Solar Decathlon Website: English to Chinese Translation

A Major Qualifying Project Report
(Professional Writing)

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Abstract

WPI is part of a team competing in Solar Decathlon China. For its Communications Contest, our team is generating a website, brochure, and signage to engage the audience in learning about the house we designed, "Solatrium", and get inspired from our Solar Decathlon experience. This MQP incorporates an English to Chinese translation of the website, brochure, signage, video walkthrough, and dinner menu. It also provides information on the house design, the target audience for the Chinese website, and experts' advice on translation. I compared my actual translation challenges and strategies to those proposed by literature. I conclude translation is not just about literal translation or reproducing sources into another language. It is also about making persuasive and culturally appropriate adaptations to attract the audience through their interests. This project reflects language and cultural differences through the experience of translation.

Acknowledgements

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Solar Decathlon Website: English to Chinese Translation

Introduction

In 2013, The U.S. Department of Energy will cooperate with the National Energy Administration of China to organize a Solar Decathlon in Datong, China. Team BEMANY, compromised of Worcester Polytechnic Institute, Ghent University of Belgium, and the Polytechnic Institute New York University, will compete with twenty-one other teams to build cost and energy efficient and attractive solar-powered houses. As part of the contest, our team will construct an online website, a brochure, signage, and a video walkthrough to attract green-tech manufacturers, public visitors, and other teams, providing details of the house and showing the team's progress. Since this international competition launches in China for the first time, a Chinese translation of the website and other promotional materials can attract public attention, increase public awareness of solar energy, and display our involvement during the competition. The English website with Chinese translation will convey international involvement of our team and will reach a wide range of audiences.

The Communications Contest comprises 10% of the competition out of a possible 1000 points. The website takes the major responsibility of communicating with the public, potential sponsors, the judges, and other teams. WPI marketing generated an English website while I translated it into Chinese. Because the English website and the Chinese translation target different groups, my project will not be a direct word for word translation. In order to deliver fluent Chinese translation to meet the audience's needs, this project includes not only language translation but a total of six tasks:

1. To learn about Solar Decathlon China and the Communications Contest background.
2. To understand our house design, especially unique features.
3. To research a Chinese audience's understanding of solar power and the Solar Decathlon, and how our house can influence their attitude.
4. To research challenges and strategies of English to Chinese translations.
5. To translate the website and reflect on real translation challenges and strategies in the website translations.
6. To conclude what I learned about translation.

I delivered:

1. A Chinese translation for the English website, brochure, signage, video scripts, and the dinner menu before the onsite competition. (Appendices C-G contain screenshots of the Chinese website, the brochure, the signage, the video scripts, and the menu)
2. An MQP which describes the English to Chinese translation process and my discoveries.

The Chinese translation is the product of the learning process. As a complete project experience, both the learning process and the product are important.

1. About the Solar Decathlon

This chapter introduces Solar Decathlon and the Communications Contest, and describes the need for a Chinese translation.

1.1 Solar Decathlon China

The Solar Decathlon is a competition in which over 100 colleges from all over the world are challenged to "design, build, and operate solar-powered houses that are cost-effective, energy-efficient, and attractive."[1] The competition is held every two years in sites around the world.

In August 2013, the first Solar Decathlon China will be held in Datong. Twenty-two teams will be hosted by the U.S. Department of Energy and National Energy Administration of China and supported by many other government and student organizations. Refer to Appendix A for a complete list of sponsors.[2]

The competition requires about two years of preparation, during which each team develops and tests a design for a completely solar-powered house. The houses must be fully functional and comfortable for up to three people throughout the summer months, or ideally year-round.[3] The houses must be affordable and attractive to appeal to the market as the precursors of houses for the next generation.

During the competition from July to August, 2013, the teams will have to build their houses onsite and live in them for a week to present their designs. Each team is evaluated in each of the ten specific Contests of the overall competition. Each Contest is rated on a scale of 1-100, for a final possible team point score of 1000. The Contests are: Architecture, Market Appeal, Engineering, Affordability, Comfort Zone, Hot Water, Appliances, Home Entertainment, Energy Balance, and Communications.[4] Part of the Communications Contest is scored based on the quality of the team's website and onsite promotional materials, which are the focus of this report.

1.2 The Communications Contest

As one of the ten Contests used to determine the final score for a team, the Communications Contest is concerned with how each team educates their audience about the houses they build, competition experiences they have, and solar power in general. As the Solar Decathlon informational website explains:

A jury of communications professionals awards points for delivering clear and consistent messages; images that represent the vision, process, and results of each project; and creativity in engaging audiences.

The Communications Jury evaluates:

- Web content quality, appropriateness, and originality
- Audiovisual presentation information, the accuracy of the representation of the as-built house on the competition site, accessible captioning, clarity of the narrative, and creativity
- The quality of onsite graphics, photos, displays, and signage
- The delivery of messages to target audiences and people of all abilities
- The use of innovative methods to engage audiences, including website visitors and people waiting to tour a house.

The Communications Contest compares the twenty-two teams' websites, brochures, signage, and all other creative methods to engage the audience. Because the website represents a large component of the overall

Communications Contest score, the BEMANY team decided to produce a website in two languages: English and Chinese. As the team includes students from American universities, the English and Chinese versions of the website were created for educational purposes for the schools involved, as well for Chinese high school and college students. Meanwhile, the Chinese version of the website was created for two additional reasons: to attract local residents and media to visit our house during the competition, and possibly to earn our team more points in the Communications Contest.

2. *Solatrium's Design*

This chapter introduces our house design and high-tech construction materials. Learning how our house works can help predict the impact on an audience. It also helps to understand the technical perspective when translating the section introducing the advanced construction materials.

2.1 Solatrium

After the first year of design and discussion, our team came up with "Solatrium", a combination of sol (sun in Spanish) and atrium (central room). The design ideas of the house are gathered from a variety of participants from the architectural engineering, civil engineering, electrical engineering, fire protection engineering, computer science, and communication science departments from Worcester Polytechnic Institute, the Polytechnic Institute of New York University, and Ghent University. The various departments collaborate to use their expertise to achieve our goal of "develop[ing] an attractive competition house that is comfortable, healthy, and enjoyable to live in, that is affordable and safe to construct, and that is highly energy efficient."[5] The different departments also contribute the Competition Deliverables, Drawings, and Project Manual for this competition.

Figure 1 Solatrium Design Drawing[6]

Solatrium is a house designed for a three-person family, about 120m^2 (approximately 1,300ft^2), including an atrium roof, which is on top of the central living room with the other rooms encircling it (See Figure1). It also

includes two bedrooms, a utility room, a bathroom, a living room, a dining room, and a kitchen, and is handicapped accessible. Our team combined a traditional atrium architecture type, with solar energy to create a new house model. The top view of the house looks like the Chinese character *hui*, written in Chinese as 回, which means return, and is also the first character of recycle. Our house is unique in many features including house design and construction materials.

2.2 Photovoltaic (PV) Panels

All our Photovoltaic (PV) panels will be put on the top of the house except the atrium area. Our PVs, donated by 1SolTech, cost $3/watt, with 290watts/panel, and has a life expectancy of twenty years. The house needs forty-two panels, producing around 12kw and costing around $36,000 in total. The panels are made of inorganic materials which can be recycled to make semiconductors.

Using the sunlight, the panels' solar cells can absorb photons and release electrons. The semiconductor then captures the electrons to generate a direct current (DC). Through an inverter, direct current (DC) transforms to an alternating current (AC) of 208Volts, 50Hz and combines into the Solar Decathlon grid. The grid can adjust the current to US standard, 120V, 60Hz, and send it for Solatrium's power using.[7]

The 1SolTech solar modules are tested to withstand extreme temperature variations as well as high wind and snow mechanical tolerances, for loads up to 5400 pa.[8]

2.3 Composite, Fiber-Reinforced Polymer Panels (FRP)

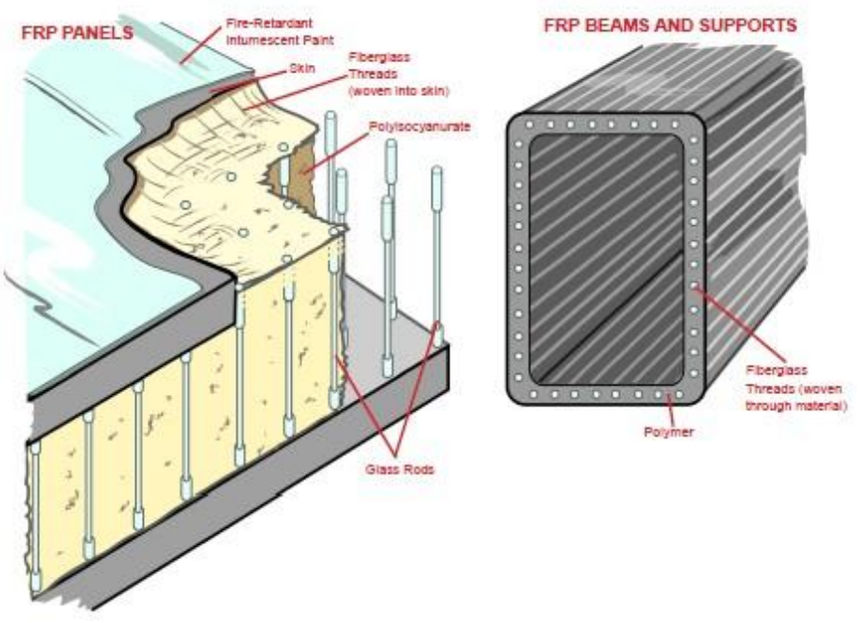

Figure 2 Fiber-Reinforced Panels[9]

The sandwich composition panel system uses lightweight composite materials for the floor, walls, and roof to decrease the volume of the shell, simplify the construction process, and reduce maintenance of the house. The system includes panels, beams, and columns. The 90mm FRP panels with an 81mm polyisocyanurate core have

an insulating R value (a measure of thermal resistance) of 12, compared to wood panels with R value of 2.7 (higher R value means more insulated) (See Figure 2).[10] The house uses fire retardant materials for the FRP panels for the walls and the composite materials replace traditional concrete. This minimizes material consumption and still meets the functional requirements for the floor, wall, and roof system. All the panels are designed in large format pieces, supported and connected by the thirty-two beams and forty-one columns composed of the same material. They are smartly designed to avoid adhesive chemicals. They are also easy to put up, easy to ship, easy to clean, and air-tight.

The FRP panels are strong and durable, can support Solatrium's weight, and even withstand an extensive snow load in Worcester or potential earthquake in Datong.

2.4 Elevated Atrium Roof

The Atrium style is a traditional architecture designing concept, the central room of a Roman house. It originates from northern China, then spread to Rome to Morocco. The roof is built by composite material on the top and glass on all four sides of the steel trusses that elevate it. The roof is on top of the central living room and higher than the other rooms to create a broad view of the house from the center. The atrium's elevated roof provides passive heating and ambient daylight. The "Solatrium" house, named for the atrium design, is centered with the atrium roof and all the other rooms around it.

2.5 Split HVAC System

Solatrium uses a split HVAC (heating, ventilation, and air conditioning) system. Unlike a single system, the split HVAC system uses several pumps to reduce duct work, therefore minimizing air loss. Two 9,000 BTU heat pumps are located outside the two bedrooms and two 12,000 BTU heat pumps are located outside the house. The split system maximizes energy efficiency.

