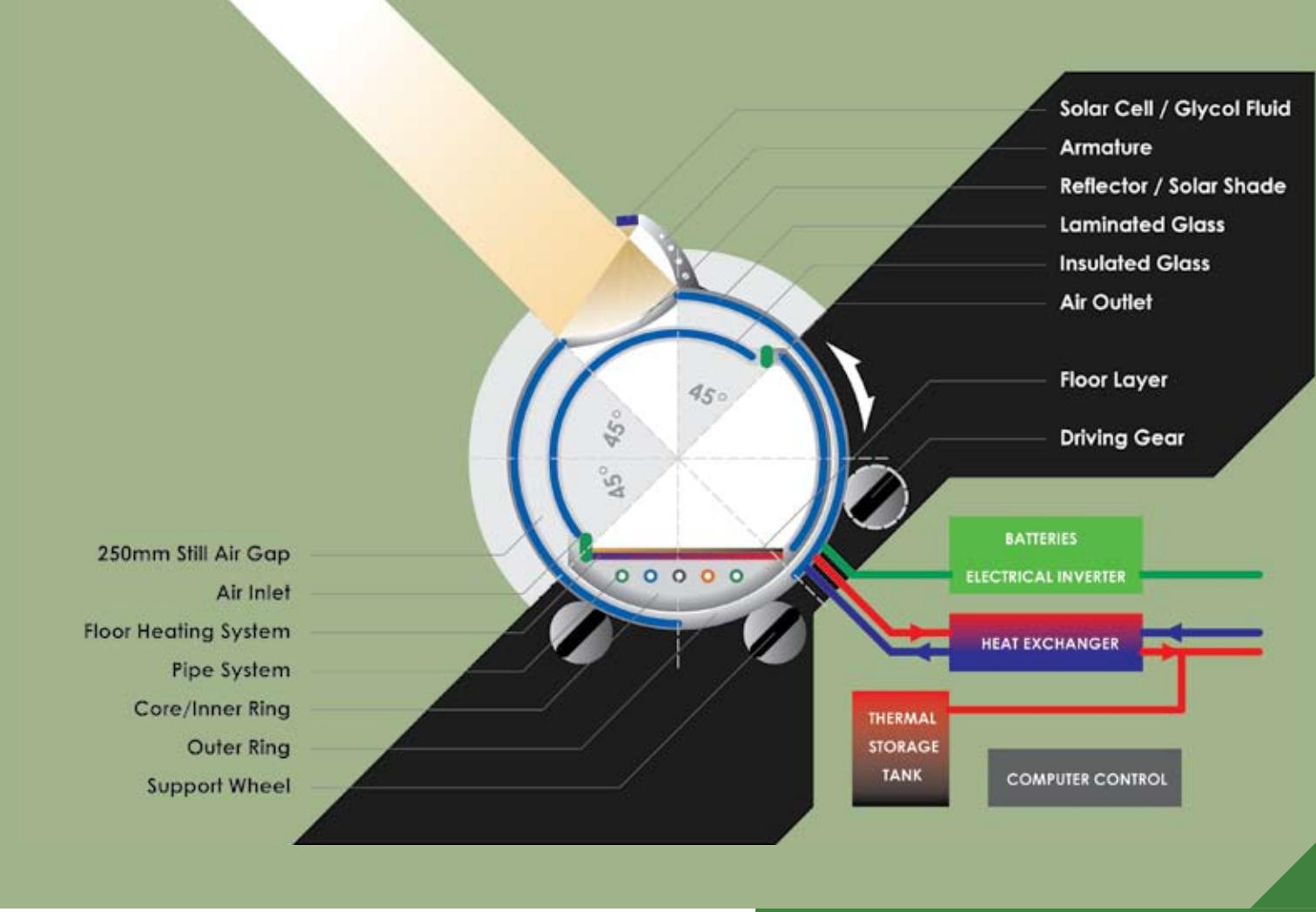


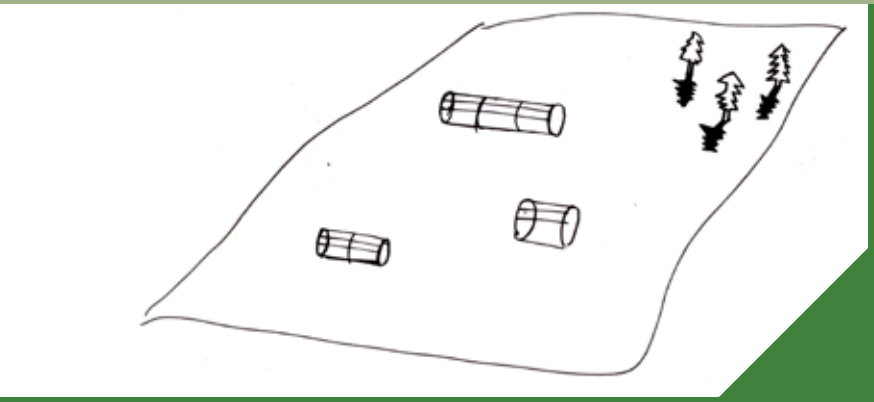
The modules are connected by rotating door systems, which regulate oxygen and CO^2 generated by the plants. Natural ventilation is achieved by the air flow created in the cylindrical "greenhouse", where the stack effect is easy to form.

The uniaxial tracking solar concentrator on one module generates 2KWp (combined thermal & PV), Cooling fluid flowing on top of the linear solar panel, increases the efficiency of the PV system and provides hot water by the heat exchanger.

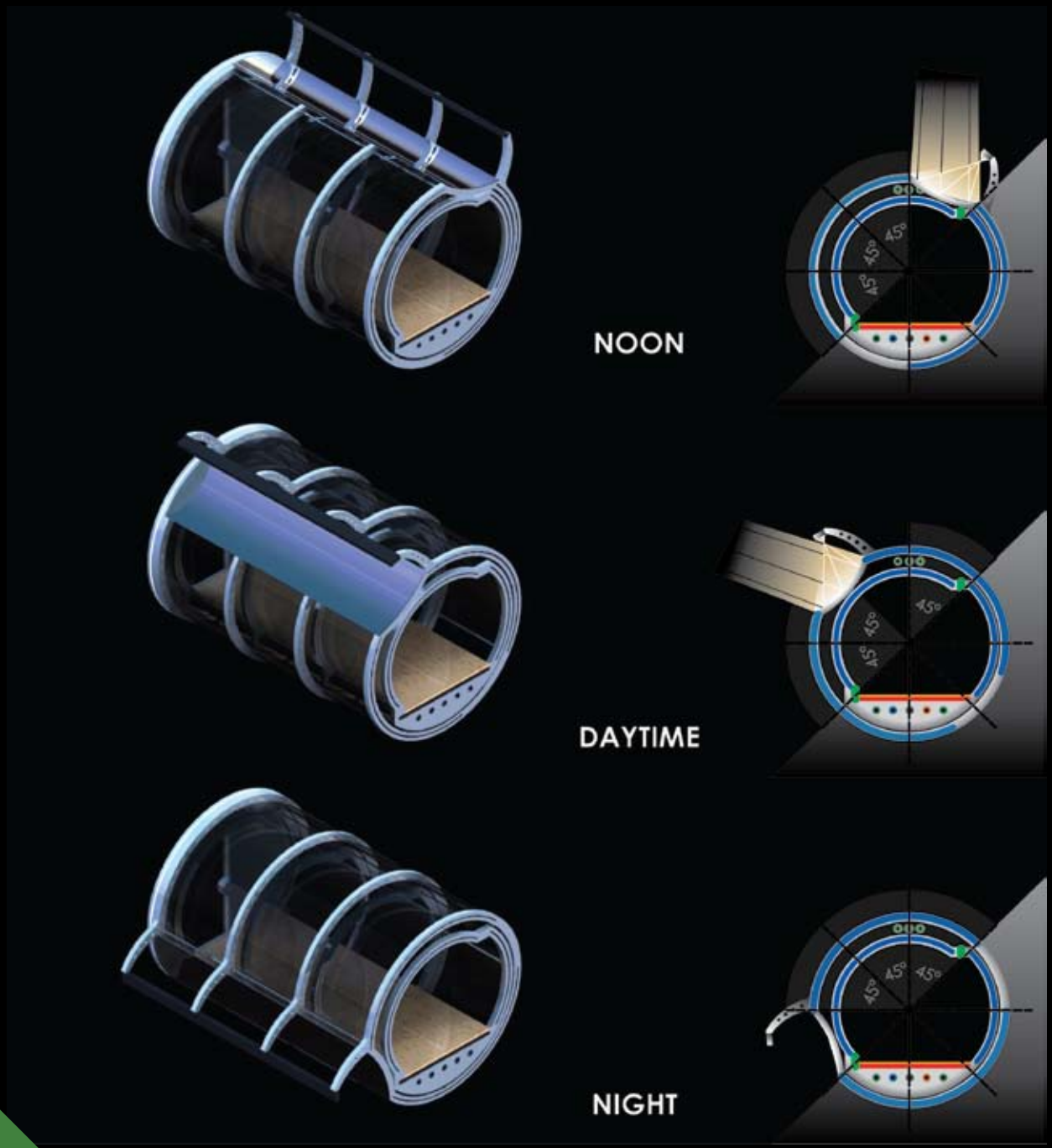
Last but not least, it is a house of dream. At night the entire ceiling becomes transparent and a magnificent starlight view can be enjoyed as you lie back in bed. Share it with your loved one - ROMANCE

