



PROJECT MANUAL

Deliverable #1
April 1st



NCTU Architecture
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國立交通大學
National Chiao Tung University



2014
EN FRANCE



Orchid House



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4 SDE RULES CHECKLIST

Rule Description	Content Requirement(s)	Drawing(s)/ Report(s)
3.2 Team Officers and Contact Information	Team officer's contact information completely fulfilled in Table 1 (SDE WORKSPACE)	
4.3 Lot Conditions	Drawing(s) showing the storage and unloading areas and corresponding load's calculations	
4.3 Lot Conditions	Calculations showing the structural design remains compliant even if there is a level difference, and drawing(s) showing shimming methods and materials to be used in case.	
4.4 Footings	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	
4.4 Footings	Drawing(s) showing the location, contact area and soil-bearing pressure of every component resting directly on the ground	
4.5 Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site and specifications for heavy machinery	
4.8 Spill and Waste Products	Drawing(s) showing the locations of all equipment, tanks and pipes containing fluids during the event and corresponding specifications	
5.1 Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	●
6.1 Structural Design Approval	Structural drawings and calculations signed and stamped by a qualified licensed professional	
6.1 Electrical and Photovoltaic Design Approval	Electrical and Photovoltaic drawings and calculations signed and stamped by a qualified licensed professional	
6.1 Codes Design Compliance	List of the country of origin codes complied, properly signed by the faculty advisor.	
6.2 Maximum Architectural Footprint	Drawing(s) showing all information needed by the Rules Officials to digitally measure the architectural footprint	●
6.2 Maximum Architectural Footprint	Drawing(s) showing all the reconfigurable features that may increase the footprint if operated during contest week	●
6.3 Minimum & Maximum Measurable Area	Drawing(s) showing the Minimum & Maximum Measurable Area.	●
6.4 Entrance and Exit Routes	Drawing(s) showing the accessible public tour route, specifying the entrance and exit from the house to the main street of the Solar Village	●
7.3 PV Technology Limitations	Specifications and contractor price quote for photovoltaic components	



7.4 Batteries	Drawing(s) showing the location(s) and quantity of stand-alone, PV-powered devices and corresponding specifications	
7.4 Batteries	Drawing(s) showing the location(s) and quantity of hard-wired battery banks components and corresponding specifications	
7.6 Thermal Energy Storage	Drawing(s) showing the location of thermal energy storage components and corresponding specifications	
7.7 Desiccant Systems	Drawing(s) describing the operation of the desiccant system and corresponding specifications	
7.8 Humidification systems	Specifications for humidification systems and corresponding certifications of the different elements.	
8.1 Containers locations	Drawing(s) showing the location of all the water tanks	
8.2 Water Delivery	Drawing(s) showing the fill location(s), quantity of water requested at each fill location, tank dimensions, diameter of opening(s) and clearance above the tank(s).	
8.3 Water Removal	Drawing(s) showing the quantity of water to be removed from each fill location, tank dimensions, diameter of opening(s) and clearance above the tank(s).	
8.5 Grey water reuse	Specifications for grey water reuse systems.	
8.6 Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	
8.8 Thermal Mass	Drawing(s) showing the locations of water-based thermal mass systems and corresponding specifications	
8.9 Grey Water Heat Recovery	Specifications for grey water heat recovery systems.	
9.1 Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	
9.2 Watering Restrictions	Drawings showing the layout and operation of greywater irrigation systems	
10.2 SDE Sensors' Location and wire routing	Drawing(s) showing the location of bi-directional meters, metering box, sensors, cables and feed-through to pass the instrumentation wires from the interior to the exterior of the house.	
11.2 Use of the Solar Decathlon Europe Logo	Drawing(s) showing the dimensions, materials, artwork, and content of all communications materials, including signage	
11.3 Teams' sponsors & Supporting Institutions	Drawing(s) showing the dimensions, materials, artwork, and content of all communications materials, including signage	
11.4 Team Uniforms	Drawing(s) showing the artwork, content and design of the team uniform	
12.4 Public Tour	Drawing(s) showing the public tour route, indicating the dimensions of any difficult point, complying with the accessibility requirements.	●
20.0 Contest 6: Drying Method	Drawing(s) showing the drying Method. (ie the place where the clothes wire will be located)	
20.0 Contest 6: House Functioning	Drawing(s) showing the location of all the appliances and corresponding technical specifications.	
36.5 Photovoltaic systems design	Specifications of PV generators, inverters, wiring, cables, protections, earthing systems, interface with the electricity distribution network.	
36.5 Photovoltaic systems design	Inverters' certificates	
36.5 Photovoltaic systems design	Maintenance plan for PV generators, supporting structure, inverters, wiring, cables, protections, circuit breakers in case of fire and earthing system. Fire protection systems for PV DC wiring.	
36.5 Photovoltaic systems design	The corresponding table "design summary" must be filled out	



51.3 Fire Safety	Specifications for Fire Reaction of Constructive elements, extinguishers and fire resistance of the house's structure.	
51.3 Fire Safety	Drawings showing compliance with the evacuation of occupants' requirements and fire extinguishers location.	
51.4 Safety against falls	Specifications of compliance with the slipperiness degree classes of floors included in House tour	
51.4 Safety against falls	Drawing(s) showing compliance with conditions for uneven flooring, floors with different level, Restricted Areas stairs, Public Areas Staircases, Restricted Areas Ramps and Public Areas Ramps	
51.4 Safety for avoiding trapping and impact risk	Drawing(s) showing compliance with conditions for avoiding trapping and impact risk	
51.4 Safety against the risk of inadequate lighting	Specifications for level of illumination of house tour areas light fittings	
51.5 Accessibility	Interior and exterior plans showing the entire accessible tour route	
51.6 Structural Safety	Specifications for the use of dead loads, live loads, safety factors and load combinations in the structural calculations	
51.7 Electrical System	Specifications of the wiring, channels, panels and protections of the electrical installation	
51.7 Electrical System	One-line electrical diagram and drawings showing the grounding, execution and paths	



5.1 ARCHITECTURE DESIGN NARRATIVE

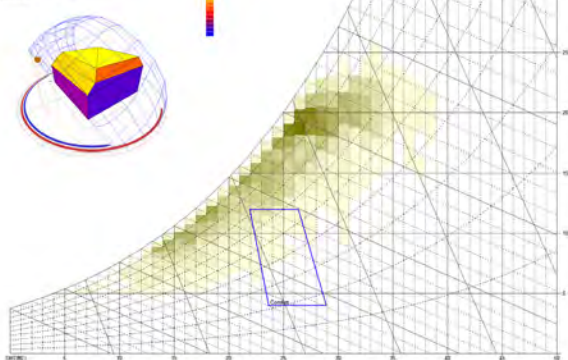
Our house design concept is based on the Taiwanese local conditions, however, we are confident that those systems are applicable to any other locations of earth. We are expecting much drier climate condition during the Solar Decathlon Europe 2014 in Versailles, France, which is almost opposite climate from one in Taiwan. It will be challenging for us to archive the house to function in the both dry and wet condition well, however, this experience will lead us to market our house in different cities and countries.



Taipei, Taiwan

Psychrometric Chart

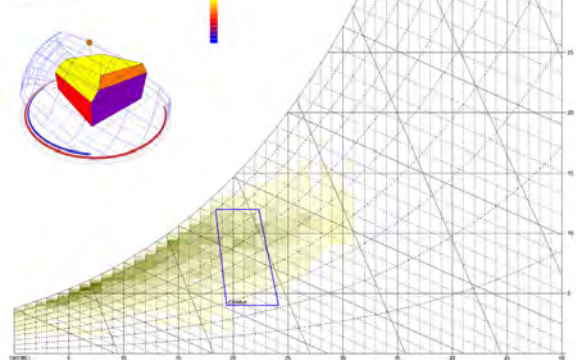
Location: 25.0363°N, 121.5623°E
 Population: 2.6 million
 Climate: Cwa (Köppen)
 Standard Atmos: 101.325 kPa
 Atmospheric Pressure: 101.325 kPa
 Humidity Ratio: 0.012



Paris, France

Psychrometric Chart

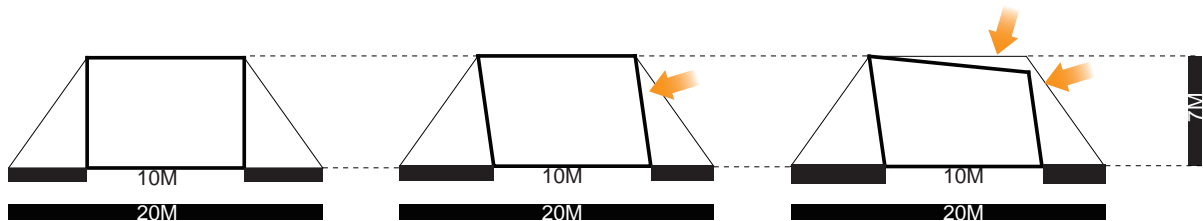
Location: 48.8566°N, 2.3510°E
 Population: 2.1 million
 Climate: Cfb (Köppen)
 Standard Atmos: 101.325 kPa
 Atmospheric Pressure: 101.325 kPa
 Humidity Ratio: 0.012