2.6 Low E Glazing Glass

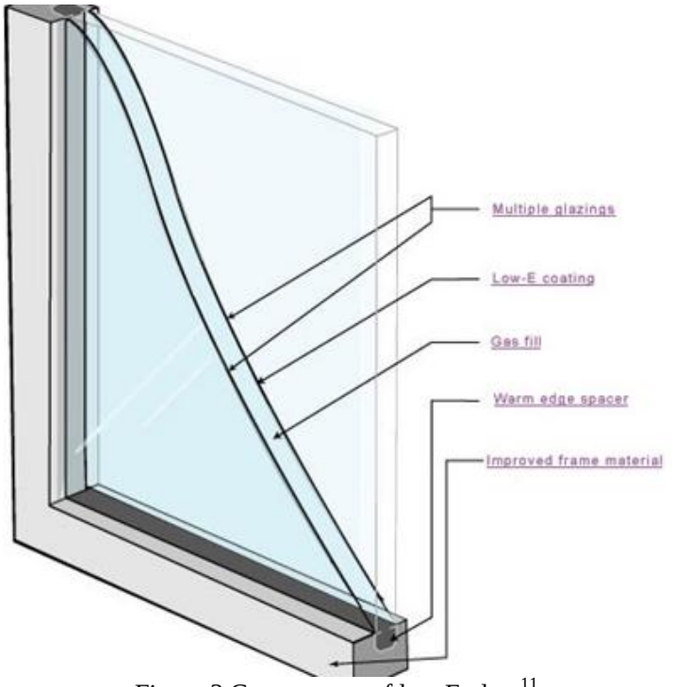

Figure 3 Components of low E glass[11]

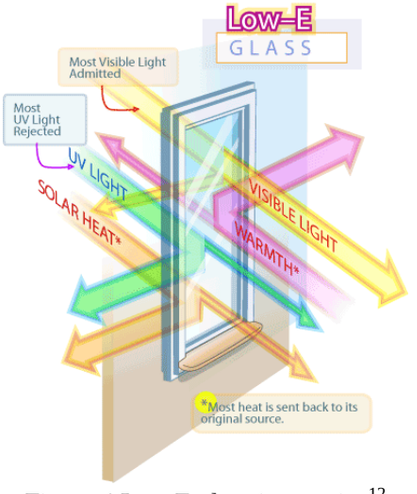

Figure 4 Low E glass in practice[12]

The low E (Emissivity) glazing glass is well insulated because of the two glass-panel composition with vacuum space in the middle (see Figure 3). The vacuum space is about 1cm in between the two panels. Solatrium uses glass windows to cover about 50% of the wall area: the entire north and south side of the house, and one third of the east and the west side. Most of the windows are from floor to ceiling. The well insulated windows ensure the minimum energy loss from the house.

Emissivity refers to the ability of a surface to absorb or reflect heat. The low E glazing glass is a poor absorber of heat because the vacuum in the middle eliminates the media for heat transfer. It does not only block heat from the outside, including IR light, UV light, and solar heat, but also prevents inside energy loss. Most heat is sent back to its original source (see Figure 4). Solatrium uses a hard coat, a type of low E coating, on the interior

surface. It is manufactured via Chemical Vapor Deposition (CVD) process, in which vapor directed to the hot glass surface reacts to form a ceramic coating. Because the coating is covalently bonded to the glass, hard coat low E is extremely durable.

Some of the floor-to-ceiling windows also have handles on them. They serve as doors for easy access to the outside or emergency exit.

2.7 Phase Change Materials (PCM)

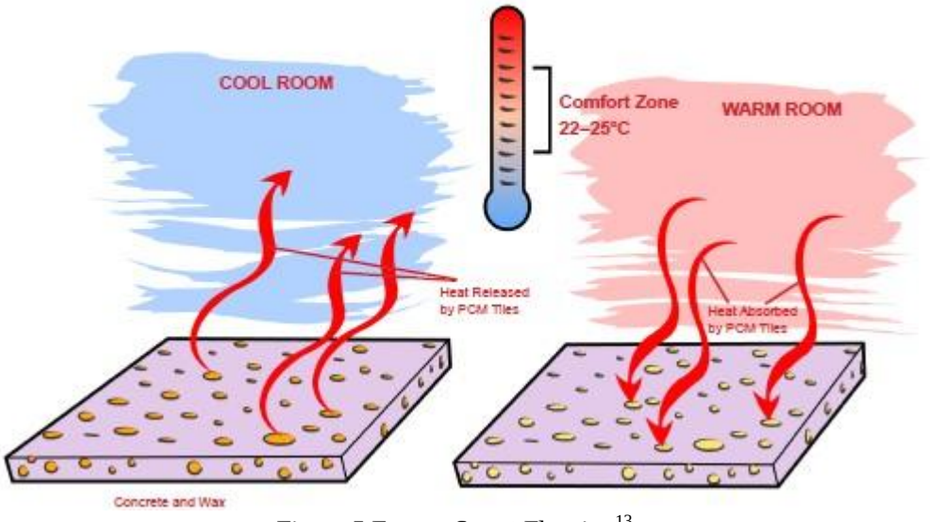

Figure 5 Energy Smart Flooring[13]

We use around 300 concrete floor tiles incorporated with Phase Change Materials (PCM) atop the floor FRP. (see Figure 5) The PCM is a heat storage media that can be applied to concrete. The melting point of this type of PCM being used is about 23 ℃ (73.4 ℉). During a day, the floor absorbs and stores heat from the ground from an endothermic reaction initiated by the PCM melting. At night, when the temperature drops below 23 ℃, the PCM condenses to release heat within the house. By absorbing and releasing heat in the material, the PCM can always keep the house at a comfortable level. Our team's design integrates PCM into a lightweight concrete tile system for the floor to increase the heat storage capacity of the house. The PCM provides passive heating and cooling, therefore reducing the energy cost of the HVAC system.

2.8 Sustainable Bamboo Materials

Solatrium adopts sustainable bamboo materials because bamboo is a fast-growing, durable construction material now used in many homes. In the middle of the living room, residents can use movable bamboo panels to customize interior living space for a diversified living style or allow for additional control of space and light. For the two bedrooms, the bamboo panels separate them from the central living room to provide private resting space. On top of the windows, the bamboo trim provides shade from the intense sunshine. It also protects the house from rain and snow.

3. Audience

This chapter analyzes the Chinese audience, their attitude toward solar power and the Solar Decathlon China, and how our team's house can educate them about solar power.

3.1 The Chinese Government

Though the Chinese government is not one of the website audiences, government policies have a strong impact on how Chinese view solar power. As one of the organizers, the National Energy Administration of China collaborates with other government organizations and student organizations to support the first Solar Decathlon China.[14]

For the Chinese government, energy needs were prioritized among all developing problems because of the large population. China is not only facing an energy shortage, but also pollution issues from the traditional energy sources, such as coal. The Chinese government is striving to promote sustainable solar energy to replace traditional energy supplies of coal and petroleum as national petroleum supplies are more and more limited and are becoming more dependent upon imports. Recently, pollution problems have become more severe and have gained more publicity. The Chinese government has focused on developing and promoting solar power since the end of last century. They reemphasized developing solar power in the national twelfth Five-Year Plan. On Oct 24th 2012, the National People's Congress delivered an Act on Chinese energy policies, reinforcing the importance of solar power.[15]

Learning from the "Solar Roof" project in Europe, the Chinese government came up with the "金太阳 (Golden Sun)" project in March, 2009 to encourage installation of PVs. In the "Golden Sun" project, the Ministry of Finance, the Ministry of Technology, and National Energy Administration of China announced that they will subsidize 50% of the cost of installing PVs for public schools, public institutions, commercial companies, mining and industrial companies nationwide, and 70% in areas with small populations. The policy requires institutions to install a PV capacity over 300kWp (kilowatts peak), which generates around 2250,000 kWh of electricity per year, and endures for over 20 years.[16]

According to this government plan, the National Development and Reform Commission (NDRC) unveiled a quantitative plan for the domestic installed capacity of PV to reach 15GW in 2015, 1.5 times more than 2011, with a longer-term target of 20-30GW (double the 2015 goal) by 2020.[17] The government currently has a running list of Condensed Solar Projects (CSP), which can be found in Appendix B.[18]

To transform energy supplies from coal and petroleum to more sustainable energy, the government is not only devoting money and publishing policies, but also enhancing publicity about solar power in newspapers and in public events. In addition to publishing its promotion policies, the National Energy Administration of China, representing Chinese central government, is hosting Solar Decathlon to attract the general public's attention and increase their awareness of solar power. This international event also shows large national involvement with thirteen Chinese universities participating, including the two most renown, Tsinghua University and Peking University.

3.2 Chinese General Public

Due to the government's efforts, solar power is becoming widely recognized by the public. However, the usage

is limited because of misunderstandings and misconceptions about cost and efficiency, further discussed in section 3.2.1 - 3.2.4. Further public solar power education supports the government's goal of PV installation.

According to National Survey Report of PV Power Applications in China 2011, Chinese families have been using PV to heat water in both multi-floor apartments and single houses since the end of the twentieth century.[19] The PV installing capacity (number of PVs installed per year) in 2011 has grown more than 200 times since 1999.[20] Water heating uses a separate system which is easy to achieve while solar heating and lighting requires updated custom meters and has not gain popularity yet.

Most home owners have a basic understanding of PVs, but it is limited in applications in water heating. Also, large businesses have not widely used PVs as their energy supplies because of misunderstandings about cost and unfamiliarity of subsidizing policies. In China, consumers still lack awareness of how much solar power can achieve.

The Solar Decathlon can educate the public, including families and businesses, about solar power so that they can consider the possibilities of low-cost and high-efficiency solar panels and other energy saving materials. Our house, serving as an example, presents many advanced energy-saving materials and encourages the public to learn more about them. Solar Decathlon China can clear up several common public misunderstandings about solar power.

3.2.1 Solar technology is not just about PVs.

Solar power includes all energy from natural sunlight, not just PVs. Besides PVs, our construction materials, such as PCM, also utilize solar energy to save electricity indirectly.

In China, standard apartments hold ten to fourteen families. The small roof surface of residential apartments would not be enough to install PVs for ten families. Many developers in China believe PVs cannot provide enough energy for multi-floor apartments so that it is not worth the installation cost. Many residents agree with the developers.

The space limit is a fair concern; however, our solar house proves PVs are not only used for collecting solar power and turning it into electricity, but also other energy saving materials and specific architecture designs can conserve solar power. The worries about the current space limit of installing solar panels, especially in cities with large populations, can be solved with other energy saving construction materials used to save energy overall. Our house floors use lightweight composite materials as subfloors, covered with concrete tiles with PCM to absorb energy from outside in the day and release energy to inside at night. The PCM can efficiently reserve the heat from the sun and release them when the temperature drops at night through phase transitions. We also use 20 low E glazing glass windows, which covers 50% of the wall area, to prevent heat loss. The vacuumed double-panel windows have much lower heat conductivity (ideally 0) than regular concrete (0.9-2 $W\ m^{-1}\ K^{-1}$).[21] These materials can conserve the heat in winter to reduce the heating cost. Some of these materials and designs can apply to multi-floor apartment.