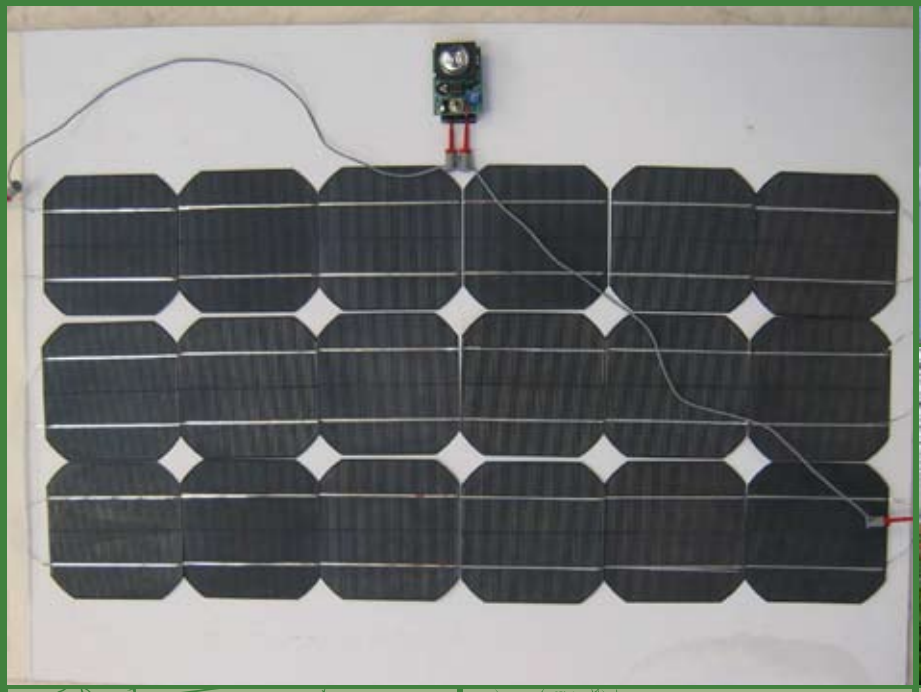
1. 135° Constant natural lighting / viewing angle
2. Uniaxial tracking linear concentrator
3. Efficient power generation per unit
4. Automatic rotating door system
5. Natural heating & ventilation
6. Adaptable to 0~45° surface
7. Multi-layer super insulation
8. Reflector as solar shade
9. Floor heating system

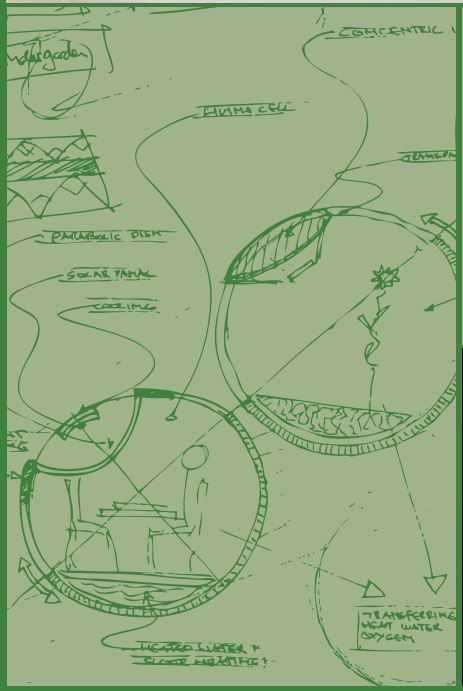

Solar Cell / Glycol Fluid
Armature
Reflector / Solar Shade
Laminated Glass
Insulated Glass
Air Outlet
Floor Layer
Driving Gear
45°
45°
45°
250mm Still Air Gap
Air Inlet
Floor Heating System
Pipe System
Core/Inner Ring
Outer Ring
Support Wheel
BATTERIES
ELECTRICAL INVERTER
HEAT EXCHANGER
THERMAL STORAGE TANK
COMPUTER CONTROL

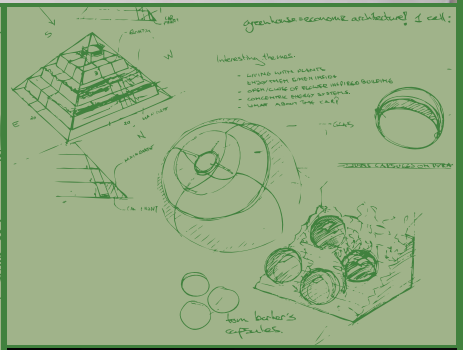


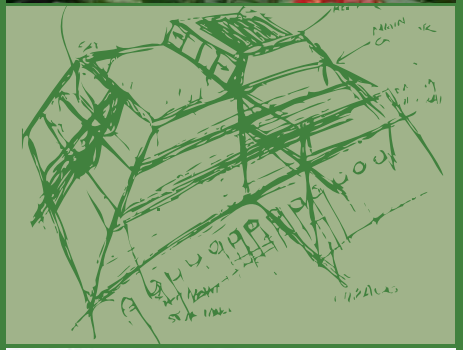
Starlight tracking

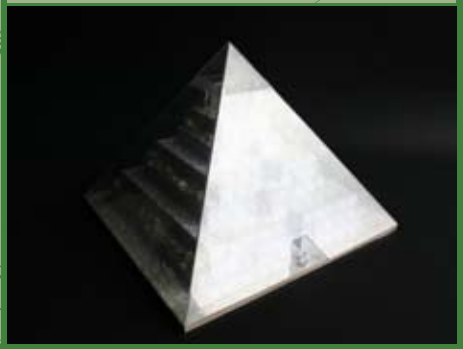


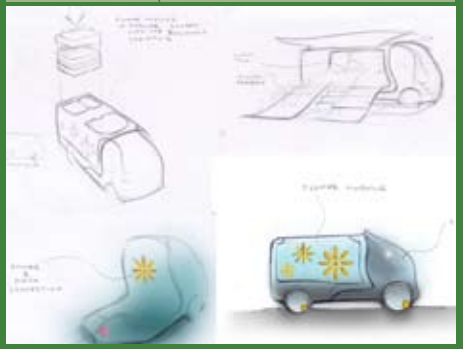



CONCENTRIC
PARABOLIC DISH
SOLAR PANEL
COOLING


greenhouse economic architecture! 1 cell:
interesting things:

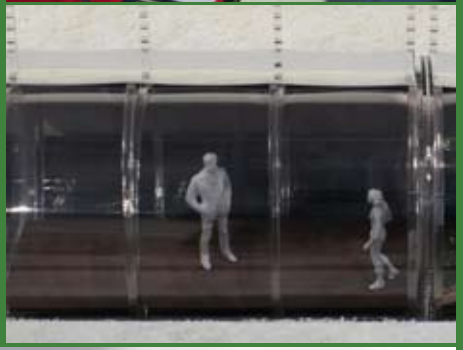











Falguera

falguera is an architectural component including innovative solution for deployable solar panels .

The need for facing south for both window and solar panels is a critical element in term implantation of such technologies. While it is more efficient to use natural heat and light when the sun is up, it is a waste to not having solar panel displayed in the optimum position. In both cases, south is the best location.

Falgera is going around this problem by allowing thin film solar panel to curl while not needed, therefore revealing a normal window. The Thinfilm solar panel is mounted on a flexible matrix which is moved by sandwiched shape memory alloy. This display allow each leaves to curl elegantly, integrating a potentiality for an innovative architectural language.

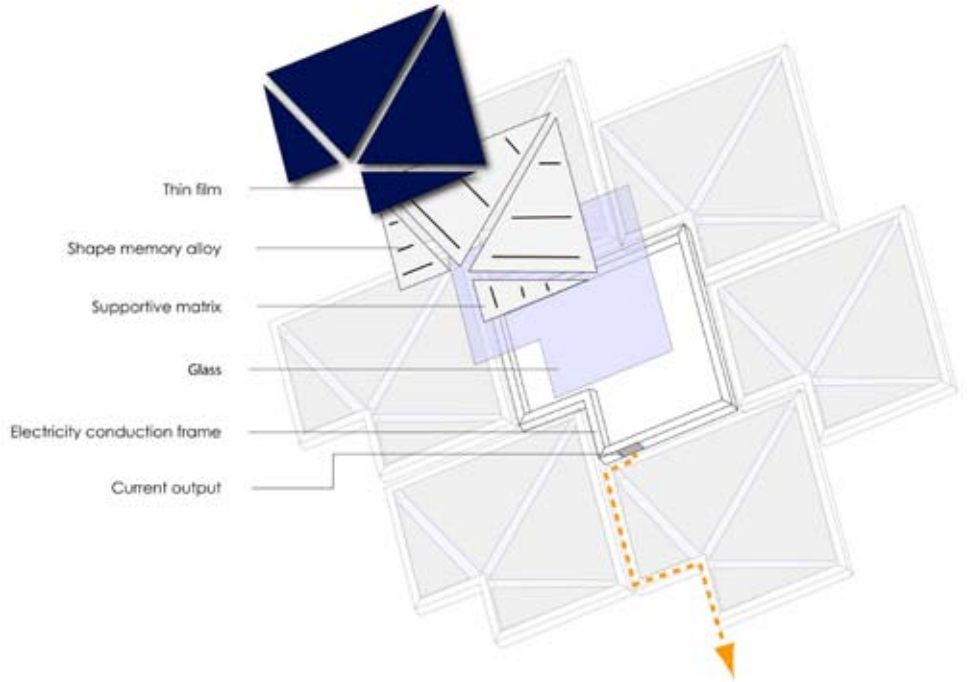
"There is a single light of science, and to brighten it anywhere is to brighten it everywhere."