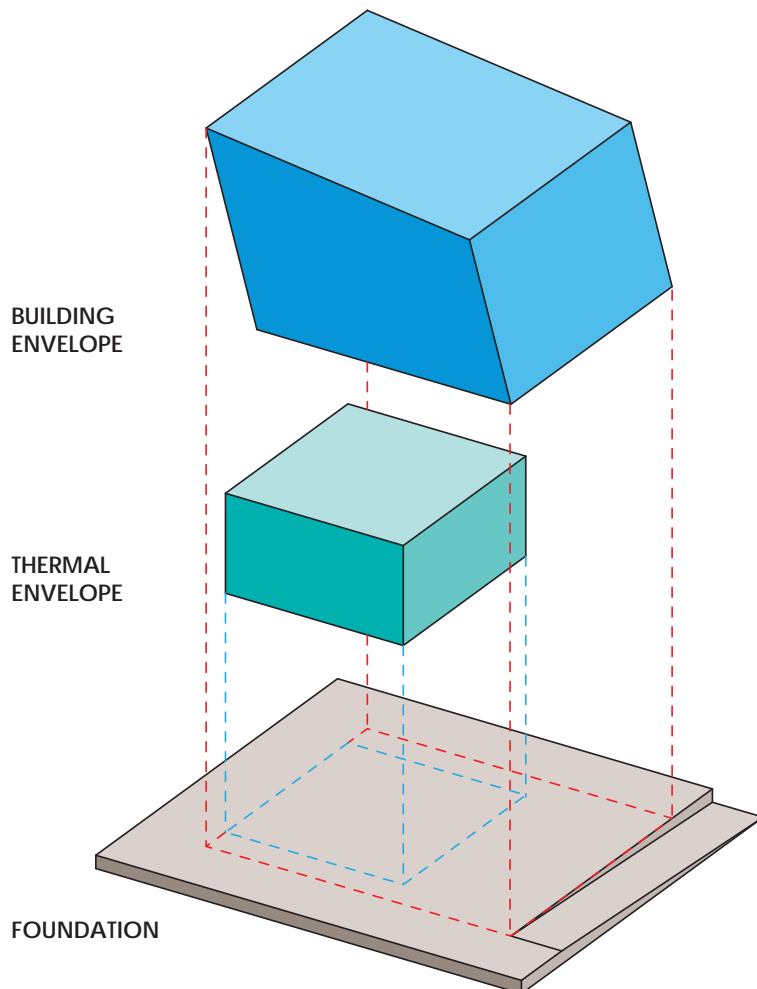
Comfort Zone Comparison Taipei & Paris

Massing Development

In order to best use of the solar envelope, we design the house to be 7 meters high and draw a square down. Secondly, the bottom side of square is shifted towards south to gain better southern sun exposure. Finally, the top plane is sloped to catch maximum solar energy.

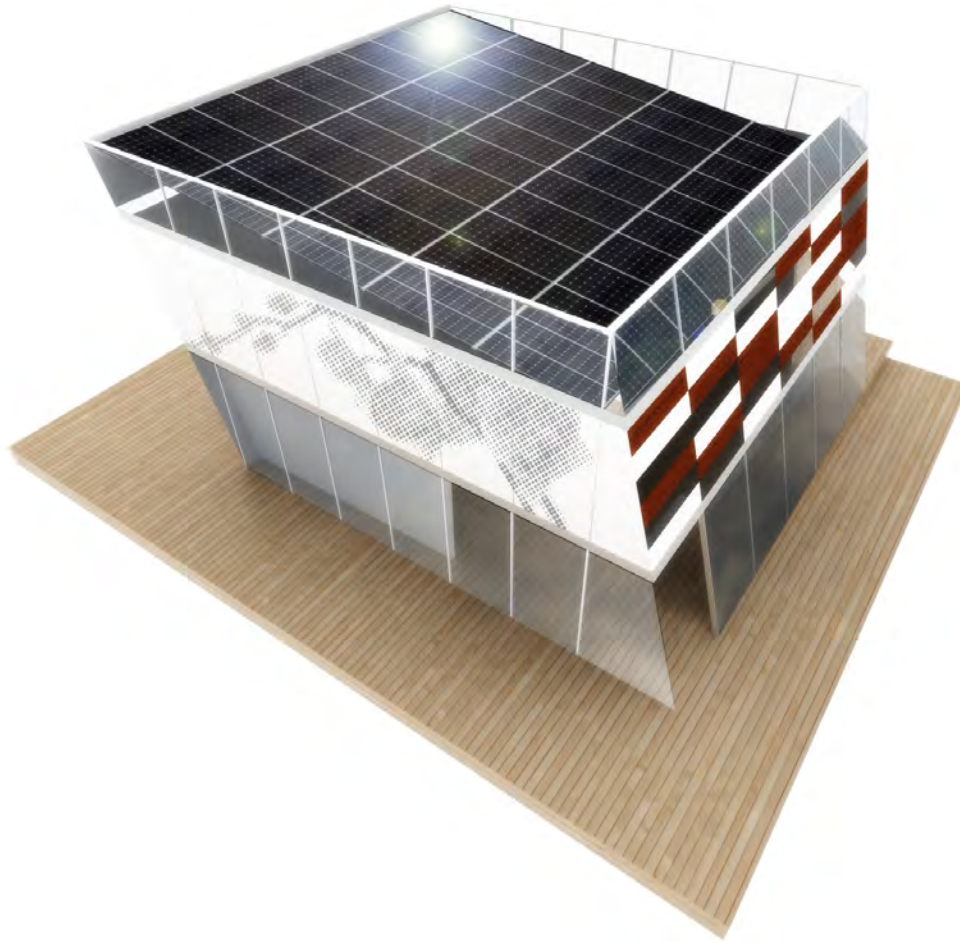


Building Envelope & Thermal Envelope



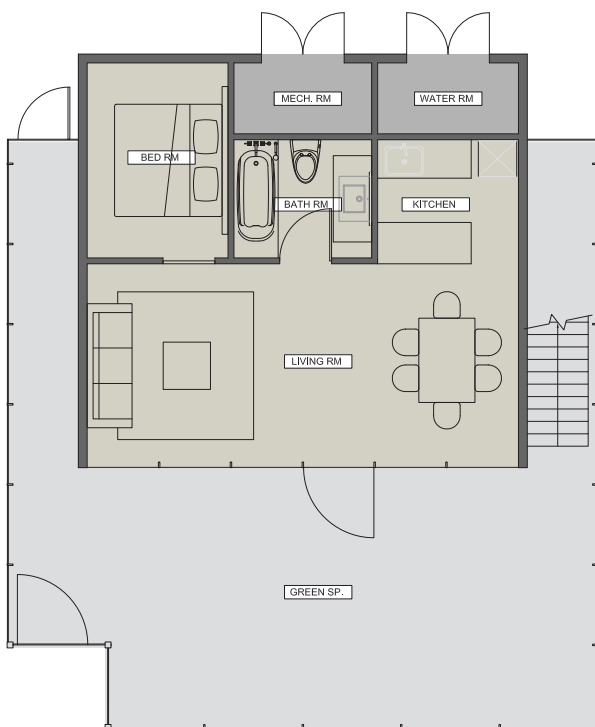
The Orchid House finds the best relationships between building envelope and thermal envelope. On one hand, the building envelope incorporates lightweight structure of a green house to reduce heat gain during summer time and heat lost during wintertime. On the other hand, the thermal envelope will control the interior space with high efficiency HVAC system. These two envelopes create a mediate zone, which reduce the fluctuation of temperature and humidity.

The green house space mainly uses water heating/cooling system as passive thermal system, while the HVAC system intakes the air from the green house space in order to reduce the load of heating and cooling. The mediate zone is a semi-outdoor space, which extends our living area.



Aerial View

Floor Plan



The programs are strategically placed to utilize passive thermal system, such as allocating machine room and water tank room in the north side to avoid heat loss of living space, and also the south side living room maintains maximum heat gain and natural daylight.

The main living space is accompanied with dining and kitchen and it allows flexible configuration of the house. The sliding doors open to the green house space to gain larger and comfortable shaded sun deck area, so the user can take advantage of the additional space. Meanwhile, the living space could be divided into one extra bedroom with convertible sofa bed for the guest to stay.



Rooftop View

Green House Space



We have studied and analyzed the advance technology of Taiwanese orchid nursery, and adapt it into the Orchid House. The mediate zone cools down the air and becomes a social space. In Taiwan, families like to sit outside after dinner and enjoy some quality time together. We want to recreate the same feeling with the Orchid House and extend the living area, with real Orchid plants growing here.

The staircase leads to the rooftop on the semi-outdoor living space. It serves as laundry area and it is large enough to host a tea party, which is very common afternoon event in Taiwan. The Orchid house incorporates transparent photovoltaic system, with PV cells laminated within clear glass panels and creates comfortably shaded space on the rooftop balcony.