The Chinese government is trying to improve the existing buildings with similar ideas. The competition's co-organizer, The Ministry of Housing and Urban-Rural Development of China (MOHURD), released a "Green Building" plan to improve existing apartments.[22] Instead of building new apartments with the latest technology, improving the existing ones saves materials, energy, and money. The major idea of this plan is to thicken walls and replace window seals to prevent losing heat at night.

Low E glazing glass and PCM can be adapted to this plan to conserve heat and prevent heat loss. Team BEMANY wants to maximize the efficiency of solar power and show that solar-powered houses are fully

functional and provide a futuristic image of the next generation's homes. The combination of the energy technologies supporting a typical family may not be completely solar, but solar will be an increasable important part as these materials support each other symbiotically.

3.2.2 PVs are the cheapest energy resource for long term and they are easy to maintain.

Solar power is the cheapest among all the current energy resource. From the first generation of PVs to the third today, the price has significantly decreased and become affordable. The cost of panels now is below $1 per watt including initial installation cost and will be equal to the cost of other energy sources by the end of 2012.[23] There should not be any difference between using PVs and traditional energy resources. However, half of Chinese do not realized that PVs are affordable. One of competition sponsors, Applied Materials, released the *4th Annual Solar Energy Survey,* June 21st, 2012, which measures consumer understanding and awareness of solar energy in China, India, Japan, and the United States.[24] Half of Chinese consumers surveyed believe solar power will become or remain equal to or less expensive than traditional power within nine years while the other half believer it will become more expensive.

PVs initial investment is expensive for the average family or small businesses which cannot get subsidized. Even though PVs are initially expensive because of installation, panels, inverters, and meters, PVs save money over time. Inverters cost will drop to $0.25-0.3/watts in 2020.[25] Meters are cheap as under a hundred dollars. Our PVs donated by 1SolTech cost $3/watt including the panels and installation fee. The house needs forty-two panels to produce 12,000watt, equal to $36,000 overall. Cheaper PVs from Arizona cost only $0.8/watt, $9600 total, much cheaper than the ones we are using. The cheaper PVs pay for themselves within ten years and starts earning in the next. If we consider multi-floor apartments shared by over ten families, the average family expense would be cheaper. Though the PVs may not necessarily meet the electricity needs of the ten families, they would at least help to defer the cost of electricity. PVs are much more affordable for large businesses because of the "Golden Sun" plan's subsidy.

Additionally, as the traditional resources become more and more expensive, PVs will become cheaper and cheaper as technology develops and become more efficient. PVs have great potential in the future.

Some people may think PVs are high-tech and hard to maintain. PVs do not require much maintenance; they work well if they are not shielded by materials, such as leaves or snow. Ideally, PVs have no additional maintenance cost once they are installed.

3.2.3 PVs save a lot of energy even the energy conversion efficiency is not high.

Some people argue that PVs have low efficiency and do not save much energy. Though the third-generation PVs only have efficiency around 15%, much lower than other energy converters, they save a lot of energy overall and have the potential to increase their efficiency.[26] Saving energy saves money too. Using PVs are also more environmentally friendly than using natural gas or fossil fuel to generate electricity.

An average American family uses 10,000 kWh electricity per year.[27] We want to compare two different electricity generation methods, PVs and natural gas, ignoring the fee for electricity installation and PV maintenance because they are much lower compared to other fees. The amount of gas consumed and CO_2 produced are based on family yearly usage calculations.

	Installation Fee	Consuming Fee	Overall Unit Price	Energy Conversion Efficiency	Natural Gas Consumed	CO_2 Produced
PV	$10000	0	$0.05/kw*h	15%	0	1000kg
Gas	0	$0.118/kw*h	$0.118kw*h	40%	5kg	4000kg

Figure 6 PV and Gas electricity generation comparison[28]

The unit price of electricity generated by PVs and natural gas was calculated. PV generated electricity is much cheaper than natural gas generated electricity. Figure 6 shows If we use PVs instead of natural gas to produce the amount of energy, we save around 5kg of natural gas, and reduce 3000kg of CO_2 per family per year. A family can save over $680 per year for 20 years with the current electricity price, about 11cents/kw*h.[29]

3.2.4 The solar power can direct industrial reform and boost the economy.

A common concern accompanying industrial reform is the fear lost jobs, especially in Datong, a coal city. However, a coal city, Shuozhou, proves the possibilities of creating jobs and boosting the economy through developing sustainable energy.

In Shanxi, the same province as Datong, Shuozhou, has been going through an industrial transformation from coal to wind. Shuozhou, like many other cities in Shanxi, has historically relied on coal for years. In 2009, the first wind power plant, Xiaowutai, opened in Youyu area in Shuozhou. Youyu has long suffered from wind damage. The government has recently tried turning this climatic disadvantage into economic advantage. The Chinese government and other private sponsors invested ¥400,000,000 ($65,000,000) into Xiaowutai wind power plant.[30] The outcome is worth the investment. A 2009 report showed the power plant generated 69,500,000 kWh of electricity, saved 24,700 tons of coal, and reduced 12,400 tons of CO_2 in a year. The government also took other actions to accompany the industrial transformation. They planted trees on the exhausted mines and developed high-tech industrial regions. From 2005 to 2013, Youyu has increased its forest coverage from 0.3% to 53% and developed two high-tech industrial regions. Youyu area's municipal annual income increased from ¥82,250,000 ($13,400,000) to ¥810,000,000 ($132,000,000), with a 39% of increase per year. Because of the improved environment, Youyu has also developed its farming and tourism, including twenty-six new tourism projects. The industrial transformation has led to a change in the city's economy and lifestyle. According to the 2012 Shuozhou City Government Report presented in 5th City Representatives Conference in 2013, Shuozhou opened 23,146 job positions and the city residents' annual income increased 15.5% from last year.[31] The government is optimistically planning to open another 20,000 jobs in the following year and keep the economy growing. The city is also building another five wind power plants.

The solar industry in Datong has potential to achieve the same goal. The industrial reform from traditional energy to sustainable energy can greatly improve the environment, industrial structure, and resident's life quality. The industrial reform could solve the problems of energy shortage and environmental pollution.

3.3 Green-tech Manufacturers

Due to the industrial transformation from traditional energy resources to more sustainable energy resources, PVs and other green-tech industries are expanding fast. Chinese PV industry currently produces a large portion

of the world's PVs. In 2011, 21GW (gigawatts) worth of solar panels were manufactured in China, though 99% were exported and contributed to 60% of global outputs.[32] Though the solar industry is growing rapidly, the domestic market in China did not show strong interest.

Solar Decathlon China hopes to promote solar industry in a more active way, especially in domestic market. Based on the fact that most PVs are used for residential water heating, the competition wishes to convince consumers that PVs and other energy saving materials can do much more by presenting fully-functional and financially feasible solar houses. Chinese consumers have great potential to purchase and use solar materials once they realize how much they can benefit from using these materials.

The competition will broaden the consumer's eyes and attract government and business to manufacture and train workers in some of the advanced technology. This will increase potential investors' interest in the joining solar industry. With all the government subsidizing policies and public attention, it is great chance for investors to join the field.

The organizers want Datong to represent a city of industrial transformation. Datong, also known as the "coal city", is the second biggest city in Shanxi province. It holds over 71.8 billion tons of coal underground. For hundreds of years, Datong's industry has relied on coal and coal mining. If Datong can gradually transform to use more sustainable energy, other cities can too. Solar Decathlon is the first step to accomplish this goal. Chinese government focuses on several cities, including Datong, for development of the solar industry because of their long duration of sunshine. Currently, over 400 PV companies have built in several provinces, including Qinghai, Xinjiang, and Sichuan.

From the Solar Decathlon, Datong can attract green-tech manufacturers' attention. BEMANY, one of the twenty-two teams, will present the latest solar technology during the competition. When the green-tech manufactures visit our house, we can introduce our energy saving materials to them. Also, traditional coal mining companies in Datong can consider possibilities to transform and develop sustainable energy.

Not only will PV companies be interested in touring our house, but other manufactures, like insulation materials companies, concrete flooring manufactures, or glass companies may show interest as well. Many insulation materials companies are developing useful applications for walls. They apply thermal insulation materials to walls to improve existing buildings rather than building new ones. The thermal improvement of walls can potentially save a great deal of energy in China. According to a survey from Insulation Materials for Wall and Application Technology of Thermal Committee, the total wall area in China is four to five times more than in developed countries.[33] China has enormous need for wall improvement, especially for buildings over fifty years old. Our PCM is a kind of thermal material. They do not only prevent heat loss, but also reserve heat which supplements current insulation materials. Insulation material companies may also be interested in learning about our PCM.

Solar Decathlon provides a stage for all green-tech manufactures in China to communicate with the teams around the world about different energy saving materials. It is a great chance to advertise these materials to Chinese green-tech manufactures.

3.4 Chinese Engineers and Environmentalists

The Solar Decathlon provides a stage for Chinese engineers and environmentalists interested in solar power to communicate with experts in other countries.

In the twenty-first century, countries collaborate in science and engineering development instead of competing with each other. The collaborations collect ideas and efforts and reduce overall cost. Chinese engineers and future

engineers can gain an important experience from collaborating with other countries in this competition. Many teams in Solar Decathlon China are formed from universities in China and universities in another country. The Solar Decathlon I China unifies five continents and builds up connections for engineers in different countries for future cooperation.

Solar Decathlon can also be a role model for utilizing green energy. Environmentalists can learn from the houses to help promote green energy to general public.

3.5 Chinese School Faculty and Students

Chinese engineers are striving to develop the solar industry and need future engineers to continue to expand their work to reach the goal of using solar power all over the country. Therefore, it is important for college faculty and students to realize the necessity of solar power, and then promote it to the general public.

The green-tech industry is a high-tech industry requiring a sizeable workforce with a strong science and engineering background. Chinese college faculty and students have participated in Solar Decathlon to learn more about the solar industry. The competition creates chances for Chinese college students in architecture and engineering majors to practice their knowledge and skills in real life. This collegiate competition can also educate younger generations about the solar industry. House presentations provide good summer educational opportunities for high school students. As more people get interested and actively participate, solar industry will develop at a faster pace therefore creating a positive synergy.

The competition can also encourage green-tech companies to sponsor college research in solar field. College researching solar technology can also benefit commercial companies. Solar Decathlon essentially serves as a bridge between colleges and companies.

WPI's active involvement in Solar Decathlon shows WPI's leading role in engineering and technology research and its educational ideals of theory and practice. WPI students can show their creativity and skills to the public from WPI's unique IQP and MQP experience. The website can also increase WPI's international reputation leading to increased applications from Chinese high school and college students.

3.6 Other Teams

During Solar Decathlon, each team is required to invite other teams to come to have a party. Other teams with Chinese universities can learn about our house from the Chinese translation. The translation provides convenience for communication.

Overall, the audience analysis suggests our team need to play up the variety of green technologies. We want to introduce to our audience what advanced energy-saving materials we are using, how they work together, how much energy and money they save, and how they reduce pollution through our communication materials. The emphasis on green technology will educate and persuade the general public to use these materials, so as to persuade people to manufacture and sell them.