Isaac Asimov

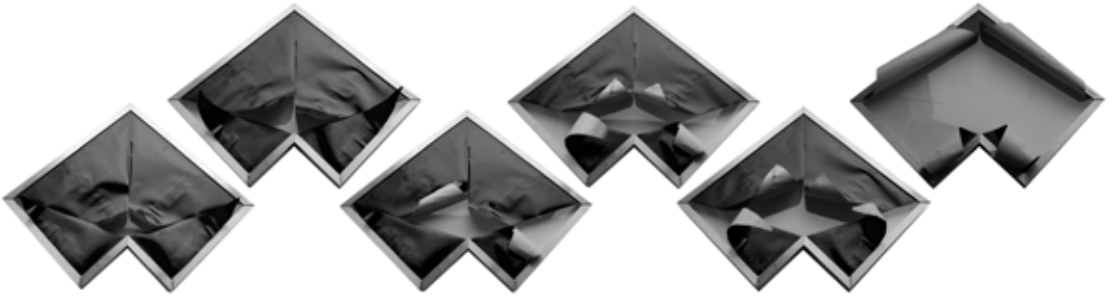
Falguera is a deployable solar panel that employs new thin film technology along with the shape memory wires. Unlike the conventional solar panels that are flat and solid, Falguera panels tessellate together in a way that it could be installed on curved surfaces as well. The panels together create an architectural language and blend with the generic form of the structure.

Falguera is both a window and a deployable solar panel. This reduces the complexity of dealing with two contractors in the construction phase. When the thin film is folded, the glass surface under the skin allows the natural light to go through. In a cold day, this increases the overall efficiency of the energy consumption for heating purposes. In a hot day, however, the solar skin will unfold and create shading inside the building, while storing the solar energy. The deployable mechanism is achieved by using the shape memory wires that are fabricated between the solar thin film and the protection under. This has made Falguera highly efficient and versatile.

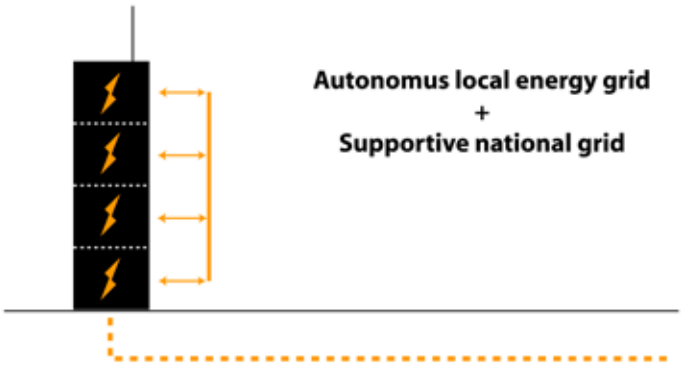
Falguera is the solution to the limitations in the solar panel technology. Deployed Falguera solar panels will halve air conditioning costs on a hot sunny day and the power generated will be enough to power all the lighting requirements of the building it clads. Transmission losses in the UK account for almost 10% of all electricity consumption. Local grid-within-grid systems minimise these losses by shortening distances between production and consumption of electricity. Deploying (or retracting) one panel takes only as much energy as making three cups of tea - easily outweighed by the reduction in air-conditioning energy alone.