Projection of Future Application: Rooftop

Taiwan is deemed to be one of the most diversified countries in the world, not only because of its richness of nature, but also social values which cause unique phenomenon. Due to lack of space, we are always trying to enlarge the living space. In order to do so, residences do lots of extension on the rooftop. In fact, the rooftop with water tanks and the metal roof are obvious problems. Generally speaking, people owning the top floor in Taiwan would utilize the rooftop space for extending their living space. Some of them become nice roof gardens, which reducing the heat island effect and compose into a pleasant view within the city fabric. However, water tanks and the metal roof form an unpleasant skyline, which becomes a culture characteristic of Taiwan.

In order to change the culture landscape caused by living necessity, NCTU UNICODE takes serious consideration to not only make an improvement of the visual part but also provide a sustainable system, which could increase the energy generation and cuts down the house utility costs. Since this sustainable roofing system could be beneficial for environment, there are more potential possibility and feasibility of marketing in the near future.



<http://www.flickr.com/photos/ttk/2918965848/>



<http://vita203.blogspot.tw/2012/11/112.html>



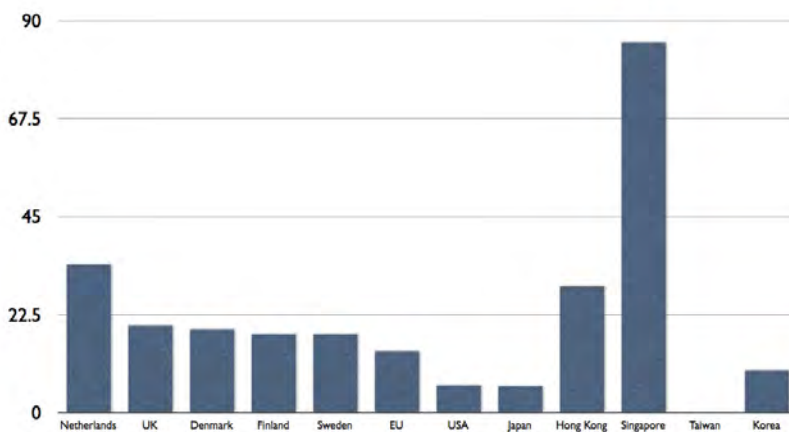
Our intension is to create a single dwelling prototype focusing on the environment issue, which can reduce heat island effect and build a feasible drainage system as a role of cleaning the city. This is an urgent task of all residence on the island. We want to use the “green rooftop system” to create passive wind ventilation system, the drainage system and the passive solar system that respond to energy saving. Thus, these environmental strategies will accelerate the speed of reaching the goal of sustainability.

Projection of Future Application: Social Housing

It is perfect timing for people in Taiwan to rethink the “social housing issue” for a few reasons. First of all, the term “social housing” is sometimes considered as a solution for insufficient living space, also as unaffordable price for housing. In reality, social housing is built for the reason of “de-commodification”, and intend to help low-income household, labors, single parents and so on to have higher quality living space. Unfortunately, due to the interference of real estate agencies, it became more complicated for government and builders to invest on social housing.

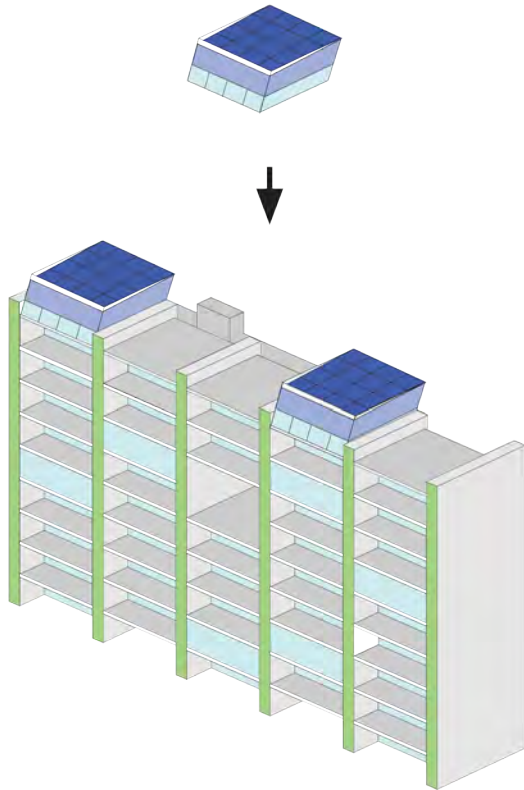
	public housing	social housing
title	non-profit	decommodification
title	by market: for sale/for rent/ loan and build	by government: building and renting provide government subsidies for renting provide government subsidies for buying
people	low-income household	low-income, labors single parent, elderly, over three children family, domestic violence, handicapped, homeless...
goal	help low-income household have living space	provide high quality living space for people

source : Social Housing Promote League



source : Social Housing Promote League

It is urgent to increase social housing, and the statistics have listed only 0.8% in Taiwan, which is extremely low compare to the other countries. It is also low compare to privately owned housing. Therefore, it is clear to us that we need to rethink the issue and provide a better solution about the way and methods which social housing has been made. With the new strategies that NCTU UNICODE provides, we believe there is a big potential to attract general public and organizations to market social housing.



<http://163.20.110.130/~map/jobs.html>

With the advance technology and building systems, the industrialization manufacturing process can reduce the load of builders and shorten the time of making, which could lower the construction budget. It is our goal to make our house simple, affordable and safe. Therefore, we focus on using local material and prefabricating methods. Currently, there is a trend of converting farmland into residential use in low-density cities in Taiwan, especially south side of the island where has abundant solar energy. Therefore, solar house that is equipped with good passive and active solar strategies will have a big market here. We provide not only the better function of each house unit but also the blueprint of the collective social housing.

NCTU UNICODE creates a prototype of a high-efficiency green system by transforming our single dwelling design into multi-floor collective housing, we will collect power through PV system and the energy will use for the service area of the housing, and the savings in terms of utility bills will and then being shared by all residence. This way, not only the top floors can benefit from the solar house, but also the entire community. For these reason, we are sure that these strategies are beneficial to large communities in a long run.

5.2 ENGINEERING AND CONSTRUCTION DESIGN NARRATIVE

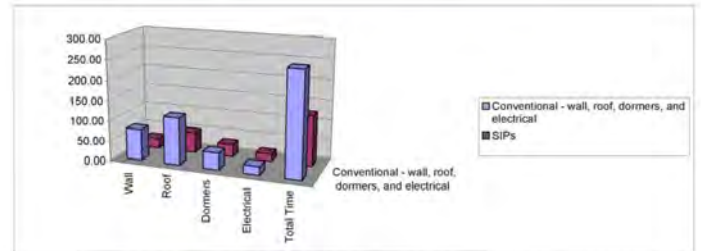
Structural Design

The Orchid house's structural system is divided into two different elements. The lightweight structural system is applied for the building envelope and the SIPs (structural insulated panels) system is for the thermal mass envelope. All the structural elements are prefabricated in factories for easy transportation and short construction time.

The lightweight structure system is composed by steel, which made with 100% recycled material and also non-toxic material. This system allows easy handling and installing the building envelope.

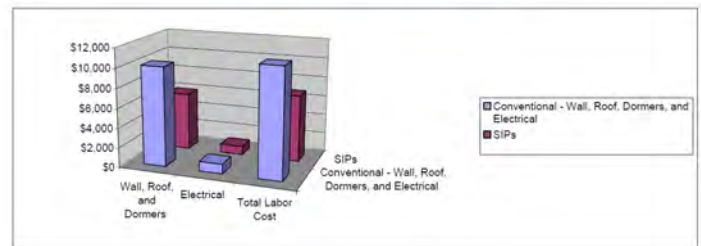
The SIPs (Structural Insulated Panels) system is the ideal structural system for the thermal envelop portion of the house since it is a self-standing structure as well as pre-insulated system, and also it is extremely strong, energy efficient and cost effective for saving time, cost, and labor.