4. Translation

Translation is a process of expressing the content from one language to another. Three major components, the source text, the target text, and the translator, play important roles in this process.[34] A translator interacts with the source text and target text to connect them together and plays dual roles as reader and writer. I will further explain the translator's role when I further analyze translation procedures.

From this project, I want to learn and practice translation in an ordered procedure. I set up several objectives for the translated Chinese website for team BEMANY. The website needs to be both visually and conceptually attractive for the Chinese audience; the language should be expressed accurately in Chinese, the website needs to maintain its educational purpose, and the non-literal translation still needs to be under constraints.

4.1 Translation Procedure

In reading about translation, I learned that the translation process is made up of three steps: breaking source text into parts and translating each part; reorganizing the parts into the target language; and comparing the original text and the target text.

4.1.1 Break into Parts

Translators should read the original text many times to understand the writers' meaning as best as possible. This repeated reading process always influences translations; the sentence structure is especially more likely to be accurate. If I have a source text in one hand and translate at the same time, I imagine myself translating word by word. Inevitably, what I translate into Chinese will be in an awkward order and the translation would not genuinely make sense. How can I avoid awkward word for word translation? Translation requires much more than reading the source text word for word, which asks the translators to fully understand the writers' content and purpose.

Jiang Yang, an experienced and reputable Chinese translator who is fluent in Chinese, English, French, and Spanish, suggests in her book, *Tips for Translation*, identifying subject, verb, and object and grammatically breaking sentence into parts because Chinese and English both follow the subject-verb-object order.[35] She summarizes how she breaks sentences into parts from over sixty years' experience: figure out the main clause, the subordinating clauses, how each clause plays the role in the sentence, and split them apart.

4.1.2 Forget the Prose in the Original Language

After dividing the sentence into smaller units, a translator needs to "cool" before he puts the parts back together into the target language. Yang provides this useful approach, "cooling", which is a process to calm the translator and forget the sentence structure and order of original sentences. She explains this "cooling" process in her book as a way to set the sentence as a translation unit and translate sentence by sentence.[36] The "cooling" process can minimize the role of the translator unconsciously translating consistently with the order of the original sentence. Translating from English to Chinese involves rearrangement of the words in a sentence and the cooling prepares for it. When a translator forgets the exact original sentence and only remembers the meaning of the sentence, he or she writes the translation in a more natural way as Yang explains. The French philosopher,

Montesquieu, also talked about the difficulties when translating Latin to French; he explained himself, as a translator, first needed to be a master in Latin, and then needed to forget about it.[37] His proficiency in Latin allows him to understand what and how the writer writes. Forgetting Latin permits him to take the writer's ideas as his own and then express them in French, which is similar to Yang's "cooling". Further discussion of how I adopt Yang's "Cooling" in my experience can be found in the reflection chapter (chapter 5).

4.1.3 Write and Reorganize

In English, people often write long and complex sentences with many attributives and subordinating clauses; while in Chinese, writers prefer short and simple sentences. A translator should consider himself a writer when he or she puts parts together back into a sentence in another language. The principle in rearranging the parts of the sentence is to emphasize the main clause.[38] Yang pointed out the main clause does not have to be in the same place, and does not even have to be kept as one sentence. It can be replaced in the front, in the middle, or in the end of a sentence. Necessary punctuation should be added as needed. Translators need to pay specific attention to coherence and cohesion when putting these parts together.

Not only does a sentence need to be broken into parts and reorganized, a paragraph as a whole needs to be broken into parts and reorganized into one piece. Adjustments should not only be made within a sentence, but also between sentences. When the translator puts the parts of the sentence together to achieve completion of one sentence, the sentence can be rearranged in different orders with other sentences, not necessarily consistent with how the writer wrote in the first place.

Yang gives an example to show adjustments between parts of a sentence and between sentences. "They all went to London. I did not go with them because I was sick." Compared to the literal Chinese translation "They all went to London. I was sick, (so) I did not go." In Chinese, reasons are usually stated before the results. The word "so" in parentheses means she did not write it, but the readers assumed it as a result of "I am sick". It is clear in Chinese even if you do not say which one is the reason and which one is the result using a conjunction. Chinese does have conjunctions like "so" or "because" but they are not necessary when writing in a specific order, and are sometimes even redundant. The deletion of "so" is to adapt to the habits of the Chinese language. Omitting "so" in English would create a run on sentence but in Chinese either with a comma or without a common would be appropriate because the punctuation is much less restricted in Chinese. Yang further combined the sentences as "I was sick, (so) I did not go to London with them". The combined sentence can vary depending on whether the writer wants to emphasize the fact of "they went to London" or "I did not go".

Conjunction of reasons and results is not the only case where English and Chinese have different sentence structure. Another example would be the phrase "I can go shopping tomorrow if I do my laundry today" in English. Yang probably would say it in the order of "If I do my laundry today, I can go shopping tomorrow" in Chinese. Following the timeline, the action occuring first would always appear first in a sentence. The writers would also state the assumptions before the result. In English, both orders work; but in Chinese, only one makes sense.

Translation usually requires combining multiple strategies. Here is an example where I broke a sentence into parts, rewrote into short sentences, and switched the order of the sentence to make it understandable in Chinese.

Under the competition tab, it is hard to translate the sentence"Solar Decathlon China (SD China) requires teams to bring new vision to the problem of growing energy needs, in a hands-on approach: building a net-zero home that derives its power from its own solar gathering system" because the sentence was long with many clauses. I first analyzed the grammar. In this sentence, *Solar Decathlon China* is the subject, *require* is the verb,

teams to build a net-zero home that derives its power from its own solar gathering system is the object, *bring new vision to the problem of growing energy needs* is the purpose of SD China. In Chinese, reasons or purposes come first. I translated the purpose to ”针对(according to)日益增长(increasing every day)的(function like the preposition “of”)能量(energy)需求(need)”. After I stated the purpose, I explained the competition mission to reader 中国太阳能十项全能竞赛(SD China)要求(require)所有(all)参赛队伍(team)设计(design)建造(construct)零耗能(net-zero energy)的太阳能(solar)居民(resident)住房(house). I insert a comma in between the purpose and the mission to make it more obvious for readers.

Under the house tab, I used a similar approach for another sentence: “a practical, comfortable, and welcoming home for the future, with enough solar power to meet its own energy needs, we were drawn to the atrium style…” *Practical, comfortable, welcoming, with enough solar power* are features of the house, and the main clause is *we were drawn to the atrium style*. This sentence explained why we chose the atrium style. If I did a literal translation here, the reasons will be too long and main clause will be very short. It created an imbalance in the sentence. So in my translation, I placed *we chose atrium style* in the beginning of the paragraph and explained what we can accomplish (the features) by using the atrium style.

4.1.4 Compare

After putting things back together, a translator should always compare the translation with the original text to see if any content is added or deleted. Comparing double-checks for missing or repetitive information.

4.2 Translation Ethos

Three groups of characters play important roles in the translation: writers, translators, and readers. Writers and readers are on the two terminals, and translators are like bridges in the middle to connect writers and readers. Translators usually use two different approaches to bring the writer and the reader together. They can either bring the source text towards the target reader, or take the reader towards the source text.[39] Bringing the source text towards the target reader makes the original text easier to understand for the readers but requires the translators to work harder, where the other way demands greater work on the part of readers.

I chose to bring the source to the readers to make the original text easier to understand because what is important in the communication materials for Solar Decathlon is the content, not the style. Our website has different target groups, but mainly the general audience does not have specialized architectural and engineering knowledge. Our team’s goal is to show them our design and highlight the potential of our house. The translation should introduce the concepts using English acronyms and simple, understandable explanations but not provide scientific evidence which involves more technical terms. Our audience should gain a general understanding of our team’s work and Solar Decathlon competition; therefore, the translation should generally be reader-based.

4.2.1 Tone down the Instructive Voice

To establish a connection with readers, I should imagine myself sitting in front of my audience and speaking to them. The communication style plays an important role, including using culturally adapted tone and the idea of “we”.

The style or the tone of the sentences will give our readers an idea of who we are. I can approach the readers in

the way that they expect me to be. In other words, when translating into Chinese, I should also speak in the Chinese style, making not only language connections but also cultural connections. In English, people speak more directly, while in Chinese, people speak in a more conservative way. This is especially prevalent when the Chinese are expressing their opinions, and they want to avoid sounding too extreme. They would not say that they totally agree or disagree with something, while in their mind, they may still hold strong opinions one way or another. What they do not say is usually more important than what they say. This is referred as "talking manners". Talking is not just stating one's opinions and listening to other's opinions, it is also about expressing something offensive or harsh without saying it and thinking about what others do not say. If you ask for fashion advice concerning a dress from a Chinese friend, "It is OK" would mean she does not like it. Most likely she would not directly say that she does not like it. On our English version of the website where I see arguments, I should avoid translating them as a direct version of the original ones. What should I do to sound indirect? One way to achieve this is to watch the tone of the sentence. I should avoid using a commanding tone like "You should do…", "You need to do…", "You must do…" Instead, I can say "You can reach…by doing…", "If you do… you can…." For example, I can say "we did … you can also do…to help…" which encourages the audience to join us to use green-tech to protect the environment instead of telling them what they should do. The communication style determines how closely we can connect with the audience and how many people we can attract. Using a friendly and casual tone, we can create a vivid image of the writer as a trustworthy person.

4.2.2 Use "We"

Another trick to approach the Chinese audience is to use "we" instead "you" or "I". In America, people are aware of and value a sense of individuality. In Chinese culture, people prefer a group to the individual. Emphasizing individualism would be considered overexpressing oneself. Using the idea of "we" as a group as the subject can help the audience relate to our team. The switch of the subject from "you" to "we" counts the audience as part of the competition. "We" can bond our team and our audience together.

4.3 Translation Accuracy

One of the biggest difficulties in translation is accuracy. How accurately a translator express a writer's ideas affects how the readers view the writer. Translators need to pay specific attention to vocabulary, grammar, and sentence style.

4.3.1 Word Choice

Word choice is always a hard part of translation. Chinese has so many words meaning the same thing, but they are not used in the same way. Word choice reflects how well a translator knows the language and he or she should choose words differently when facing general terms, technical terms, and idioms.

4.3.2 General Terms

Most of the time, translators need to deal with regular verbs and nouns. As discussed, translators try to understand the original text first. From reading, translators remember the meaning but not the particular words. So how do they choose the right word in translation? One way is to write down all the choices and compare them with original text to pick the closest to what the writer means.

In English, a verb has specific tense to show completion of an action. However, there are no tenses in Chinese, so different verbs or additional adverbs are used to express the duration of an action. Words do not exist by themselves, they exist in a sentence together. For example, wash in Chinese is “洗”; adding “完”, an adverb, to it means *has washed* and the action is completed.

For nouns, plural forms and articles are the difficult parts. The difficulties always come from different usage in two different languages. In Chinese, writers do not distinguish between singular and plural nouns and they do not specify nouns with articles most of the time. Plural form and article do exist, but are not strictly specified. Sometimes writers use “们” for the “s” in plural forms and “这个” for “the” to specify. No specific rules for plurals and articles are applied in sentences but their presence can make sentence sounds better. Depending on different situations, I should try to read it out to determine whether they should be used or not. Every word matters because the website has limited space for text. I should consider each choice of a word and compare them to determine the most appropriate way to translate.