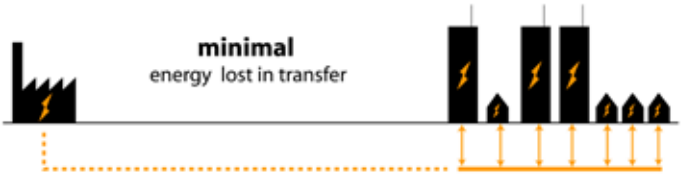


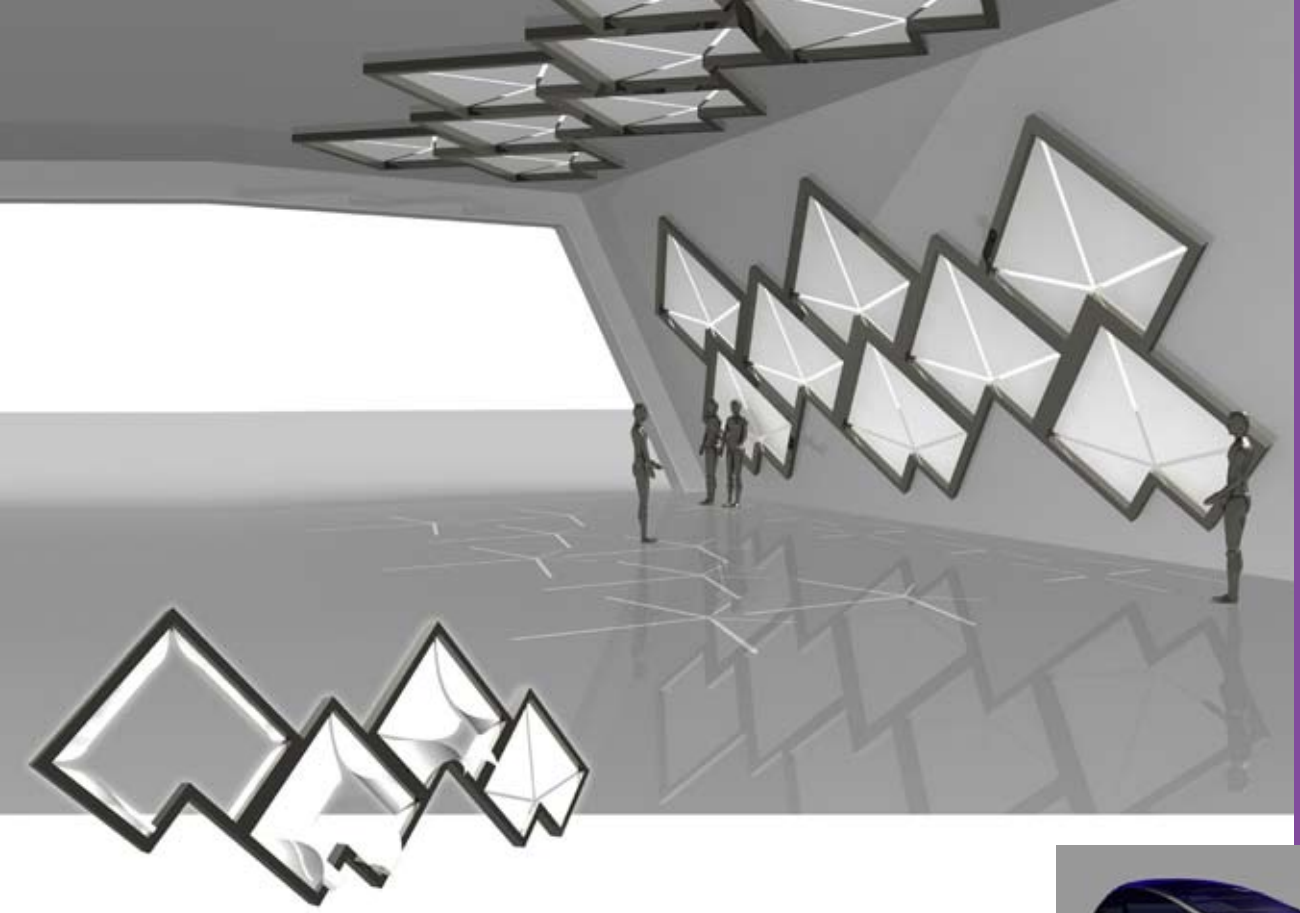
Exploded view

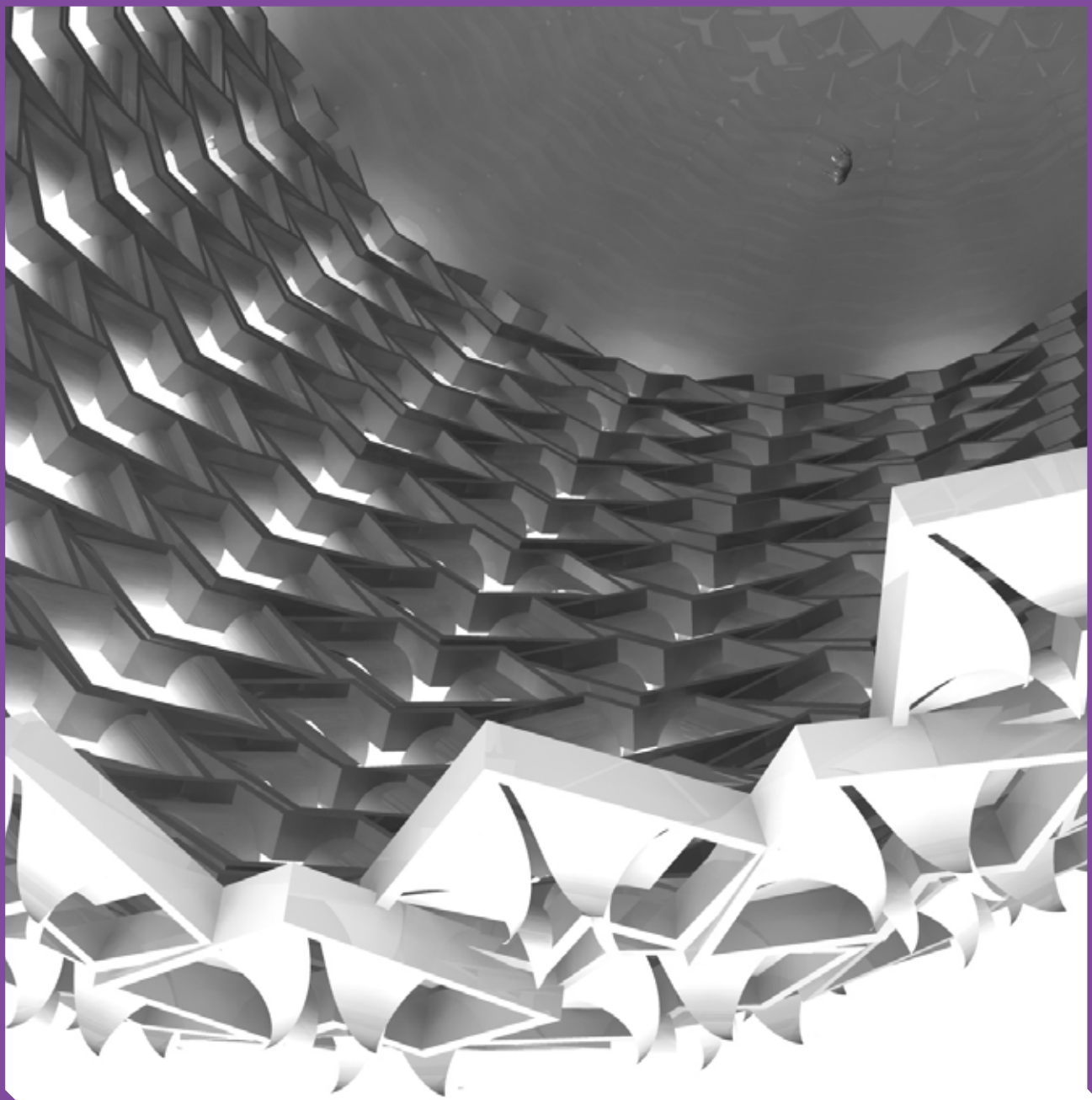


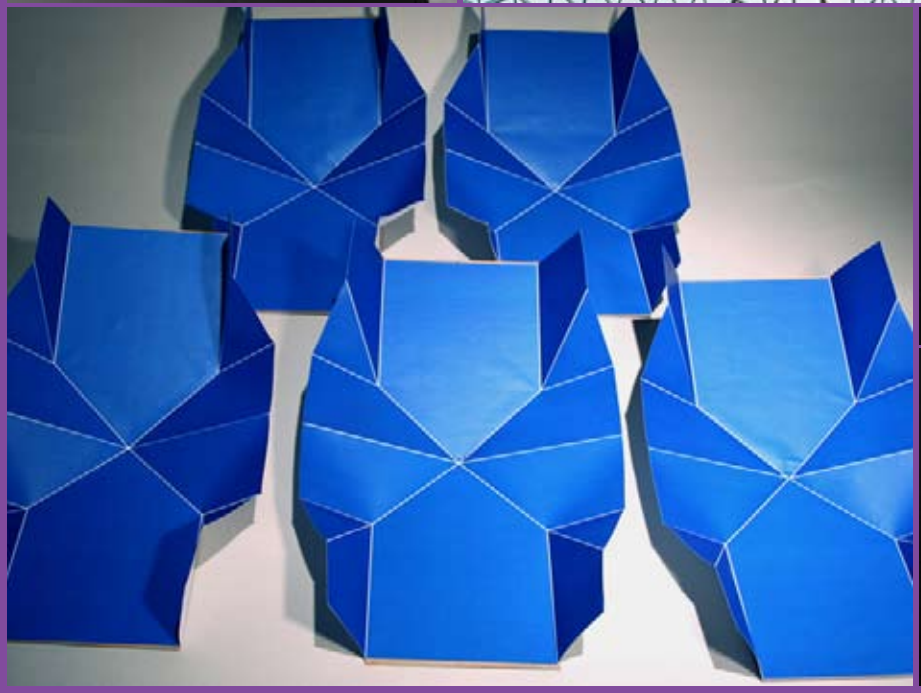
A grid within a grid

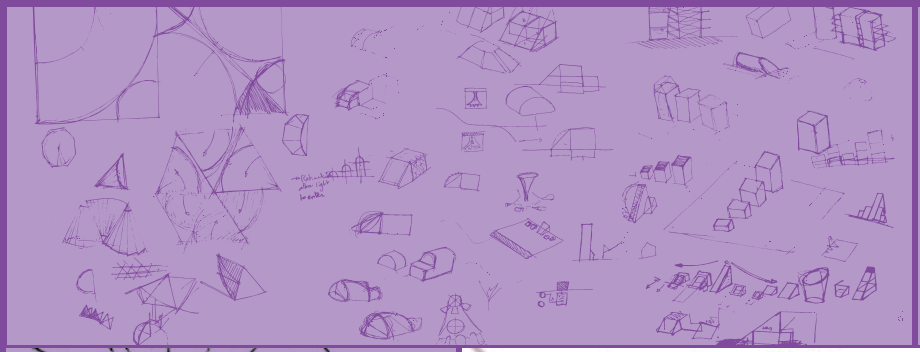


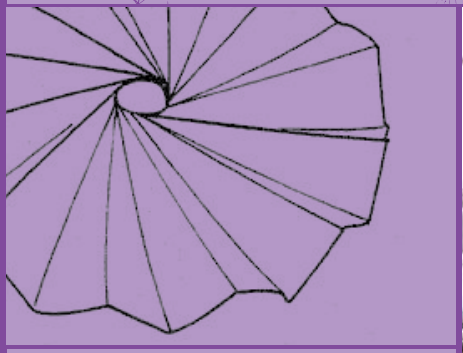


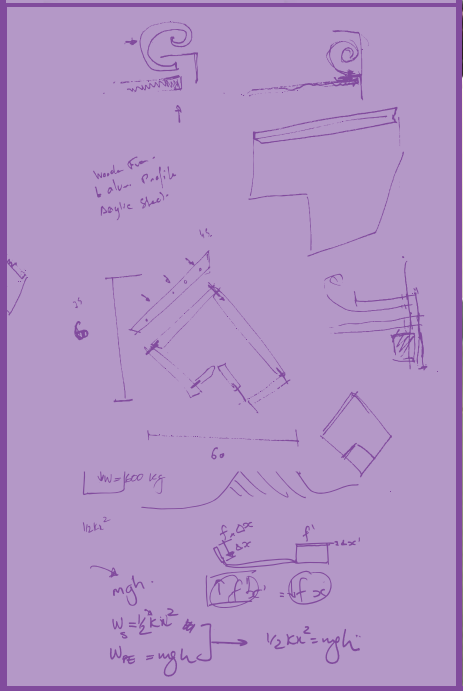











Wooden Rim
Aluminium Profile
Acrylic Sheet
60
mgh
$W_s = \frac{1}{2}kx^2$
$W_{PE} = mgh$
$\frac{1}{2}kx^2 = mgh$

Go Neutral

GoNeutral is groundbreaking in letting small initiatives benefit from the carbon markets. It does this by grouping together the carbon savings of many initiatives and selling them as carbon allowances, for example in the European Union Emission Trading Scheme. The philosophy is that many 'small' carbon savings add up to something very significant. For changes that don't cost too much to implement the money is returned directly to those doing the initiative - to you. The more initiatives you get involved in, the more you earn.

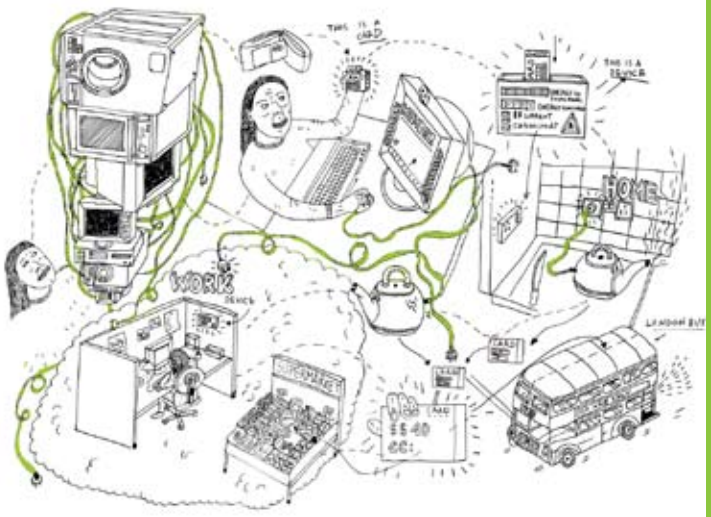
Alternatively, if the initiative has a high start-up cost, 'GoNeutral invest' is a place for many people to invest small amounts to help you cover the capital. In this case the investors will receive the carbon allowance earnings.

Anybody can apply for investment, and projects in places that will benefit most are encouraged. For example a charity or local entrepreneur might apply for investment for solar cook-stoves in a rural Indian village. As well as the social benefits, such projects are often a particularly efficient way of saving carbon. You might want to become a micro-investor yourself. Much like small carbon savings adding up, so can many small investments.