Figure 4: Chart for Actual Installed Time Comparison (hours)

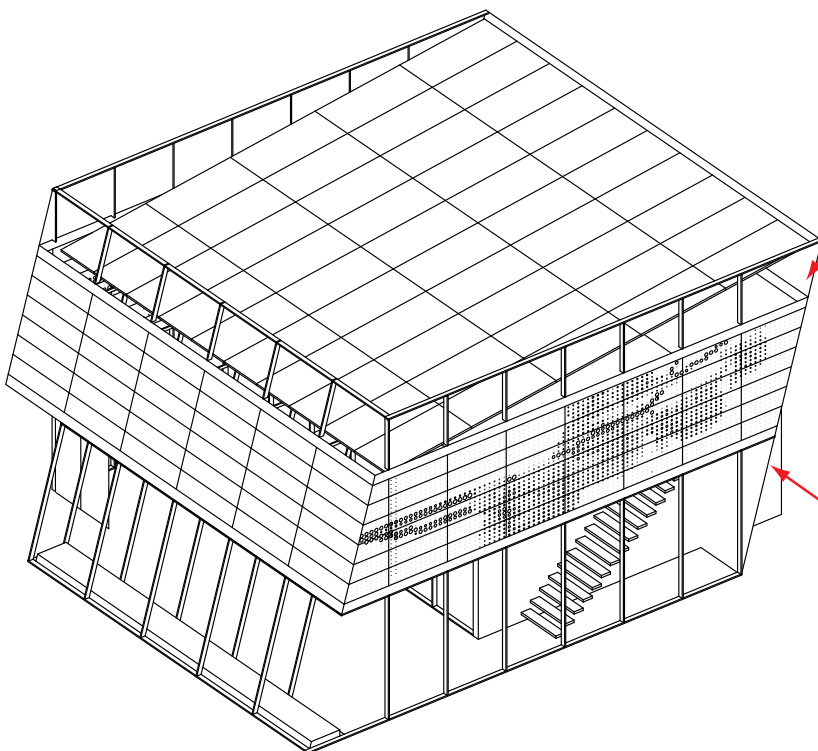


(Exhibit P1.2)

Figure 1: Chart for Overall Cost Analysis (Dollars)



SIPs Time & Cost chart

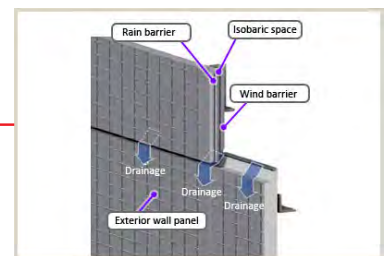


Building Envelope



Lightweight Structure

Thermal Envelope



SIPs (Structural insulated panels)



Time Data Reference SIPs System

Application: Wall
Client: BASF Corporation
Contractor: PANEL PROS
Observer: RS Means

Installation of SIP
Building size: 42' x 28' house
Location: Tilton, NH

Dates: 10/17, 10/18, 10/23, & 10/24/2006

Tilton is a town located on the Winnepesaukee River in Belknap County, New Hampshire, United States.

1 foot = 12 inches = 0.305 m
42 f * 28 f = (42*0.305)*(28*0.305) square meter
= 109.3974 square meter
= 33 pin

Figure 4: Actual Installed Time Comparison (hours)

Application	Column A Wall	Column B Roof	Column C Dormers	Column D Total Time	Column E Delta % for Column A+B+C
Conventional - wall, roof, and dormers	78.12	117.48	41.87	237.47	
SIPs	24.76	50.84	31.33	106.93	-55%

Application	Column A Electrical	Column B Delta % for Column A
Conventional - Electrical rough-in	21.11	
SIPs	18.76	-11%

Summary of Actual Installed Time Comparison

Application	Total time	Delta for Time	Delta % for Total Time
Conventional - Wall, Roof, Dormers, and Electrical	237.47 + 21.11 = 258.58		
SIPs	106.93 + 18.76 = 125.69	-132.89	-51%

125.69 hours /24 hours =5.237 days

Note: For Delta % by using conventional time as denominator

(Exhibit P1.1)

Budget Data Reference for SPIs System

Figure 1: Overall Cost Analysis

Application	Wall Cost	Labor Cost	Roof Labor Cost	Dormers Labor Cost	Subtotal Cost	Delta % for Column E
Conventional - wall, roof, and dormers	\$3,331	\$4,998	\$1,765		\$10,094	
SIPs - wall, roof, and dormers	\$1,372	\$2,816	\$1,735		\$5,923	-41%

Application	Electrical Labor Cost	Subtotal Cost	Delta % for Column C
Conventional - Electrical rough-in	\$979	\$979	
SIPs - Electrical rough-in	\$870	\$870	-11%

Summary of Total Labor Cost Comparison

Application	Wall, Roof, & Dormer Labor	Electrical Cost	Total Labor Cost	Delta % for Total Cost
Conventional - Wall, Roof, Dormers, and Electrical	\$10,094	\$979	\$11,073	
SIPs	\$5,923	\$870	\$6,793	-39%

Note: For Delta % by using Conventional time as denominator

Figure 1A: SIP Wall Cost Analysis

Application	Wall Cost	Subtotal Cost	Delta % for Column E
Conventional - Wall	\$3,331	\$3,331	
SIPs - Wall	\$1,372	\$1,372	-59%

Figure 1B: SIP Roof Cost Analysis

Application	Roof Labor Cost	Subtotal Cost	Delta % for Column E
Conventional - Roof	\$4,998	\$4,998	
SIPs - Roof	\$2,816	\$2,816	-77%

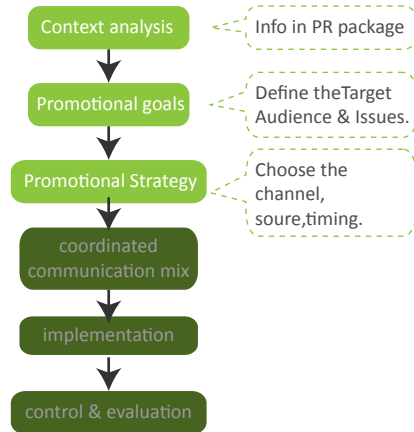
Figure 1C: SIP Dormer Cost Analysis

5.4 COMMUNICATIONS PLAN

Communication Project

The left diagram is our process of communication plan. In the first step, we define the MISSION we want to achieve for this project, and analysis the context we can create. And then, we define WHO is our target audience, and WHAT kind of information we would like to convey as the promotional goals. Now, we are working on the promotional strategy, and try to come up with some innovational ideas.

The Process of Communication Plan



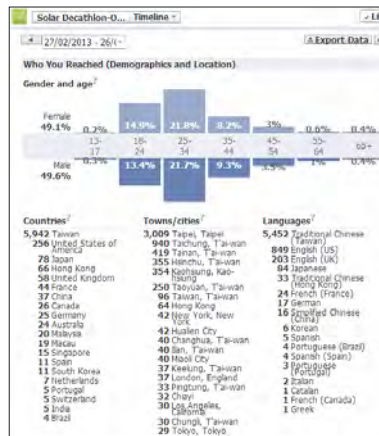
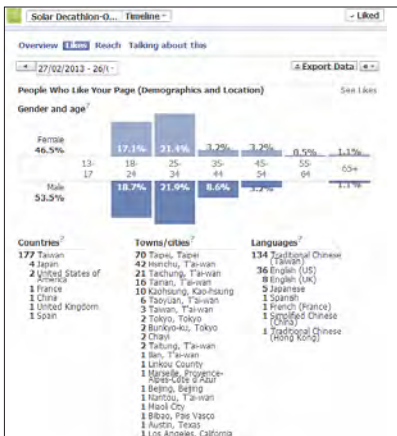
Source	<ul style="list-style-type: none"> NCTU UNICODE is a cross-disciplinary team, which integrates the architecture, construction, sustainable, energy, market ability, and innovation, and create a comfortable, high quality, affordable, low carbon homes and a housing sector that helps to establish a successful low carbon economy across Taiwan - Global. 			
Message	<p>NCTU UNICODE</p> <p>Represents Taiwan to compete with 19 teams in SDE.</p>	<p>Cross-Disciplinary</p> <p>NCTU is leading the research of clean energy, and a well-integrated university as well.</p>	<p>Market Viability & Innovation</p> <p>A low cost proposal for social housing.</p>	<p>Social Awareness</p> <p>A Possible resolution for living in the "non unclear" era.</p>
Media	<p>Mass Media Workshop</p> <p>Social Network</p>	<p>Social Network</p> <p>Mass Media Lecture, Seminar, Exhibition Workshop</p>	<p>Mass Media Seminar</p>	<p>Mass Media Social Network Workshop</p>
Receptor	<p>General Public</p>	<p>Academy (architecture, business, social science, communication, engineering, etc.)</p>	<p>Government (Department of Urban Developpe, Environmental Protection Administration, etc.)</p>	<p>Green promoter, S.I.G. (ex: Green enterprise, Green NGO, NPO, consultant, etc.)</p>
Response	<ul style="list-style-type: none"> Raise the public attention on clean energy, green, social housing issues. Win the reputation for NCTU. Get more funding and sponsors for next competition or further research/project. Be an excellent solar house case for green promoter. 			



Material for the Project Dissemination

For the social network, we set up the “Solar Decathlon - Orchid House Facebook Page” (<http://www.facebook.com/TWSDE>), and keep posting the dissemination of NCTU UNICODE.

Through the statistic of Facebook, we can analyze the source of social network target audience, develop the potential audience groups, and evaluate the response and feedback.



According to the statistic, the majority of our audience is in their twentieth to thirtieth and also located in Taiwan, even though we collect some from Japan, Hong Kong, UK, and USA.

These statistics indicates the potential audience we can farther develop. One of our main goals for the Orchid house project is to arouse the social awareness of clean energy in Taiwan, and we believe our majority audience plays the influential and powerful role in our society. Thus, as the starting point of the project dissemination, we have acquired enough potential for broaden our audience through the new social network.



Sponsorship Manual

The Orchid House project brings academic institution and technology industries in Taiwan together. NCTU/UNI-CODE provides Taiwanese institutions and companies an opportunity to present their ideas and products to global market during the competition process.