Not only words matter, visuals do as well. The website uses many pictures to attract the audience. The images must be culturally appropriate too.

4.3.3 Technical Terms

Specific terms are even harder to translate than common words. Two circumstances that I might encounter are technical terms and idioms. Translators might not be familiar with these words so that they tend to remember and imitate the original text. The “Cooling” method might not work in this case.

Many technical terms are involved in this project because solar power is a high-tech field. This is a competition presenting the latest solar panels and other building materials, requiring a strong background of science and engineering. The Chinese website can easily turn into a technical translation if I do not consider the general audience’s needs and fully understand the technology we used. I should stand at a distance and put myself in my audience’s shoes. It is an advantage for me because I am not familiar with civil, architectural, or electrical engineering which makes it easier for me to realize my audience’s difficulties when understanding technical concepts. As a member of the non-specialized audience, I should recognize my difficulties as my audience’s and never make any assumptions. However, the website audience also includes judges, college faculty and students, and architects who are familiar with the field. I should combine English acronyms, literal translations, and a short explanations for technical terms. These technical terms usually have literal translations used in the field. For example, “PCM” (Phase Change Materials) can be expressed in the form “PCM (相变材料: 由于物理变化储存和释放能量的材料)”. 相变材料 is the technical translation for phase change materials in the field. 由于物理变化储存和释放能量的材料 is to introduce how PCM works in a few words, literally meaning *materials store and release energy due to physical reactions.* English acronyms are especially important for those terms used in science and engineering field that did not originate in China. Also, English acronyms give the audience freedom to research the materials if interested. Around forty years ago, it became standard for students in China to learn English. In today’s Chinese educational system, English is a required course for all students first-grade and beyond. The Chinese public could easily recognize the English acronyms though they might not know the exact meaning. The combination of English acronyms, literal translation, and short explanations serves for all my audiences’ needs.

4.3.4 Idioms and Set Phrases

Idioms and common phrases are also difficult to translate. The cultural differences cause many language differences. Some idioms and common phrases only exist in one language but not in another. Specifically in Chinese, a group of phrases, composed of four characters, means something more complex than just four characters and usually comes from allusions. These phrases and idioms are frequently used but cannot be directly translated to English, so as the other way around. English also has idioms and metaphors that cannot directly translate to Chinese. For instance, "she is **pulling** my **leg**" would mean to tease someone by telling them something untrue. The direct translation of this into Chinese would mean someone is getting behind the team and lowering the average. Even a literal translation has different meanings in English and Chinese. Phrases originating from historical stories are more different in two languages. Another common example is that "red" on someone's face would represent anger in English but anger is "black" in Chinese. How do we deal with idioms and clichéphrases? How can I translate them into Chinese or how can I translate normal English words into Chinese idioms or phrases? Boase-Beier, a professor of English and Linguistics at the University of Regensburg, Germany, explains to us out of her book, *A Critical Introduction to Translation Studies*: "Translation is not about absolute equivalence of meaning."[40] In this project, when I am translating the website, I am writing to create the equivalence of function and effect, but not the meanings of single words or phrases.

Here is how I dealt with idioms and set phrases through website translation. I translate English idioms to normal Chinese words, so as normal English words to Chinese idioms.

On the website front page, I encountered the phrase "sustainable from the inside out". It tricked me at first because from the inside out is a common phrase. To approach this phrase, I searched it online and read several sentences with the phrase in it to get an accurate understanding of what the phrase mean and how it is used. The phrase actually has an equivalent Chinese phrase; however, both of them are usually used to describe people. Though the English writer used it to present the overall sustainability, I felt awkward using the equivalent Chinese phrase for translation so I avoided using it. Putting myself in the website writer's shoes, I thought the writer wanted to show the house was sustainable in many perspectives. So I translated the phrase to "三百六十度(360 degrees)全(all)方位(directions)绿色(green)". Though 360 degrees and everywhere is an exaggerated way to express the writer's idea, readers can understand the house is very environmental friendly, which is different from the traditional houses. I chose to use "green" here but not sustainable because green contains a broader meaning of environmental friendly, clean, and sustainable in Chinese, and it also matched the background color of the website.

I did not just translate English idioms to normal Chinese phrase; I also translated English phrases to Chinese idioms. Under TEAM tab, one of the subheadings was "Not Just a Concept, a way of seeing". By reading the paragraph under that subheading over and over, I discovered the paragraph focused on more of mind set through our experience this competition, as the three schools encourage students to integrate their knowledge into practices. I used a Chinese four-character-phrase 学以致用 to express the practicality of this project, literally translated to learn for use. The phrase express the idea of putting knowledge from the book into practice which I think fit perfectly here.

4.3.5 Nonexistent Words

The most challenging part in the website translation is the name of the house. "Solatrium" is a made-up word in English, combining with two words "solar" and "atrium" to represent the idea of solar-powered atrium style

house. Since this made-up word cannot be literally translated into Chinese, I have searched for different ways to translate it.

I first looked up existing names with “sun” or “atrium”. I searched many developer websites selling apartments, specifically for apartment names that include “sun” or “atrium”. Many names with “sun” were very rhythmic. I tried to add “atrium” into these names, and some of them sound nice, but they are not commonly used words. The combinations of words could not impress the readers.

Then I tried to accommodate “sun” and “atrium” into idioms so that people would easily remember the word and relate to our house. Some words worked out but sounded awkward. During the discussion with my advisor and proofreader, we talked about how the English name itself sounded awkward and wondered if the awkwardness could actually make our house more recognizable. In Chinese culture, people are more likely to prefer rhythmic names. The awkwardness might cause the Chinese audience to develop negative feelings toward our house.

In order to translate “Solatrium” into a short, simple, and recognizable Chinese phrase, I recalled why we chose the house design and how we designed the team logo. Atrium, originated from a traditional northern Chinese house type, looks like the Chinese character 回 (pronounced *hui*), which is the first character in the word recycle. It literally means return, which also represents one of our design ideas, to bring people back to nature. In addition to this character, I added another character 家 (pronounced *jia*) meaning home in Chinese. The phrase, 回家, is very common and recognizable, and means *go home* in Chinese. However, go home is a sentimental phrase with nostalgic feelings. To reduce this feeling, I wanted to separate the phrase to make each character stand by itself. The final translation, <回>家, used angle brackets to break the phrase in the middle and emphasize the first character, which contained the core house design ideas.

Through the translation for the house name, I understand why Boase-Beier said “translation is not about absolute equivalence of meaning”. Recalling the original house design ideas, I came up with the house name that is the closest to our house, but not necessarily the closest to the word “Solatrium”.

Complementary to the house name, I added a paragraph in the homepage to explain the meaning of the name. Similar to the structure of the original English website, I explained where the house design and the name came from, and what it means in the first paragraph. I did not translate but wrote this paragraph to maintain the same key points on the homepage.

For the words that are nonexistent in another language, translators should be creative. They should introduce this new word through existing words and annotations like what I did for “Solatrium”.

4.4 Translation Spirit

4.4.1 Understand the Purpose

One of the major purposes of this website and this competition is to educate people about solar energy and other green technology. I recognize the idea of using advanced technology to protect the environment as the “spirit” of our website. This idea should be carried along in many sections in our website, and most importantly, transfer to our audience. A French-English and Hebrew-English translator, Jeffery M. Green, summarized in his book *Thinking Through Translation:* “Writers ‘translate’ something mental into text for readers to ‘translate’ text into something mental.”[41] The competition wishes to educate people about green technology so that people can use these tools to solve problems like traditional energy shortages and pollution. From the competition’s global

involvement, the organizers wish to increase the general public's consciousness of global citizenship. Getting my audience to understand these purposes and appreciate our team's work and the competition would be my biggest challenge. In this case, my translation needs to impassion people enough to affect their belief.

From the previous background section, we discussed what my audience's beliefs and feelings about environmentalism are, especially those about solar power. In order to bring passion to my audience, I need to add necessary information to appeal to them, sometimes even attempting to change their beliefs.

For one of the subheadings "Our moment in the sun", I originally came up with a translation "我们的(our)阳光(sun)计划(plan)". The original English phrase literally translated to Chinese sounds prideful, so I wanted to avoid using it. However, "Our Sun Plan," is not creative and does not contain a message for readers. A better way to translate this phrase is to set the subheading here to function like a slogan. If a slogan was here on the front page, readers could get inspired and motivated from our project, which could reach the educational purpose of Solar Decathlon and our involvement. I create a new translation, "把阳光带<回>家", which means "Take the sun home" in English. The advantage of this slogan compared to the plain translation is that the phrase did not contain a subject. No subject provides an inclusive feeling for the readers. From this slogan, we sent a message to readers that they could join us to be part of the project by visiting and learning about our house. The phrase also included our house's Chinese name <回>家 which could give a deeper impression of our house to readers.

4.4.2 Persuade the Audience

As discussed in earlier sentences with commanding tones, "You must", "You should", "You cannot", "You should not", should be written as "By doing … and …. we could." In this way, we can persuade our audience that their efforts can make a difference and encourage them to do so.

I also want to share my enthusiasm about this project and the competition with my audience. I wish to get them excited about the development in solar power and other green-tech fields. These feelings can also be considered as part of the spirit.

4.5 Translation Constraints

Translation constraints are related to translation honesty. While the Chinese content should persuade people in an effective way, it also should not cross the border to manipulation. Green discusses translation honesty in *Thinking Trough Translation* when he first admitted; "The process of translation necessarily entails a certain revision of the original."[42] Since the original text and target text are not in the same language, the translator needs to revise the original text to make it fluent in the target language. During this revision, the translator is free to revise the original text. However, that freedom is limited.

4.5.1 Research Carefully and Never Make Things Up

For this project, I should not change any text if the change violates the spirit, and I should not make things up. Also, I should not translate based on my bias and assumptions. It is hard to predict exactly how much the audience knows about the Solar Decathlon and solar power. I need to predict carefully based on my research about the competition and my audience. Green also agreed that in translation, unlike normal writing, the translator should know where exactly to go and which information should be conveyed.[43] The information needs

to maintain the same function in both the English and the Chinese website. Though I will act as an active writer when translating, I should still obey the rules of honesty. The Solar Decathlon project is team work that combined all team members' efforts, and I should not only represent myself or my own views. When I meet something that I am not certain about, I should talk to my team members or the instructor. I should not translate based on personal understanding. I want to keep a close relation with Marketing, who is writing the website, and my team members to minimize misunderstandings and misinterpretations.

5. Translation Reflections

This chapter discusses the real translation experience. Comparing with the proposed translation procedure and strategies from the literature review, my real translation experience reflects something different. I made the choice to act as a co-writer for all the translation materials.

5.1 Opt to Become a Co-writer

From the previous research, I understood team BEMANY's competition goal is to educate and encourage a general audience to learn about and use solar technologies. Keeping my focus on teaching the audience, I chose to write the website, the brochure, the signage, and the video caption based on the content of the English communication materials in order to deliver a fluent Chinese prose. To reduce confusion based on a literal translation of English prose, I used my own strategy when I was translating the materials.