We can sell our collective carbon savings on the carbon markets because each initiative is well documented by those involved, so the carbon savings, calculated with the help of our Carbon-Calculator, are clear and publicly verifiable. There is auditable assurance that the proposed carbon savings are really being made. This requirement is easily met by using the GoNeutral project management platform to set up and organise the initiative. The platform provides a convenient place for all aspects of the initiative to be managed, using tools such as a blog, gallery, wiki, calendars and discussion forums.

Finally, initiatives can seek advice and team members from the community, for example people to help with construction or specialist skills. There is also a growing bank of relevant knowledge and ideas from previous initiatives.

LOCAL/PERSONAL



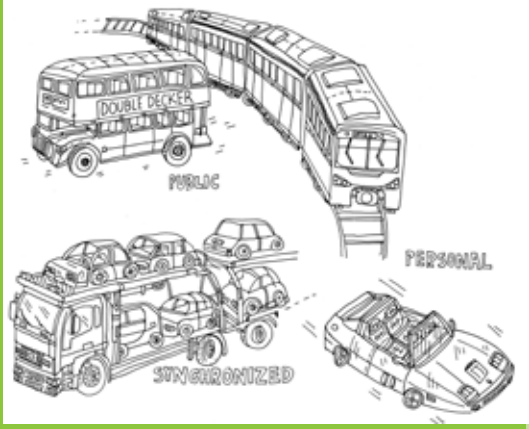
Personnal Card

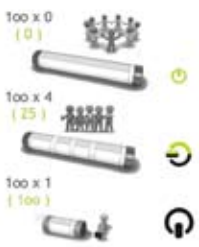
This system begins in the home, where the benefits are greatest and you can make the most of your energy savings. This card is a membership to a global community of people who are working together to lower their energy consumption. When you save in your house you earn carbon credits proportional to the amount you save. These credits then go into your card and you can use them for your everyday needs. For example, public transport, buying sustainable goods, locally produced food, etc. The interface of the card gives you immediate visual feedback letting you know when you are behaving sustainably, so that you know which actions to repeat. This system influences peoples' behavior because it facilitates the visualization of the balance between savings (lowering your CO2 emissions) and the credits you earn in return.

Energy Consumption Interface

With our current system there is no way to measure how much energy appliances are consuming, therefore people don't know how to save energy properly. Each room will have a monitoring device integrated into the light switch, where each number represens a socket informing you whether energy is being wasted or saved. A main interface, will help you monitor the entire households' energy consumption, and inform you about the savings and credits you are earning. This system will make visualizing, and influencing, the amount of energy you consume an easy task.

TRANSPORT



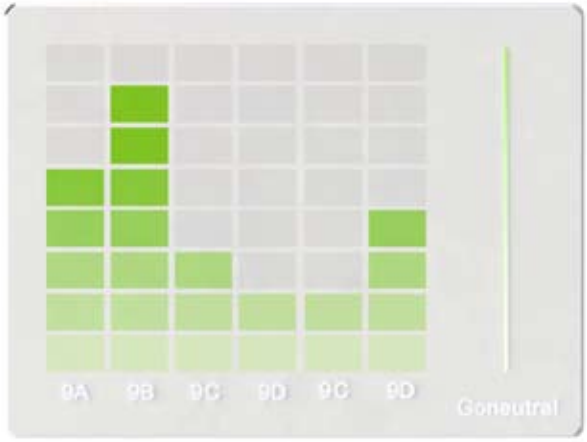


Synchronised Transport

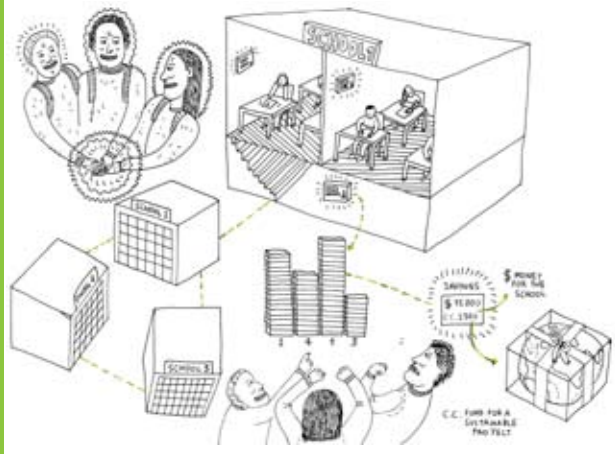
By using a vehicle that allows you to synchronize your journey you can learn about the ecological effects of your habits, save and share energy, and enjoy more time for social relationships. A unique interface system on the steering wheel display, controls the credits on your card.

School Competition

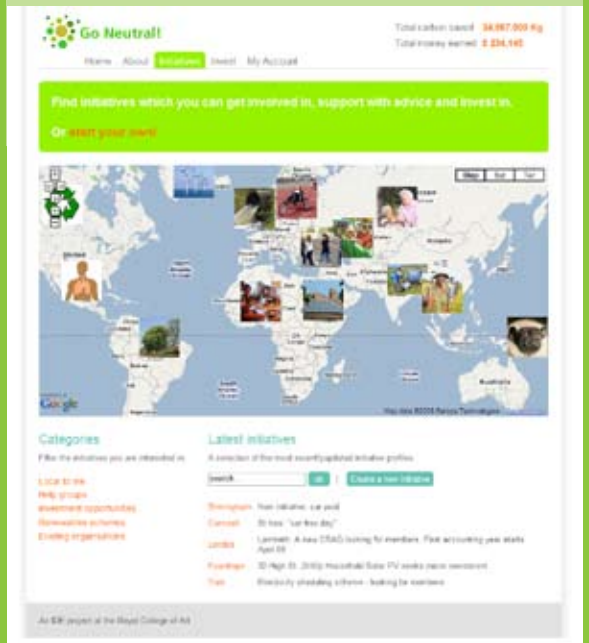
Taking advantage of children's inherent eagerness to learn and improve through competition, we propose an interscholastic scheme that will help schools lower their energy consumption. Each classroom will be equiped with an interface showing the energy consumed by that room. At the school level there will be another device which shows how the school is doing in relation to other local schools. By allowing students to monitor their energy consumption, a spirit of competition will be fostered, with the goal of reducing the school's CO2 emissions. The winning school will receive a certain amount of credits, which the students can choose to invest online at www.goneutral.biz in a sustainable scheme of their choice.