Depending on the contribution to the project, each sponsor is entitled as SDE partner, platinum, gold, silver, and bronze. Each category can enjoy the different degree of benefit from the project.

Sponsor Opportunity

	Title Co-Sponsor	Educational Promotional & Social Event	30-second video demo in solar house	Company product + logo on pamphlet	LOGO inside the SDE House	Logo listing on team gear	Logo listing on website invitations / communications / signage / event publications	Invitation to receptions and events
SDE Partner	O	O	O	O	O	O	O	O
Platinum			O	O	O	O	O	O
Gold				O	O	O	O	O
Silver						O	O	O
Bronze							O	O

(Sponsor title and content is updated on 2012/3/27)



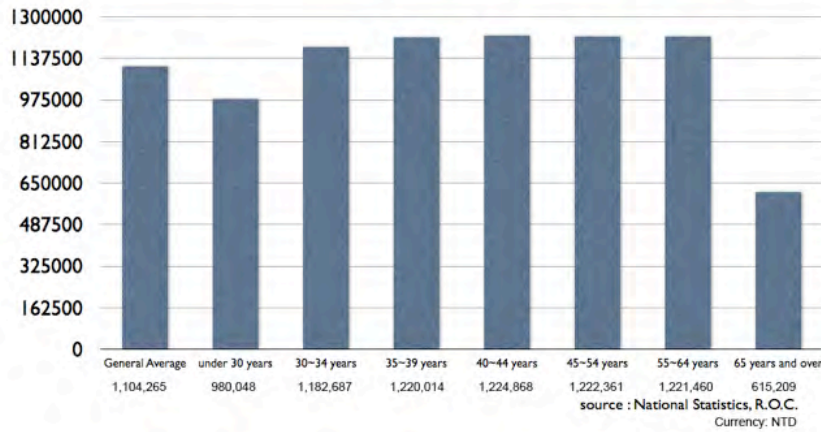
5.5 INDUSTRIALIZATION AND MARKE REPORT

Introduction

The intension of our solar house is to design a single dwelling prototype, which can be easily developed into a large scale of collective public housing. We think these two strategies will expand the market of sustain-able housing in Taiwan. In order to have a better understanding of our potential users and create an affordable housing module, it is important to initiate a market study that covers the average family income per household and average housing price in Taiwan.

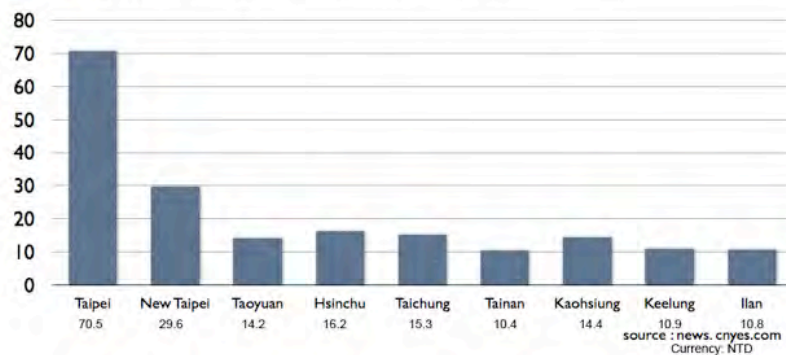
A.General Research of Housing Market in Taiwan

■ Average Family Income & Expenditure per Household by Age of Household Heads (year/ 10 thousand)

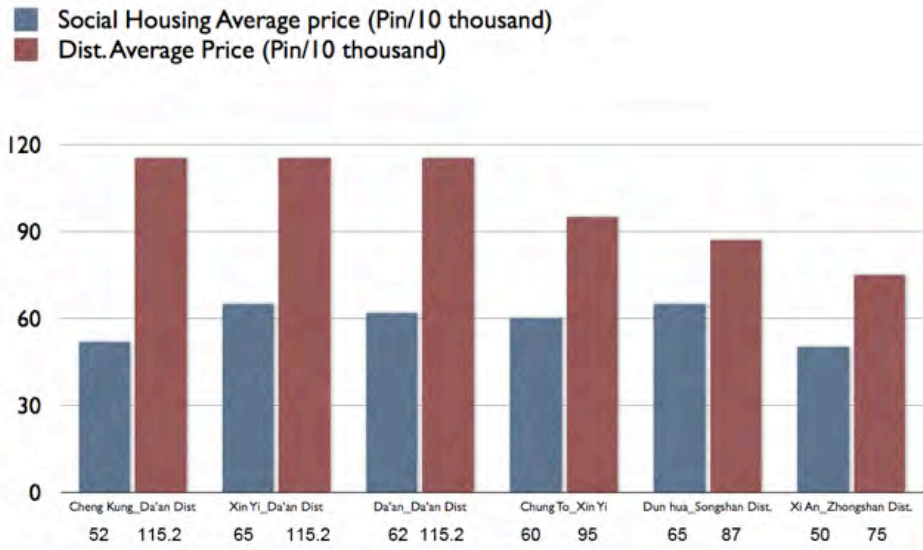


Taiwan housing market can be divided into 3 groups, such as “Below 35 year-old”, “35~64 year-old”, and “Above 65 year-old”. However, the majority is 35-64 year-old.

■ Average Price of City in Taiwan Household (Pin/10 thousand)



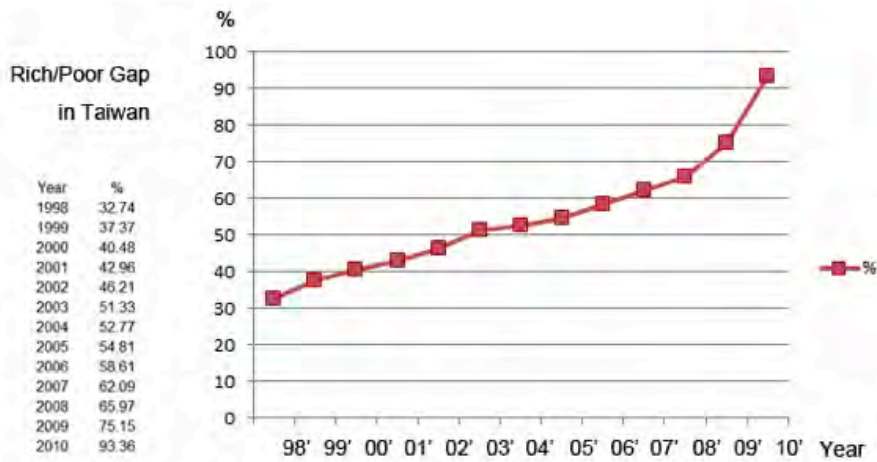
The average housing price of Taipei is NTD 705K per pin, which is equal to €6184 per sq.m..



source : news.cnyes.com
Currency: NTD

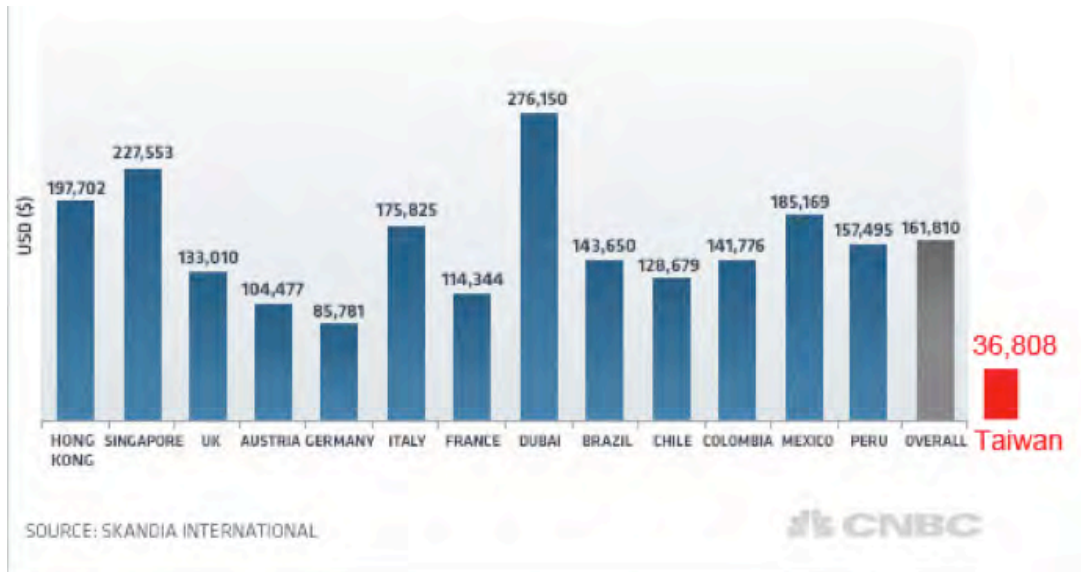
The Social housing price is much lower than average housing price in the same district.