For this specific educational and nonliteral translation project, my strategy is "Don't look". For example, when I was translating the website, I first read all the pages and overlooked the entire website. By skimming through each page, I got a general idea about what each page was talking about and their relationship with one another. When I started to translate a specific sentence or a paragraph, I read it over ten times to make sure I could paraphrase the content in English. Making sure I remembered the content, I wrote the Chinese translation without looking at the website. Even though I was not looking at the English prose, I was thinking about its content. It was the content that I was translating, not the actual prose. This "Don't look" strategy gave me freedom to write so that my translation could honestly reflect my Chinese writing ability. The strategy reflects what I learned from Yang's "cooling" process, to forget the original English prose. I acted more like, but was not limited to, a writer in the translation process.

However, I found it interesting that learning English had an impact on my Chinese. Professor Xin, the proofreader, pointed out a problem in my comma usage. In a list of three or more things, I tended to put a comma before 和 (and), which is usually not the case in Chinese. Because there are no strict comma rules in Chinese, I sometimes used comma the same way as I used it in English.

5.2 Achieve Writer's Objectives

Translators should try to reach the writers' objectives. This requires a thorough understanding of the entire project, which is not simply the content, but also the purpose and background of the writing, and sometimes the writer's style and experience.

In this project, I tried to achieve the team's objectives. In the SD China project, students and WPI Marketing worked together to deliver the communication materials. The writers gathered the design concepts and the technical information from the house designer and the engineers. In the communication material delivery, information was supposed to be passed from the engineers to WPI Marketing or student writers, and then passed to me as a translator. I, at the end of the line, was afraid that the information could be lost or misunderstood because not all writers had technical background and were involved in real construction. I attended group meetings, talked to the engineers, and participated in real constructions to make sure I got messages directly from the team managers.

Other than getting the information directly from the team members, I have also done rhetorical analysis on the

content. A translator is never simply another reader. He or she does not only read, but also analyzes. I did rhetorical analysis on the website to look for key points on what the writers were emphasizing. By making a list of the key points, I ensured all the important messages were included in my translation and delivered accurately to the audience.

5.3 Talk to the Writers

Translation involves more than understanding a language. It requires the translator to understand the culture. However, understanding culture is more difficult than understanding language. Culture is never taught in class but learned from experience. To overcome the cultural difficulties, translators should talk to the writers.

In my case, I translate English, a learned language, to Chinese, my native language. I experienced difficulties in understanding specific words or idioms, though I sometimes did not even realize the difference. I understand these words and phrases literally, without understanding the implied meaning. Green explained this problem as, "To some degree his or her initial response to the text is a guess as to how native speakers would respond to it. No matter how skilled one becomes in the source language, this is something a translator can never truly know."[44] I would never know how a native speaker responds to the website by just guessing. The solution is to talk to a native speaker directly and ask how he or she feels.

Here is an example of how I understood the website content correctly by talking to a native speaker. For the heading in the homepage, "Our Moment in the Sun", I first understood it as a summary of our project related to the sun. I viewed "in the sun" as a phrase with the sun only because we were building a solar-powered house. Through the discussion with Professor Higgins, a native speaker, I now understand the term contains a glorious feeling of being under a spotlight. Translators need to discuss details closely with the writer or a native speaker to get the right message when they are translating a learned language. Translators should double-check with a native speaker to make sure their understanding is as close as possible.

5.4 Change Content

Translators do not have to say things in the exact way as the writers do. Though I did not catch the glorious part of "Our Moment in the Sun", my original translation to a slogan, 把阳光带<回>家 (Take the Sun Home), still has its advantages. The slogan-type subheading is easier to remember and contains inclusive feelings. I had to make a choice here. Since "Our Moment in the Sun" is kind of bragging, which my Chinese audience would not like, my original translation to a slogan would fit better than the actual sentence here for my audience. Translators sometimes have to make judgments based on their reader's needs.

I substituted another subheading with the slogan for a different reason. Under the "Mission" tab, the third paragraph's subheading is "Welcome to Learning and Collaboration!" The paragraph under the subheading introduced SD China's educational goals and wished the audience to get inspire from the competition, our house, and our team's involvement. The word "Collaboration" could confuse the readers about our team's collaboration among three universities, which was not mentioned in this paragraph. My translation into a slogan instead, separates the two collaborations, one among the three universities, the other potential collaboration between our team and the audience of the English website. The slogan, 把阳光带<回>家, states the SD China's goal, and also includes part of our house name <回>家 in the sentence. The slogan is consistent with "welcome to" and "we hope you will…" in the paragraph and indicates "learning" and "collaboration". Translators sometimes

should make their own judgments to ensure the each part of the translations is well connected.

5.5 Reorganize as Needed

To ensure the translation is well organized, translators do not only need to change the content, sometimes they need to reorganize the structure. Here is how I reorganized the translation to emphasize our team's innovation on advanced energy-saving materials. From what I learned from the discussion with the house designers and the engineers through the actual house construction, I believe that the selling points of our house are the advanced energy-saving construction materials, which stand out from all the other teams in the competition. In the English website that I was translating, the PCM, the FRP, and the PV were listed under "Innovation" tab and low E glazing glass was neglected. The atrium style was mentioned under the "Solatrium" tab. When I translated the two pages into Chinese, I put all of these together under "Solatrium" as the five special features of the house and listed them with numbers. This is an optional value choice I made that is not related to translation. It does not agree with the website itself, but agrees with the content of the four major posters we made about PCM, FRP, PV, and low E glazing glass, and the extra one for the atrium. Rearranging and listing all of the energy-saving materials under "Solatrium" tab allows my Chinese readers to catch the home' s special features immediately. In addition to this, I still generally mentioned all of these features under the "Innovation" tab so the Chinese translation and the English website are consistent. If I were writing the English website, I would create a parallel page more visually and rhetorically.

For the Solar Decathlon project, I made a lot of choices to get close to my audience as possible, some of them are not translational issues. I made these choices based on what I learned in my rhetoric classes and visual design classes.

5.6 Adapt to the Chinese Culture

Translators are also writers, but writing from their readers' standpoint. Writers often write for an audience with the same cultural background, but translators need to adjust for a different audience with another cultural background. In the website translation, I imaged myself as a member the Chinese audience and made cultural adaptations to make my readers more comfortable.

Chinese do not like bragging, which, in Chinese, would be implied many times by the English website. As a translator, I need to modify the content to avoid bragging. On the homepage of the website, I felt the first sentence "The only home in Solar Decathlon China 2013 to be built in United States" might be bragging or implying that the US is somehow better than China. As a Chinese reader myself, my feelings represent possible feelings of my Chinese audience. The sentence makes sense in English because it targets a general US audience while the translation targets a general Chinese audience. I cannot translate the sentence as it is because my Chinese audience would feel awkward though the US audience would not. So my translation contained this information but was moved to the third paragraph, as a reason why we had to "ship the Solatrium to Datong, China". The integration presents the uniqueness and challenges of our house constructions, but avoids patriotic overtones. Standing in my readers' position, I was able to identify culturally sensitive content and translate it in a way to avoid misunderstandings.

5.7 Add Annotations

As I was changing the content or reorganizing the structure, I needed to add more notes to explain reasons. Because I was adding value to the translation when I made the changes, I needed to provide additional notes to explain the value to my readers. One of the examples is the name of the house. Because I created the house name in Chinese, not translated it, I added a couple sentences in the first paragraph in the home page to explain what the Chinese name means and represents. I also explained where the English name is from under the "Solatrium" tab for the Chinese readers. Translators should always consider how much their audience knows about the materials and add notes if their audience needs additional background to understand the materials.

5.8 Translate Technical to Nontechnical

The Solar Decathlon Chinese website targets the general Chinese audience, most of which do not have a technical background. The challenge of this project is to translate the technical materials into nontechnical phrases for general educational purposes, both for the English and Chinese website. When building "Solatrium", my team used many advanced energy-saving materials and I have to introduce how they work to my Chinese audience. My science background and research on the materials helped me along the project to understand exactly how the materials work. However, I have to pass the information to both Chinese engineers and a general audience, so the translation should be both technical and nontechnical. To achieve this goal, I integrated technical translations and additional explanations. Like the rephrasing of PCM (相变材料：由于物理变化储存和释放能量的材料), I used English acronyms (technical Chinese translations in parentheses: additional nontechnical explanation.) for all my technical translations.

The technical translation is easier than the nontechnical. Many translated words from English have already then adopted in the field and they appeared in many scientific journals and reports, for example PCM. I looked for them and checked whether they were used regularly in the field. When I was translating PCM, I listed the English acronyms with the Chinese technical translation in the parentheses so engineers can easily refer to original English word.

The technical translation is not enough. The general audience would not understand PCM from the technical translation. I provided nontechnical explanations in plain Chinese. Because I am a chemist, I came to this project familiar with technical vocabulary. When I was translating for the general audience, I avoided using technical vocabulary when I was explaining how each material work. My proofreader Professor Xin, without a technical background, provided me direct and useful feedback about my translation. She came in without any knowledge of the website, and if she could understand the technical part of the project through my translation, my Chinese audience would be able to.

However, when Professor Xin was proofreading, some of her comments showed the possibilities of different translation style as mine. The word "marketable", which I translated to 具有市场竞争力, means to have potential to compete in the market. Professor Xin translated it to 可市场化, which might be a literal translation for "marketable" in business that she learned in her previous work. I, as a college student, had never heard of this word so it sounds awkward to me. I avoided words that sound awkward. Her translation here did not fit my audience because they, like me, are not familiar with business and they might also feel the translation is awkward.

6. Conclusions

The Solar Decathlon Website English to Chinese translation is a very specific, educational, and nonliteral translation. As the translator for this project, I discovered a translator cannot and does not need to provide perfectly equivalent translations. By actively involving myself in the project, I learned many technicalities, including design aspects and specialty terms, about the project are not available to the casual observers. Actively approaching this project, I creatively translated the materials to present our team work to the audience.

6.1 Cannot and Do Not Need to Translate Perfectly Equivalent

Translators are not the original writers, so it is impossible to produce a perfectly equivalent translation. Either translating content in a translator's native language to another learned language or translating a learned language to a translator's native language has limitations. Even a translator who grew up in a bilingual environment cannot translate perfectly equivalent because of cultural and language differences.

Translators cannot and do not have to translate perfectly equivalent. Not perfectly equivalent translations do not mean bad translations. Translations can have different values than the sources. For example, though I did not combine the word "Solar" and "Atrium" in Chinese for the house name, I incorporate the visual aspects of the house, which the English name did not provide. Good translations always need annotations. For readers to fully understand the materials in a different culture, translators should always use annotations to provide explanatory information. The amount of information is not equivalent, but the extra annotations make the work easier for readers to understand, sometimes necessarily.

Translation is a different type of literature from original writings. One English work can be translated to Chinese, Japanese, Arabic, or German. All these translation versions have different impact on the readers depending on the culture. Every translation choice carries its own advantages and disadvantages. Translators do not only reproduce sources, but also create values.

6.2 Go to the Sources

Learning from the written communication materials are not enough to understand how our house works, nor does it provide knowledge for a good translation. As a translator, I have to learn more about the house and the project from other resources. I read the project proposal, participated in real construction processes, and talked to the project managers and participating students. I was not acting passively and waiting for the information in this project. Instead, I went to the sources and acted constructively. After I learned more and more about "Solatrium" and the entire project, I became more confident to make translation choices and value choices.