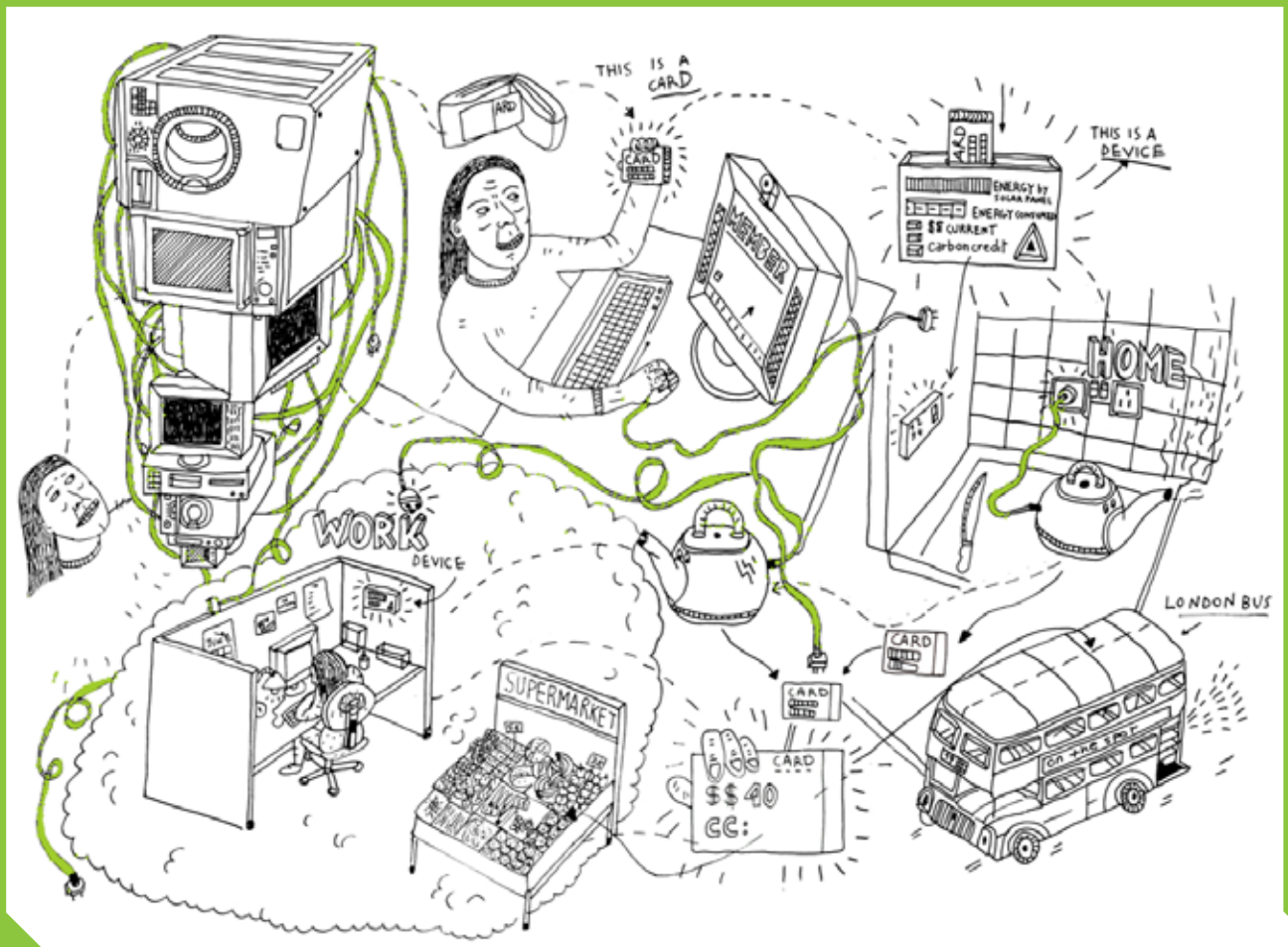


COMMUNITY



Website screenshots

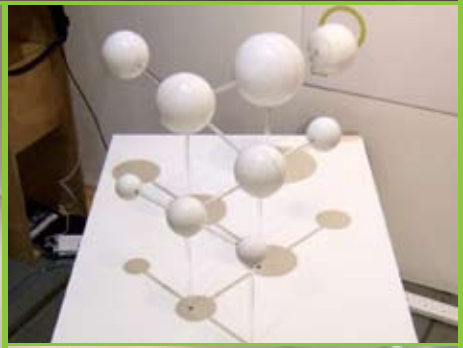



THIS IS A CARD
CARD
THIS IS A DEVICE
ENERGY by SOLAR PANEL
$$ CURRENT
Carboncredit
HOME
WORK
DEVICE
SUPERMARKET
CARD
$$40
CC:
LONDON BUS









Tergum

We were inspired by the technology that we discovered during the research phase. We focused specifically on spherical photovoltaic cells. Spherical cells have distinct advantages such as 360 degree light capture, mechanical strength and ease of modularisation. Encouraged by the potential of this new photovoltaic form, we liberated the spheres from their current static mountings and embedded them into a new composite material which allows for:

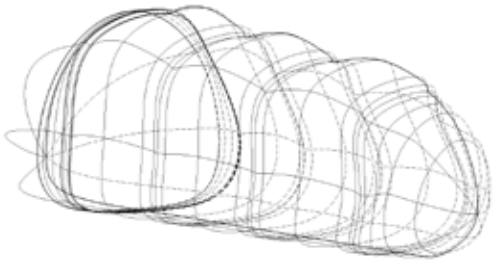
- High level of flexibility,

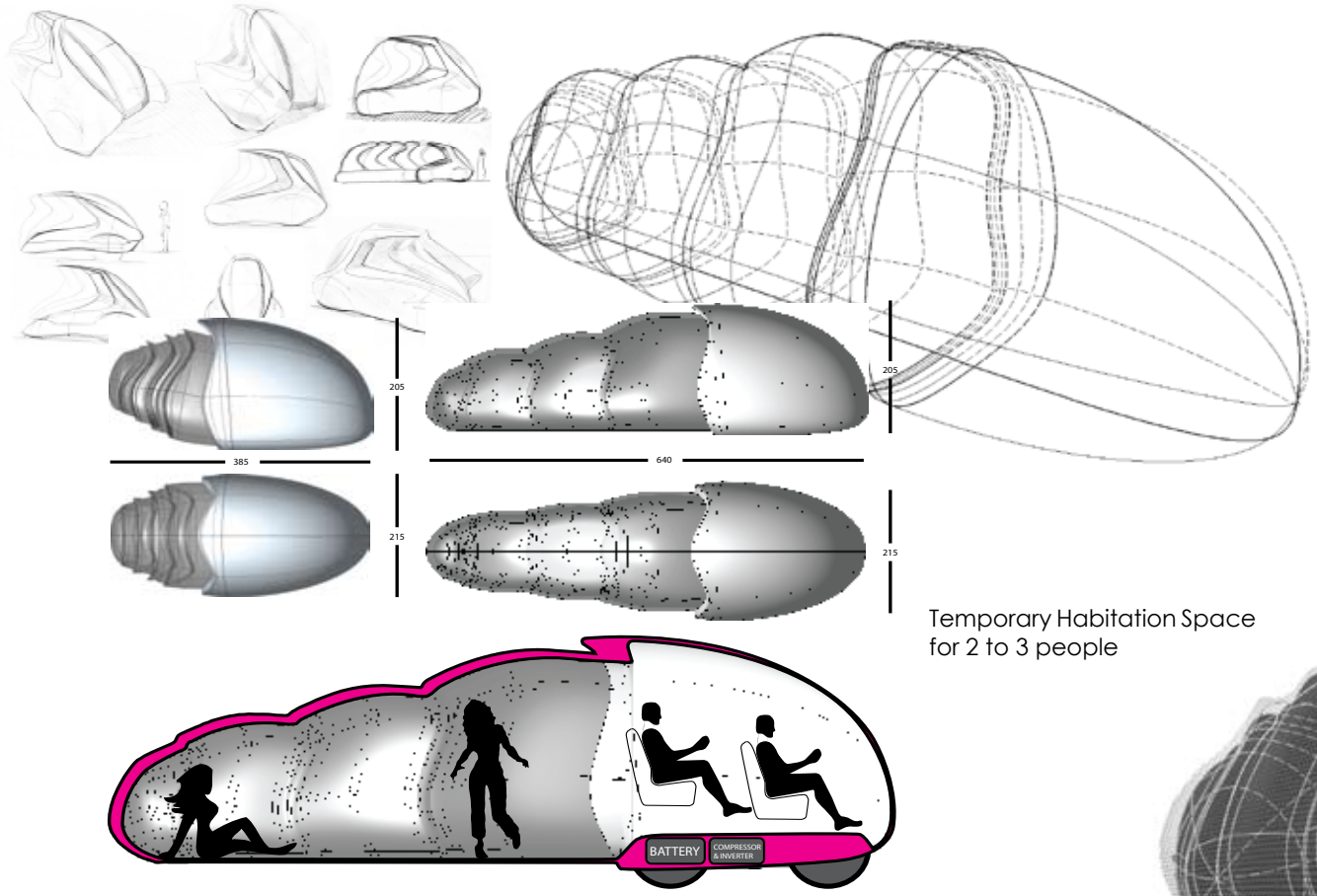
- Improved Mechanical Properties,

- Transparency.

Tergum is "a temporary, independent (self sustained in terms of power), deployable nomadic structure/vehicle"

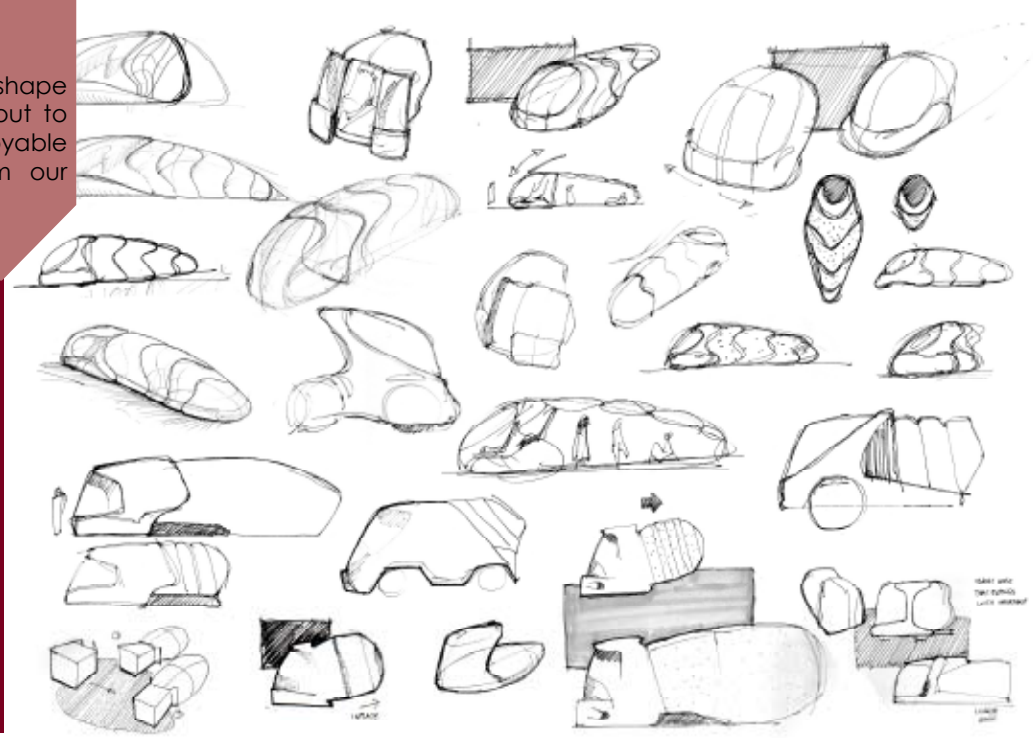
Our proposal spoke to the dynamic nature of the material, its unique transparency and the ability to fold and unfold. We turned to Pneumatics to create a dwelling free from a framework by situating the hardware requirements for the pneumatics and solar power infrastructure in the vehicle body. In this way, the Solar skin is capable of generating power while deployed and undeployed allowing both the vehicle and the living space to use the same power source.