B. General Research of Global Housing Market Viability



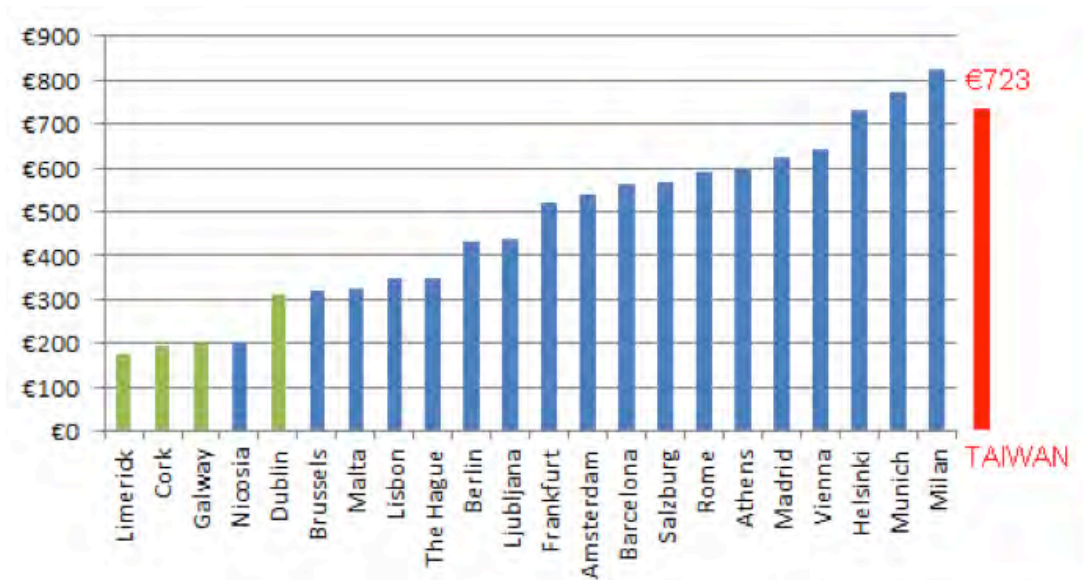
Source: Fiscal Information Agency, R.O.C.

From the chart of "Rich/Poor Gap in Taiwan", the income gap between Rich and Poor in Taiwan is huge and increases rapidly in the past years. Take the year of 2008 to 2010 as an example, the percentage of Rich to Poor is up to 93%, and the income NTD\$4200K/Year of the richest is extremely higher than the income NTD\$460K/Year with the gap of NTD\$4294K.



Annual Salary USD\$36,808 of Taiwan is 1/4 of the overall annual salary. This is describing our labor cost is much lower than other developed countries.

Average housing price a 120 sq.m. in Europe cities



Average housing price for a 120 sq.m. in europe cities

Unit: €1K

Average housing price for a 120 sq.m. in Taiwan(Taipei) is 723K€.

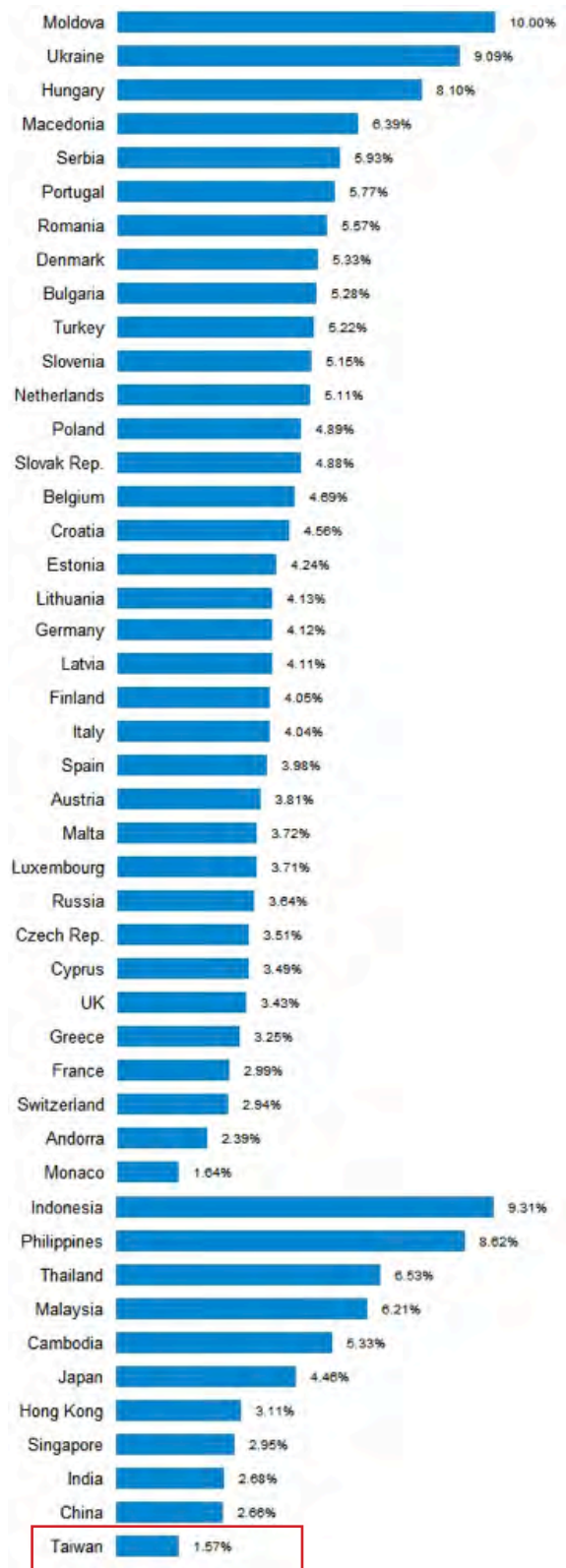
Source: Ronan Lyons

<http://www.ronanlyons.com/2011/03/16/is-irelands-property-market-competitive/>



Low gross annual rental income in Taiwan

Chart name: Gross rental yields (%) in Europe and Asia



Gross rental yields (%) in Europe and Asia

The gross annual rental income, expressed as a percentage of property purchase price. This is what a landlord can expect as return on his investment before taxes, maintenance fees and other costs.

The properties are 120-sq. m. apartments located in premier city centers.

In this graphic, the gross annual rental income of Taiwan is relatively much lower than most of the countries in Asia and Europe.

We take that as an opportunity of market viability opportunity to have a deeper observation and research in the further market research.

Source: Global Property Guide Research (2010)



C. Conclusion and future market study

After a detailed market study, we have come to a conclusion that our target users age are under 3 brackets: below 35 years old, between 35~64 years old, and above 65 years old. The potential housing types in Taiwan are social housing and rental housing, and statistics have shown inadequate number of social housing. Therefore, it is ideal to apply the solar strategies toward this housing type.

Furthermore, the modules should be designed to fit in the shipping container, so it can travel easily oversea. The parts are prefabricated and in manageable size to avoid using large machinery. We aim to provide high quality good design to our oversea users with low construction cost.

Here are some of the related research topics we will conduct in the next stage:

- Cost of construction / material / facilities and comparison worldwide
- Energy consumption of household and comparison worldwide
- Specific consumption of water/electrical appliances and comparison worldwide
- Farmland study
- Rooftop study
- Floor Area rewards in Taiwan

5.6 INNOVATION REPORT

Innovation in Architecture

The designing of the Orchid House aims to produce a comfortable living space which can be sustained with minimum amount of required energy and other natural resources. To achieve this goal, a number of innovative ideas will be examined and incorporated into the design of the house, and this includes a recycling water system, an adaptive building envelop and the use of smart materials.

Rather than simply considering the supply and consumption of fresh water for living, in Orchid House, water harvest, fresh water, grey water, along with HVAC and water-cooling building skins will be integrated into one sustainable water system. That is, grey water will be treated and recycled, and in addition to fresh water supply, the house will have various water resources including rain and condensed water from dew and HVAC. A passive dew harvest design will be tested and implemented as part of the whole building envelope system. Water in this integrated system, fresh, harvested or recycled, will be used for general household consumption, in addition to water-cooling screens, fitted into exterior walls, which in turn reduces the use of electricity for cooling purpose.

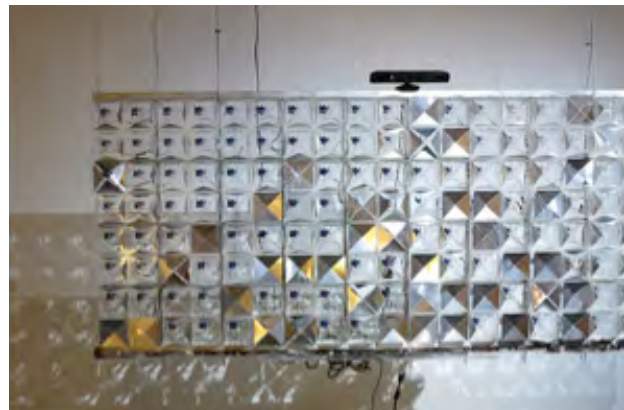
The building envelop of Orchid House will be equipped with adaptive designs, which enable the house to respond to weather conditions. The adaptability takes place in three major aspects: shading, opening and water-cooling. With specially designed kinetic machineries, the building envelope will able to change its statuses in providing sun shades and openings corresponding to sun exposure and air flow. In addition, with the embedded water-cooling screens, it can, without kinetic movements, adapt to the exterior temperature with moisture generated by the screens.



dew drop



sustainable water system



Both are the adaptive design made by NCTU Graduate Institute of Architecture



Using materials with special capabilities can contribute to sustainability by reducing the consumption of energy or natural resource. For Orchid House, a few materials are being examined. Memory alloy, for instance, can be adopted into the design of adaptive building envelop as the actuating mechanism, which does not rely on electricity to operate. Special hydrophile paint, with chemicals providing necessary properties, such as TiO₂, can be used on exterior surfaces to minimize the amount of water needed for cleaning or cooling purposes.