6.3 Be Creative

Knowing translations do not need to be perfectly equivalent, translators should be creative when they are translating. Translators do not constrained by the framing of the sources. Because perfectly equivalent translations do not exist, translation is a field with diversity. Different translators provide different versions, but a great translator is always a great writer. When translators are translating, or even writing, they should be creative

and make their sentences flow.

To translate in a more Chinese style, I incorporate famous poem lines with the English text. Under Team, Blending Skills Tab in the first paragraph with the subheading “Not Just a Concept, a Way of Seeing”, I started the first paragraph with “纸上得来终觉浅，绝知此事要躬行”. This is an excerpt from a famous poem in 1199. The poet wrote this to educate his son that what people learned from the book is not enough. To truly master the knowledge, people need to practice and get real experience. This well-known poem fit perfectly in our situation. Solar Decathlon brings students a chance to practice what they learn in school. Citing poems or quotes is also a common Chinese writing characteristic. By adding this to the text, the translation flows better in Chinese and has a style more like authentic Chinese.

Translators need to be creative and combine the strength of languages. Translations can even stand as a type of literature that contains their own value beyond their original.

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Appendix A

Solar Decathlon China is hosted by the U.S. department of Energy and National Energy Administration of China, co-hosted by the Ministry of Finance (MOF) and Ministry of Housing and Urban-Rural Development (MOHURD), sponsored by Applied Materials and Schneider Electric, supported by All-China Students Federation Secretariat (ACSFS), and organized by Peking University (PKU).

Appendix B

Currently, here's a list of Chinese CSP projects either planned or under construction:

- 1-MW Badaling Pilot Project — collaboration between the Institute of Electrical Engineering (IEE) and the Chinese Academy of Sciences (CAS)
- 12-MW (short term) / 300-MW (long term) project — collaboration between Xinjiang Qingsong Building Materials and Chemicals (Group) Co. and Guodian Xinjiang Company
- 50-MW project in Tibet by Huaneng Tibet Company
- 100-MW project in Sichuan Abazhou by Tianwei New Energy (Aba)
- 50-MW (TBD) by China Huadian Corporation
- 100-MW project in Golmud by GD ENERGY
- 100-MW project in Ningxia by Beijing Control Technology Co. Ltd
- 100-MW project (TBD) by Avic Xi'an Aero-Engine (Group) Ltd
- 100-MW project (TBD) by Guangdong Kangda
- 100-MW in Gansu by SETC Tianjin
- 1000-MW in Qinghai by Lion International Investment Ltd.
- 2000-MW in Shaanxi by Shandong Penglai Dianli and eSolar

Appendix C

1. Team Website link: Solatriumhouse.org
   Website Screenshots
   I. Homepage

II. House: Solatrium

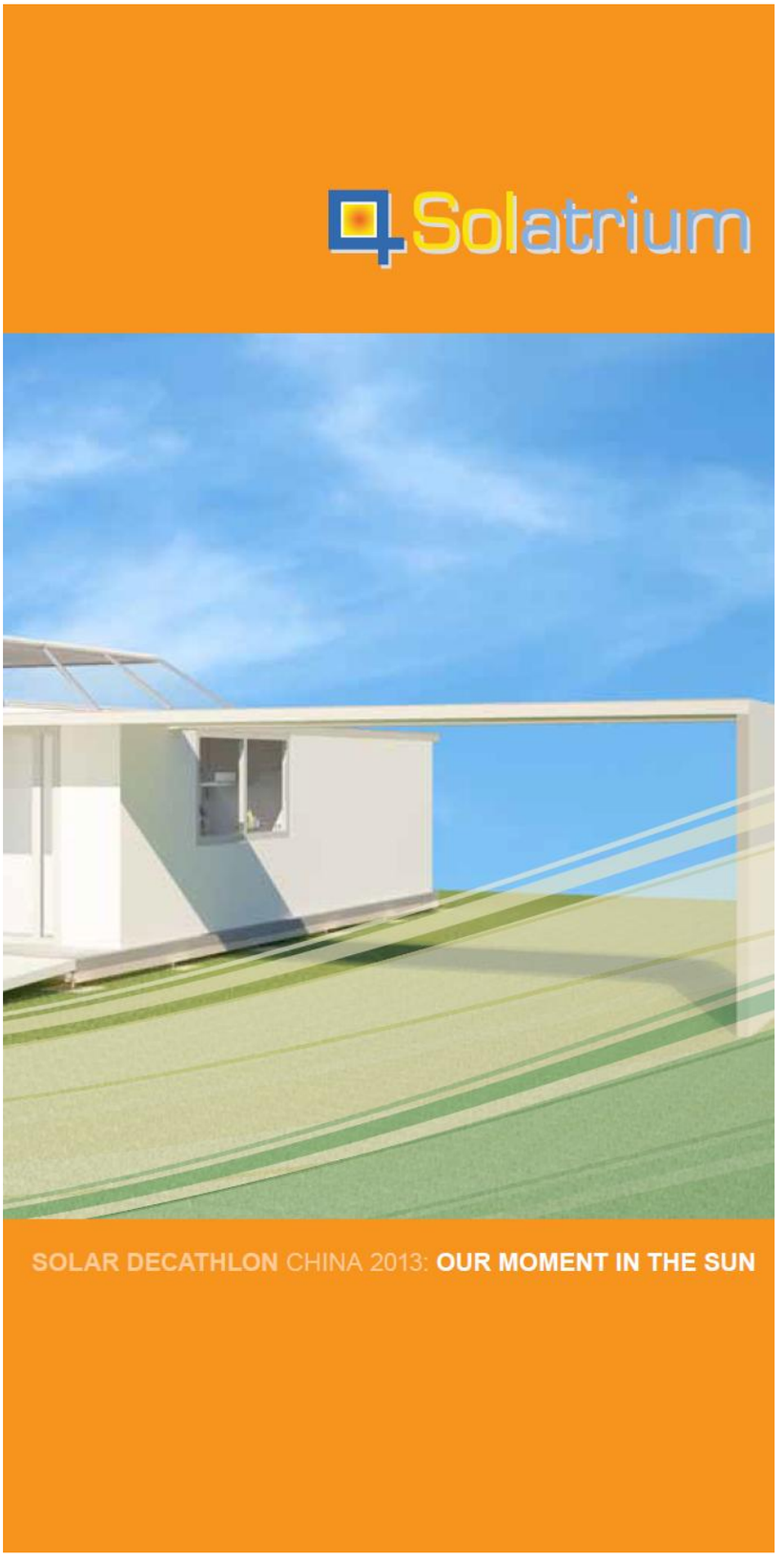
III. Team: Blending Skills

IV. Competition

V. Competition: Mission

Appendix D

Team BEMANY Exhibition Brochure



INTRODUCING **SOLATRIUM**

Solatrium is an attractive option for today's energy-conscious family seeking a versatile, low-maintenance home. This one-story, 120-m² dwelling is completely powered by the sun. Solatrium draws energy in through its 42 photovoltaic (PV) panels, which produce 290 watts of power each. The construction incorporates green materials from floor to rooftop and uses energy-smart appliances and mechanical systems to maximize comfort and efficiency. The home's centerpiece is a spacious indoor atrium that feels like an extension of the home's outside environment. The sleek, open floor plan features two bedrooms, one bathroom, dining and living room areas, a utility room, and a kitchen.

<回>家简介

由比利时根特大学. 美国伍斯特理工. 美国纽约大学理工学院三校联合设计的参赛作品: <回>家. 是一个基于三口之家而设计的单层住宅. 两室两厅. 一卫一厨. 共占地120平方米。该作品鸟瞰图形如“回”字. 设计沿用了中国四合院的理念. 各屋环绕中心客厅. 视野开阔. 宽敞舒适。这间太阳能房屋使用42块光伏板. 共提供功率为约12千瓦的电能. 并配合使用节能电器和新型建筑材料. 最大限度地节约能源和提高舒适度. 达到整体零耗能。

DESIGN PHILOSOPHY: FLEXIBLE LIVING, IN HARMONY WITH NATURE

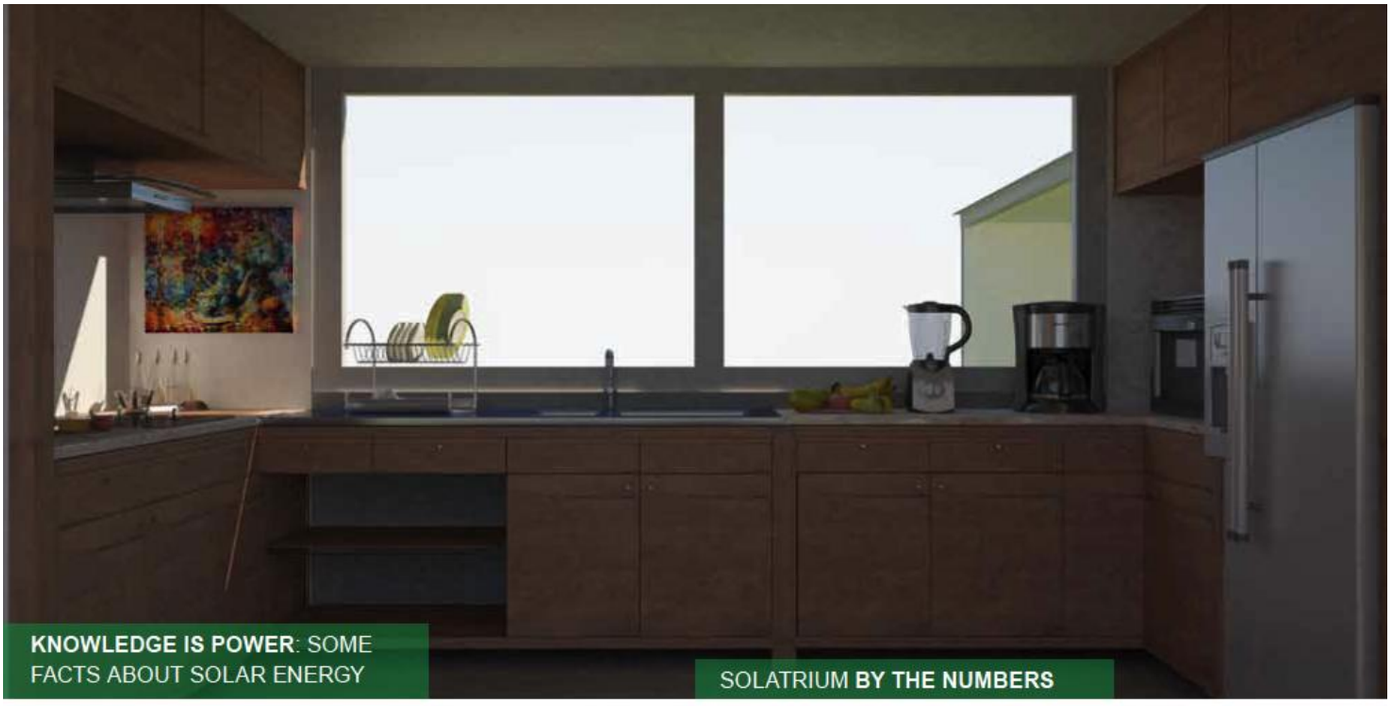
Solatrium is designed to draw the outdoors in—to blur the boundaries between the house and its natural surroundings and to provide a sense of ease and openness to its residents. The home is organized around a spacious central **atrium**. The **elevated roof** and windows (1) are expansive, providing a view of the sky and allowing light to enter from above as well as through the many **floor-to-ceiling windows** (2) lining the exterior walls. The **open floor plan** provides easy access to all areas of the home. Line of sight may extend from one part of the house to another and beyond—into the surrounding landscape. Central common areas can offer **movable panels** to accommodate diverse lifestyles or allow for additional control of space and light. Sustainable bamboo comprises the two interior walls, providing additional privacy for the bedrooms, and bamboo window ledges provide shading.