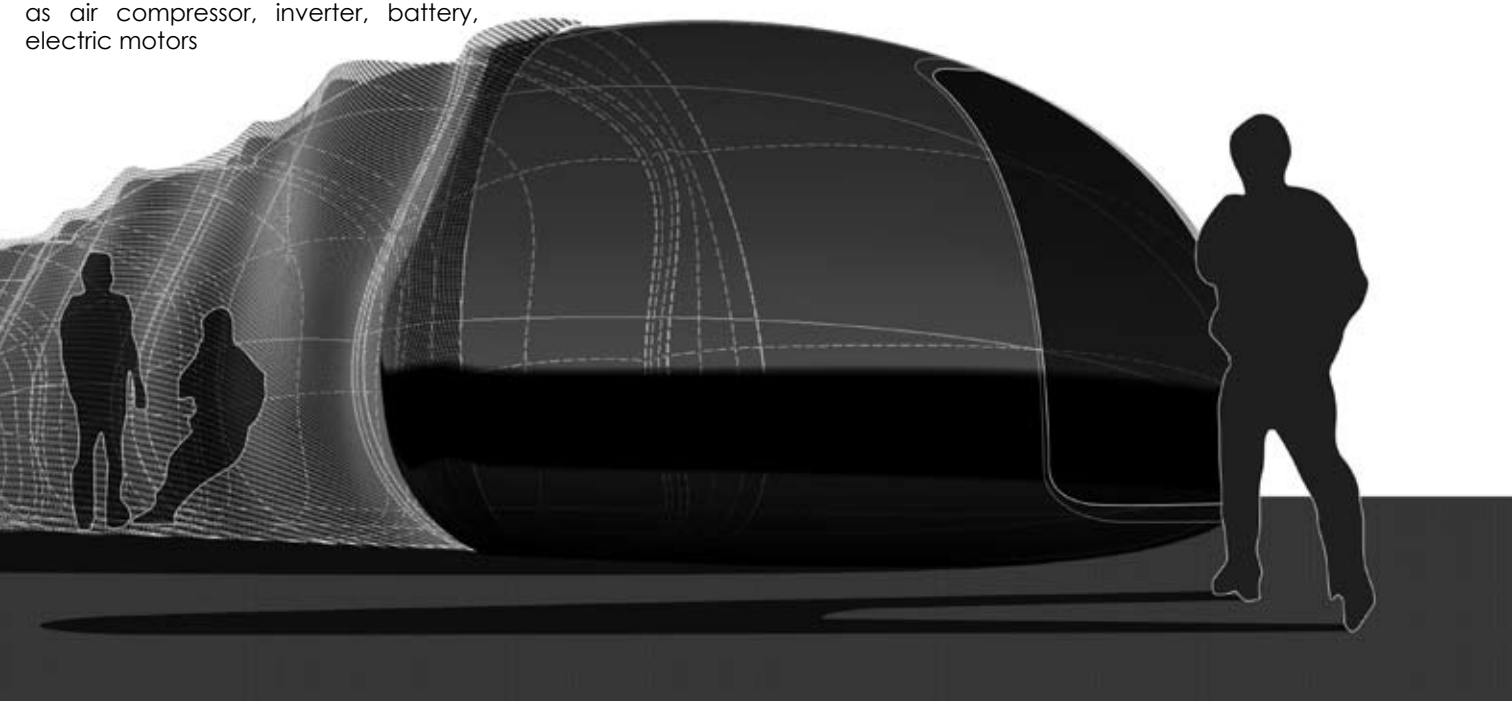
Temporary Habitation Space for 2 to 3 people

Surface Modelling and shape explorations were carried out to find the form for our deployable structure taking cues from our materials and inspirations.



Vehicle contains common infrastructure for both the vehicle and the shelter such as air compressor, inverter, battery, electric motors

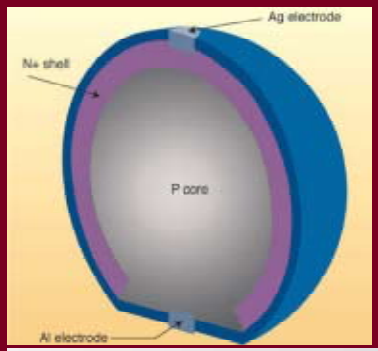
Windshield / Front Entrance of Deployable Vehicle Leads into Structure

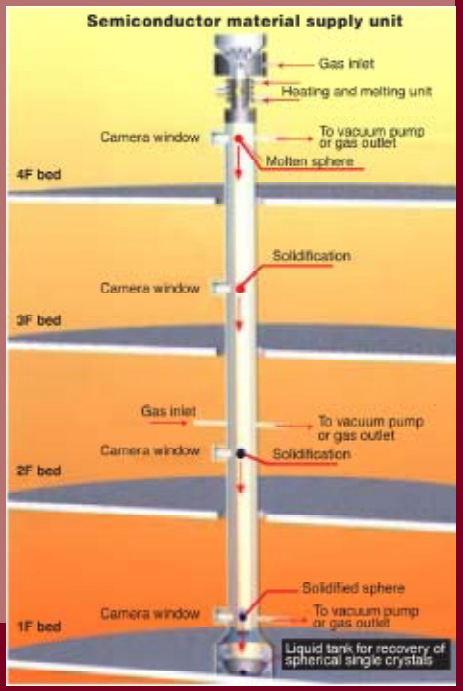


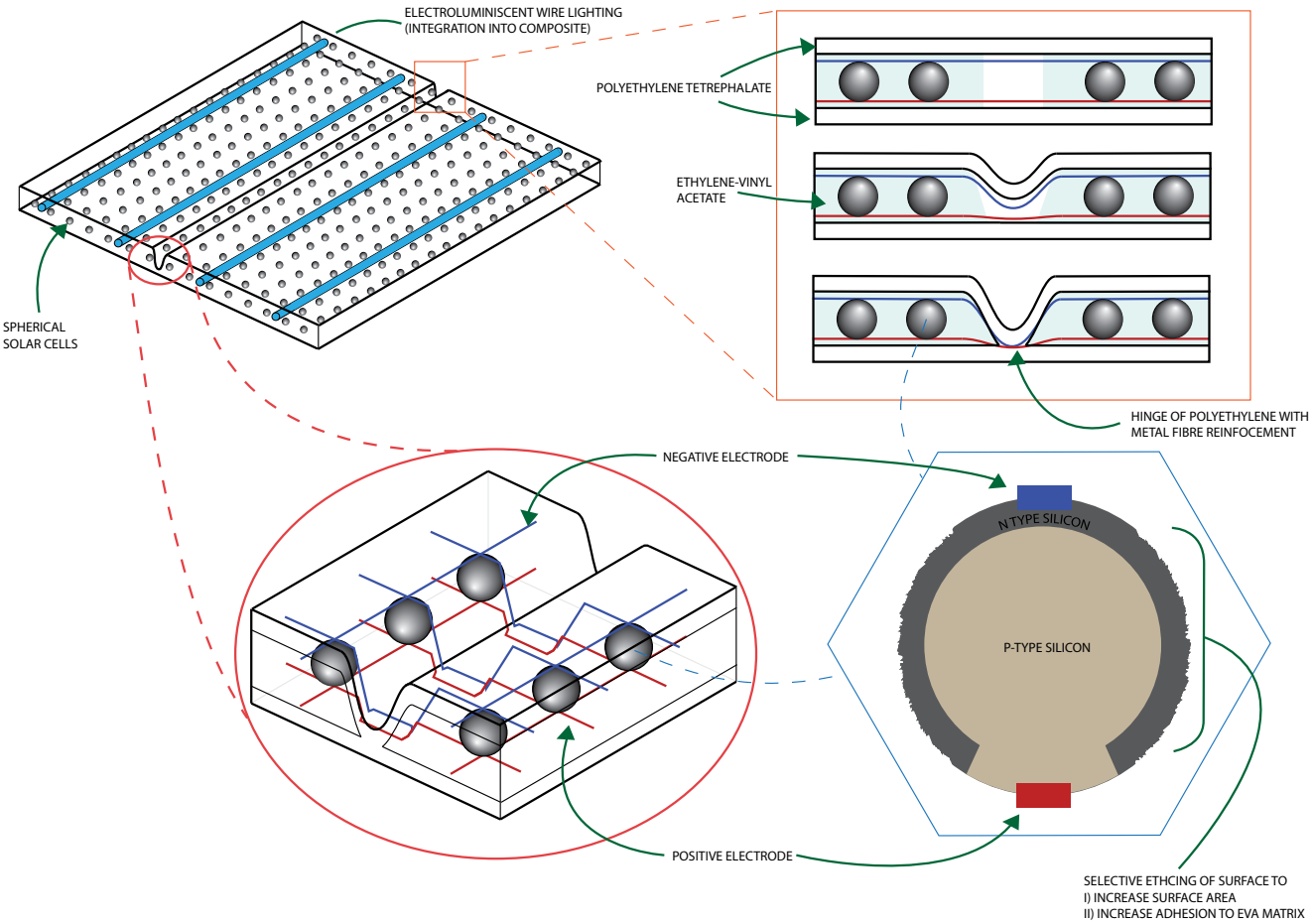
BASICS OF SPHERICAL SOLAR PHOTOVOLTAIC CELLS (SPVC)

Spherical solar photovoltaic cell's or SPVC's were pioneered in the late 80's by Texas Instruments. Initially these cells were mounted into a hexagonal honeycomb grid in order to provide electrode contacts and add additional reflectors.
In the late 90's to early 00's Japanese researchers took SPVC's a stage further by doing away with the aluminium honeycomb and replacing it with a minute electrode grids, above and below the ball. By mounting this array into a transparent resin, SPVC's became unidirectional, able to capture high levels of direct and indirect sunlight.