Water wall in the green house

5.7 SUSTAINABILITY REPORT

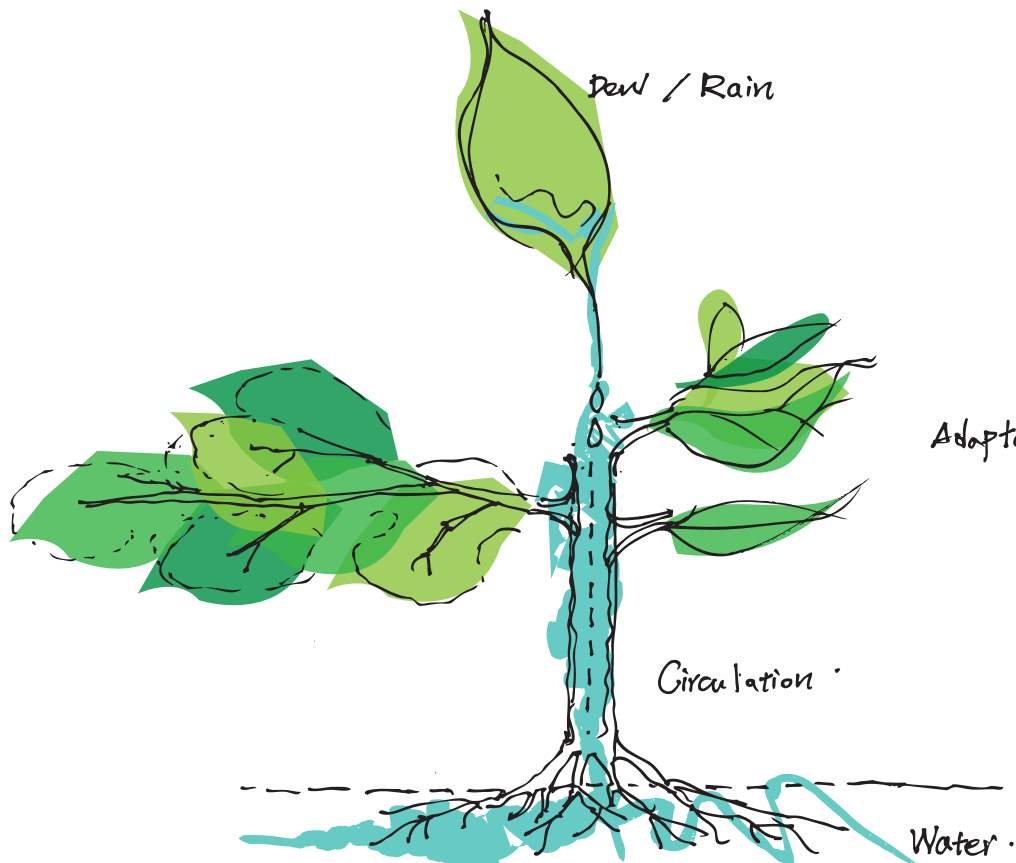
Introduction: Sustainability concept applied

We can all learn from Nature. A house is like a plant. The leaves create dewdrops, and the root absorbs water, circulate in the stems, and the leaves performs photosynthesis. This cycle creates water and energy, properly stored, then supply to the entire plant. Our house will function the same, as the solar panels absorb light from the sun, converted and stored in the battery, then supply to the rest of the house. We can also harvest our own water, circulate, recycle and reuse.

Our house design concept is based on the Taiwanese local conditions, however, we believe those systems are applicable to any other locations of earth. Here are the sustainable approaches to the house, which we have incorporated during the design process:

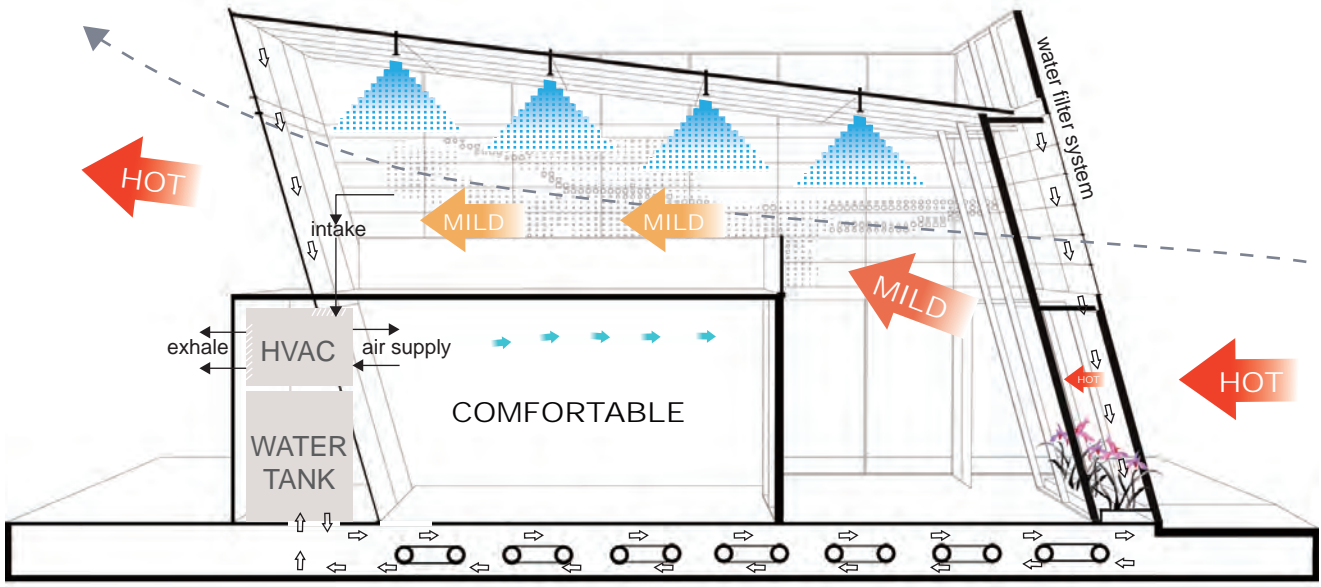
1. Light weight structure with BIPV (Building Integrated Photovoltaic) system
2. Highly insulated structural panel for living space
3. Solar thermal water device for radiant flooring
4. Humidity and temperature control system develop upon the green house technology.
5. Water circulation systems

To create and control a comfortable living environment, we incorporate a special building system at the Orchid House. First is to create a skin, which is semi-covered for shading and ventilation purpose. Inside core is the actual living area, where we will have a well-controlled system to keep temperature and humidity level even.

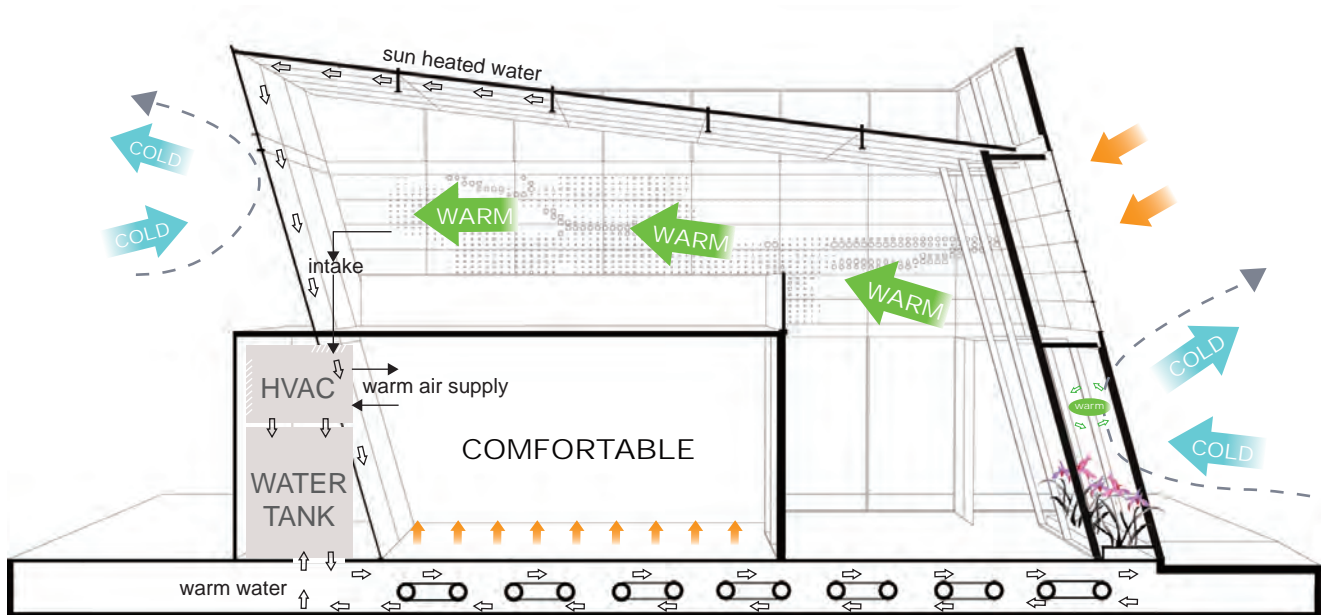


Bioclimatic Strategies

The below two sections describe summer time and wintertime bioclimatic strategies for the Orchid house.



SECTION DIAGRAM: SUMMER TIME



SECTION DIAGRAM: WINTER TIME

6 DINNER PARTY MENUE

Festival of Taiwan

At the Orchid House, we would like to bring our guests an unforgettable and spectacular dinner, Taiwanese style. Taiwan is a country of food, we hope our guests can enjoy not only food, but the special drinks which make Taiwanese cuisine known in the world.



To welcome our guests, we begin with a toast to a more sustainable future, with Taiwan made special Gaoliang Liquor, which is often drunk during celebration. The cook then takes the liquor and start making the first appetizer, which is the Mullet Roe. It is best soaked in Gaoliang for a minute then put in the pan to cook with slow heat, until it is golden brown. The delicate texture of Mullet Roe is tangy and soft. 2nd course would be the Chinese Chicken Salad, which is an Asian flavored dish, specially prepared with the freshest ingredients.



Our 3rd course is the famous Shiao-Long-Bao (stuffed steam buns), which is delicious soup dumplings served in bamboo steamer. The buns are small, but it sure will leave a great impression to our guests.

Now it's time to bring out the most popular bubble tea in the world, with a little bit milk added for a nice, smooth taste.



Our main dish of the night would be Dongbo Pork (Braised Pork), served with steamed bread to balance the savory flavor. The dish is named after the Song Dynasty poet, artist and calligrapher Su Dongpo, to celebrate the health and prosperity.

Finally, we bring the sweet Almond Tofu to satisfy the taste pallet of everyone. It is often decorate with flower paddles, and this time, we will use the beautiful orchid paddle on the plate. It does not only tastes great, it is visually pleasing, too.



To conclude our dinner party, we would like to invite our guests to the 2nd floor balcony space. In Taiwan, families and friends often enjoy tea and chitchat after dinner. Our guests will enjoy the Taiwanese high mountain tea with the view from the 2nd floor.

Taiwanese is also famous for our hospitalities, and we never let our guests go home empty handed. Thus, guests can go home with a box of pineapple cake to share with their friends.



8 COST ESTIMATE AND PROJECT FINANCIAL SUMMARY

Business and Fund-Raising Plan:

1. Description of overall project

NCTU / UNICODE, team of National Chiao Tung University, is taking Solar Decathlon Europe as the opportunity to develop a prototype house for co-existing with nature by focusing on the green house technology that has been developed for cultivating orchid in Taiwan combining with the research institute here in NCTU. The university's main campus is located at the center of the Hsinchu Science Park, Taiwan's national research center. The area is referred to as the Silicon Valley of Asia. More than 400 technology companies have been established in the park.

2. Project Budget

See the list below

3. Interaction with other departments

In terms of inter-university departmental collaborations, NCTUNICODE tem is base in The Graduate School of Architecture and is in the process of collaborating with the following schools in various aspects related to SDE 2014 project:

NCTU President's Office

1. Administrative and overall support
2. Alumni relations and resource advice
3. School-wide and nation-wide media, communication, and press release

NCTU School of Engineering

1. General engineering solutions and prototyping
2. Database management and technology advice
3. Simulation and specifications

NCTU School of Management

1. Multidisciplinary coordination management
2. Risks management advice
3. Communication planning and strategy

NCTU School of Science

1. Research on various subjects related to horticulture, nursery, and industry
2. Database sourcing related to weather, environment, and other academies

4. Fund-Raising Plan

4.1 Goals and Objectives

- 4.1.1 To engage the leading industry leaders in each of the key areas of our design as strategic support
- 4.1.2 To engage the most relevant technology/capacity providers that are capable of extending our research into materialization and commercialization
- 4.1.3 To engage leaders of sustainability promoters for expanding the public and market awareness of our design

4.2 Strategy

- 4.2.1 To identify key merits and values in our design and the overall SDE-related activities – by consolidating the driving values inside and out of our design of the solar house project, we will then leverage these key merits for the entire fund-raising activities as our Core Values.
- 4.2.2 To establish database and contact information - which includes government agencies, private corporations, research-backing institutions, and special interest communities and groups.



4.2.3 To research and engage initial contact – based on internal research of target candidate’s credibility, relevance, and likelihood of support, the team will engage initial contact and communication towards a short-list of candidates for in-depth communication and fund-raising activities.

4.2.4 To solicit government or special interest group’s endorsement and reference in approaching potential candidates.

4.3 Target Candidates (categorized by sector)

4.3.1 Solar/PV Technology

4.3.2 General Building Construction

4.3.3 General Mechanical, Electric, Environmental Control Provider

4.3.4 Housing Builder

4.3.5 Orchid Horticulture Enabler

4.3.6 Urban Regeneration/Renewal Promoter

4.3.7 Logistics

4.3.8 Alumni Office and Development Office at NCTU

4.3.9 Media, PR Agencies and Advertiser



Cost Estimate:

Project Budget Summary (in €)

Date: April, 1, 2013

	ITEMs	COST (est'd)	Remarks
I.	DIRECT MATERIALS		
	Landscape	10,000	Earthwork, planting, deck
	Foundation	5,000	
	Structure	23,000	
	Building System	85,000	Wall assembly, metalwork, waterproofing, insulation, etc.
	Roofing	23,000	Including prototyping
	Openings	34,000	Doors & windows
	Finishes	10,000	Interior & Exterior
	Electrical	80,000	Power, storage
	Plumbing	10,000	
	HVAC	23,000	
	Specialty	57,000	Solar PV
	Furnishings	22,000	Including shading device
	Appliances	30,000	Fixtures
	V.A.T.	20,600	@ 5%
	SUBTOTAL	432,600	
II.	MATERIAL OVERHEAD	43,260	@ 10% of total MATERIALS
	V.A.T.	2,163	@ 5%
	SUBTOTAL	45,423	
III.	DIRECT LABOR		
	Faculty & Researcher	75,000	5
	Assistant – Admin.	15,000	1
	Assistant – Research	45,000	3
	Granted Students	60,000	4
	Draftsman	15,000	1
	SUBTOTAL	210,000	
IV.	LABOR OVERHEAD		Including Fringe Benefits
	Granted Students	10,000	
	Laborers	10,000	
	Assistant – Admin.	10,000	
	V.A.T.	1,500	@ 5%
	SUBTOTAL	31,500	
V.	LOWER-SUBCONTRACTORS		
	Prototyping Phase	2,500	
	1 st Construction Phase	3,000	
	2nd Construction Phase	4,500	
	V.A.T.	500	@ 5%
	SUBTOTAL	10,500	
VI.	CONSULTANTS		
	Structural	3,000	
	M/E/P	3,000	
	Life Cycle Analysis	3,000	
	Energy Simulations	3,000	
	Transportation	3,000	
	Site Preparation	3,000	



	Lighting	1,500	
	V.A.T.	975	@ 5%
	SUBTOTAL	20,475	
VII.	OTHER DIRECT COSTS		
	Professional Photography	500	
	Security	1,000	
	Model	500	
	Communication	2,000	Media, Website
	Publications	2,400	Booklets for various purposes
	Event	4,000	Promotion
	Past Competition Monitoring	10,000	
	V.A.T.	1,020	@ 5%
	SUBTOTAL	21,420	
VIII.	TRAVEL & ONSITE COSTS		
	Travel Costs	35,000	30 person/trips
	Accommodations	30,000	
	Food	5,000	
	Uniform	5,000	
	Tools & Misc. Expenses	4,000	
	Site Supervision & Security	8,000	
	Shipping and Handling	1,000	
	Allowance	10,000	
	V.A.T.	4,900	@ 5%
	SUBTOTAL	102,900	
IX.	ASSEMBLY/DISASSEMBLY & LOGISTICS		
	Disassembly in Origin	10,000	
	Transport. & Crane	40,000	
	Assembly Onsite	15,000	
	Disassembly onsite	10,000	
	Transport.	30,000	
	V.A.T.	5,250	@ 5%
	SUBTOTAL	110,250	
X.	INSURANCE		
	Liability	5,000	
	Transportation	5,000	
	Accident	10,000	
	Medical	10,000	
	V.A.T.	1,500	@ 5%
	SUBTOTAL	31,500	
	TOTAL	1,016,568	