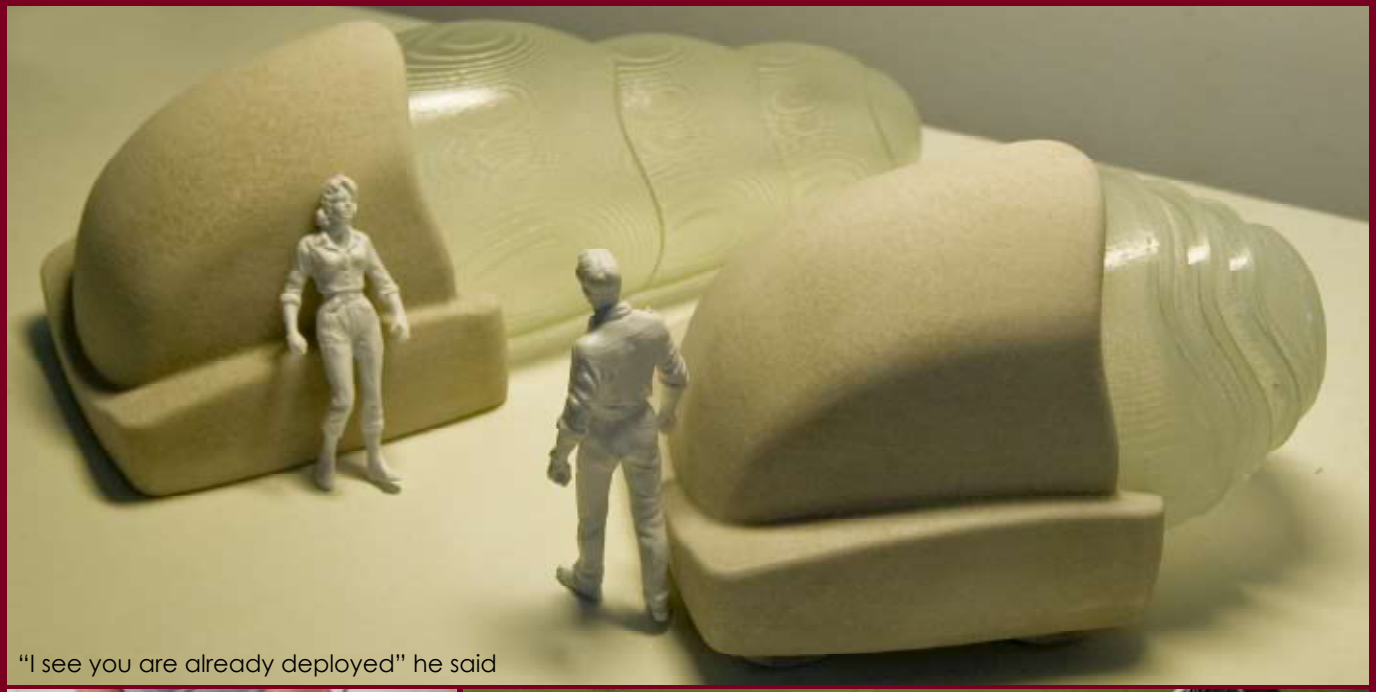
Top Left : Component Schematic of an SPVC
Top Middle: Prototype SPVC Cell Array
Right: SPVC drop tube manufacturing process
Bottom Left: Aimulet LA, mass manufacturing application of Kyosemi's SPVC technology







One of the key developments of Kyosemi's work is the ability to embed SPVC's into a resin. For our application we took this one step further by embedding the SPVC and electrode matrix into a custom designed composite that acts as the structural component of the pneumatic shelter as well as integrating power generation and lighting.



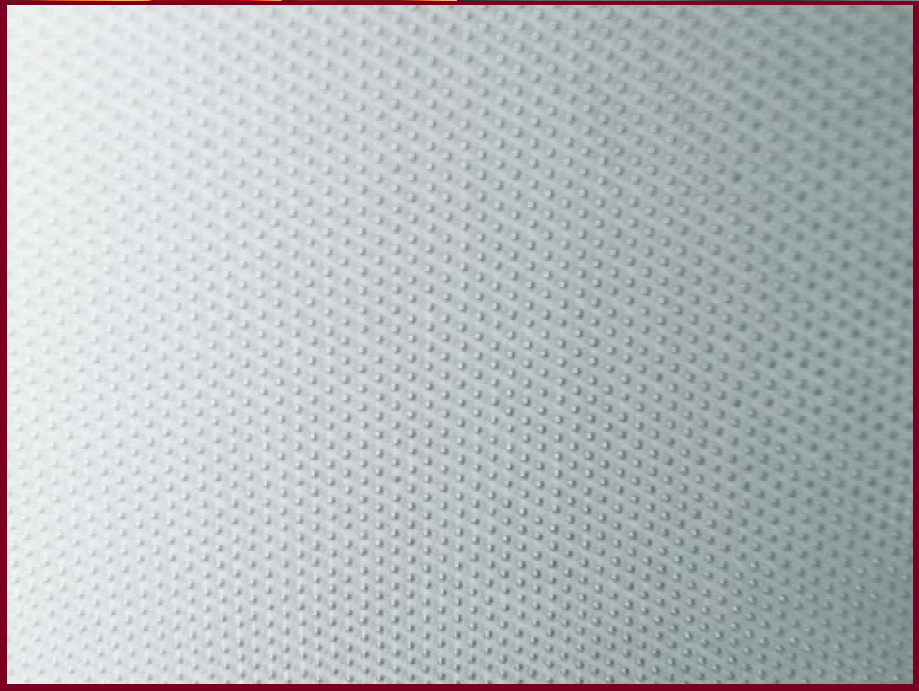
"I see you are already deployed" he said

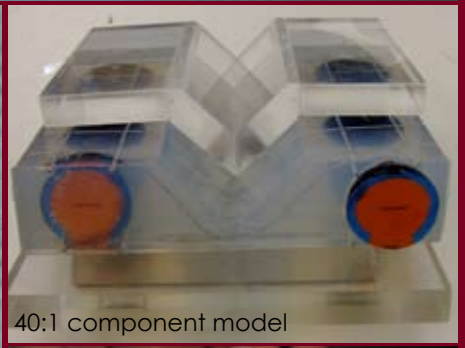
Inflatable structure


Scale exploration


Haptic material prototyping


Construction of 1:1 material model




40:1 component model


RP of Undeployed Surface

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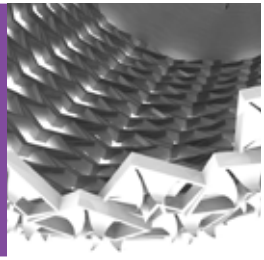

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Ross Lovegrove kindly donated his space at the Seoul Design Olympiad in October 2008 to an exhibition of the Sunny delight Masterclass. The Olympiad was visited by over 2,000,000 visitors during the 20 days it was open, representing a quarter of the population of Seoul. The following images record the installation of Sunny Delight at the exhibition.

Seoul Design Olympiad


Folium
SWAROVSKI
ROSS LOVEGROVE
Royal College of Art
Imperial College London


Go Neutral
Ross Lovegrove Masterclass:
Sunny Delight (Solar Living)
SWAROVSKI
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Royal College of Art
Imperial College London


Fold It
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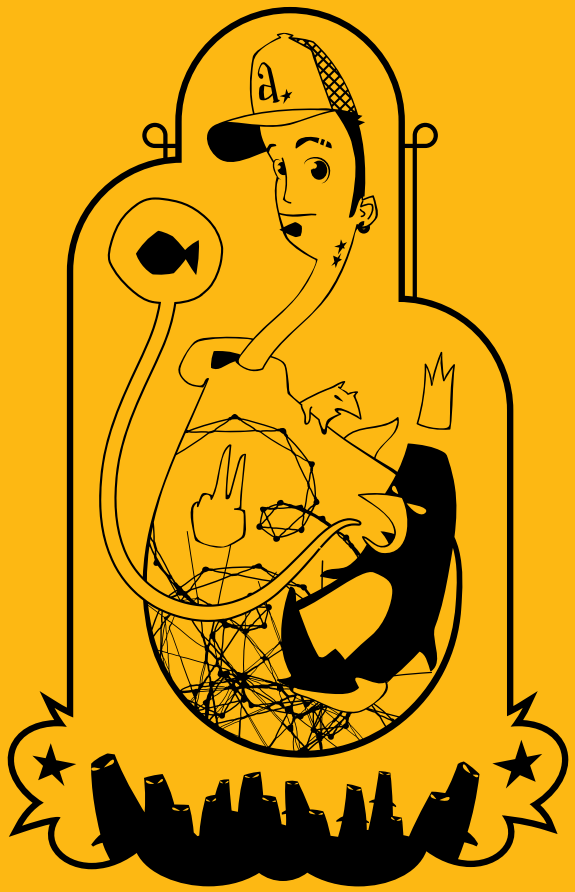
Thanks to Swarovski for the kind and generous sponsorship of the Sunny Delight (Solar Living) Ross Lovegrove masterclass in Innovation Design Engineering and Vehicle Design at the Royal College of Art. We would also like to thank Sharp for providing us with solar cells and McLaren, Solar Century, Housing Corporation, General Motors, Global Cleantech, Arup and Rogers Stirk, Harbour and partners for expert lectures and tutoring.



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