Solatrium's combination of **green technologies** offers homeowners almost effortless energy independence by maximizing energy efficiency. The home's smart materials work together to harness natural sunlight, provide air circulation, and moderate temperatures automatically.

设计理念

<回>家不仅形如“回”字. 更包含了回收资源和回归自然的深刻寓意。中心客厅上方的屋顶额外加高。南北两面安装了整片的落地窗. 全屋格局开阔. 采光良好. 与周围环境融为一体. 无论是白天的自然风光还是夜晚美丽的星空. 都可以在室内一览无遗。卧室与客厅用竹制屏风隔开. 提供私人空间. 窗户顶端安装竹制遮阳篷。竹制品的运用自然天成. 既高雅大方也利于人体健康。

全屋设计结合新型节能环保材料. 减少能耗的同时可以自动调节室内温度. 保持室内空气流动. 采集更多自然光. 以求最大的生活舒适感。



KNOWLEDGE IS POWER: SOME FACTS ABOUT SOLAR ENERGY

- Every second, our sun produces enough energy to sustain the Earth's needs for 500,000 years.
- Ninety-five percent of people who are asked *overestimate* the cost of "going solar."
- Massachusetts homeowners report that they can pay off the cost of buying and installing solar panels in 8-10 years, simply by using the money they save in monthly electric bills.
- China and the United States are two of the top ten countries using solar power.
- Enough energy for all of China can be supplied by 260 km² of solar panels.
- Your neighbor is more likely to install solar panels if you do.
- Switching from coal to solar energy can reduce energy costs by 80%.
- Of all home appliances, electric ovens consume the most energy, followed by microwaves.

太阳能知识小贴士

- 太阳每秒提供的能量能够维持地球五十万年的需求。
- 超过95%参与调查的居民高估了使用太阳能的成本。
- 麻省居民反映，8–10年内节省的电费开支即可抵消太阳能光伏板的购买和安装费用。
- 在全球各国太阳能使用量排名中，中国和美国位于前两位。
- 260平方千米的光伏板可以提供整个中国的能量所需。
- 一家住户安装太阳能光伏板可以带动周围居民。
- 用太阳能取代传统火力发电可以减少80%的电费支出。
- 所有家用电器中，电烤箱耗电量高居首位，其次为微波炉。

SOLATRIUM BY THE NUMBERS

- Solatrium weighs 30,000 kg.
- Steel trussing in the atrium roof weighs 1,280 kg.
- Solatrium has a footprint of ~135 m² and a volume of 325 m³.
- It is supported by 32 beams and 41 uprights.
- It can withstand a snow load of 1.92 kN/m², winds of 40 km/hr, and an earthquake shear force of 37 kN.
- Solatrium uses 335 m² of RFP panels, saving wood framing and other wood products that would be used for a house of comparable size.
- Solatrium's solar panels produce 12 kW of clean energy, enough for a family of three.
- Its PV panels produce the same amount of energy as ~1000 kg of coal, keeping ~1500 kg of CO_2 from being released into the atmosphere.
- The panels save ~4500 liters of water that would be needed to cool turbines that generate electricity.
- Solatrium's 350 PCM floor tiles will reduce electrical demand on the house's HVAC system by up to 60%.
- It takes 45 days to ship Solatrium to China from the United States.

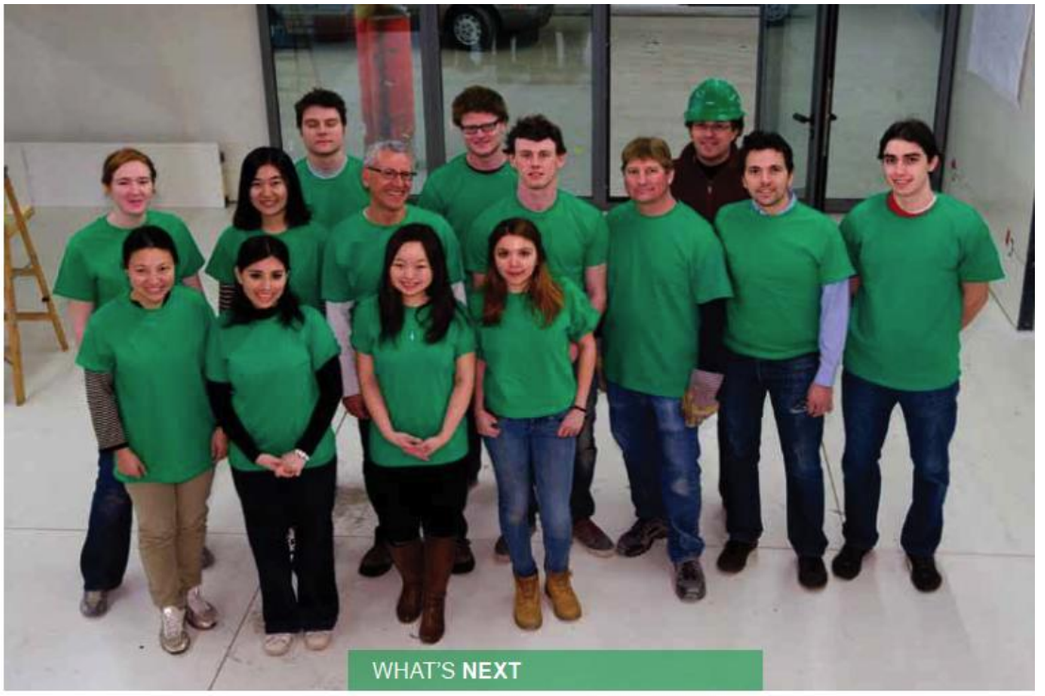
<回>家数据库

- <回>家共占地135平方米，体积325立方米，重30000公斤。
- 天井屋顶重1280公斤，完全靠钢筋支撑。
- 全屋结构依靠由FRP(纤维复合材料)制成的32条横梁和41条支柱定型。
- <回>家可以抵御1.92kN/m2的雪量，40km/hr的风速，37kN的地震剪切力。
- 全屋共使用335平米的FRP纤维复合材料板。与同面积房屋相比，节约房屋结构用木材和其他建筑木材。
- 42块光伏板提供了功率为12千瓦的电能，可以支持三口之家的日常用电。
- 一户居民改用太阳能发电，一年可以节约1000公斤煤炭，减少1500公斤的二氧化碳排放量，并可节约4500升发电时用于降温的水。
- 350块地板砖添加PCMs（相变材料）自动调整室内温度，可减少60%暖通空调的耗电量。
- 将<回>家从美国运输到中国耗时45天。

- Solatrium's 62 x 62-cm floor tiles were created from an advanced concrete mix incorporating **phase-changing materials (PCMs)** that release heat as indoor temperatures fall below 23°C and that store heat as temperatures rise above that, providing passive heating and cooling, and reducing strain on the home's smart HVAC system. 1
- Solatrium uses a **split HVAC system** as opposed to a single system, reducing duct work and thereby minimizing energy loss. The split systems feed into two 9000-BTU heat pumps that are located just outside each bedroom and two 12,000-BTU units located outside.
- **Composite, fiber-reinforced polymer (FRP) panels** form Solatrium's sub-floors, floors, walls, ceiling, and roof. FRP beams and columns crisscross the substructure to provide needed support against Worcester snow loads, Datong earthquake loads, and everything between. The Transonite™ system is a 90-mm-thick panel with an 81-mm-thick polyisocyanurate foam core. The core has an R-value of about 12, providing insulation and an effective thermal barrier. It is sandwiched between two 4.5-mm-thick FRP skins connected by 3-mm glass fiber rods stitched across the insulation. The composite material is 60% glass fiber by weight. These panels provide structural integrity and eliminate the need for additional layers of construction materials. Their lighter weight simplifies transport and installation. 2
- Floor-to-ceiling windows incorporate energy-efficient **double panes and glazing** that controls the influx of light and radiation, reducing glare and moderating temperatures. Some windows serve as doors for easy access to the outside from anywhere in the house.
- Solatrium's 42 PV panels generate 12 kW of power under desirable conditions. An inverter converts DC to AC power.
- A **fire-retardant, intumescent paint coating** on the wall paneling creates a protective barrier that chokes fire.
- Solatrium uses **energy-efficient appliances** and an energy-smart hot water heater.

绿色科技

- 边长为62厘米的地板砖添加PCMs（相变材料），在23° C时发生物理变化，温度过高则自动储存热量，温度过低则自动释放热量以保持全屋温度适中。1
- 暖通空调使用分离式管道以减少能量损耗。每间卧室外分别有一个热泵输送9000BTU（英热单位）热量，房屋外有两个热泵分别向室内输送12000BTU热量。
- 房屋地板、墙壁、天花板和屋顶均使用FRP（纤维复合材料），既能负荷伍斯特冬天的大雪，也能抵御中国大同潜在的地震影响。Transonite 公司生产的这种90毫米纤维复合材料，内置81毫米厚的聚异三聚氰酸脂泡沫，两边为4.5毫米厚的FRP面板。复合材料60%的重量来自面板中3毫米厚的隔热玻璃纤维管，热阻值高达12，有效地防止了室内热量的散失。全屋由纤维复合材料整片拼接而成，横梁和支柱使用同种材料，无需额外黏合剂，轻便坚固，便于运输、施工和安装。2
- 50%外墙使用双层真空落地窗，玻璃窗分别覆盖南北两面和东西部分的墙体。玻璃上釉隔绝光线和辐射，减少白天长时间日照造成的升温，有效控制室内温度。部分卧室和客厅的落地窗设计为推拉门，可自由进出房屋。
- 42块光伏板最多可提供12千瓦功率的电能，通过一个转换器，将直流电转换为50赫兹、208伏的交流电 。
- 墙体添加防火涂料，遇火膨胀，增加房屋安全性。
- 全屋配合使用节能电器和节能热水器以减少总体能耗。



TEAM **BEMANY**

Team BEMANY comprises 25 students and 10 faculty members from three universities: Ghent University in Belgium (BE), Worcester Polytechnic Institute in Massachusetts (MA), and the Polytechnic Institute of New York University (NY). BEMANY's goal is to design an attractive, net-zero energy home to inspire and educate the public. Our message is that comfort, affordability, and responsible use of the Earth's resources can be achieved by combining green technologies and intelligent design.

Our team members study engineering, architecture, and writing, and are organized into four groups. The *structural group* ensures that Solatrium is structurally stable and conforms to code.

The *architectural/design group* oversees design and utilities integration.

The *PCM design group* is responsible for the concrete mix that integrates PCMs into Solatrium's flooring.

BEMANY's *communications group* develops content for the website, brochure, blog, and other promotional materials. This group is assisted by WPI's Division of Marketing and Communications.

Student volunteers and teachers from Worcester Technical High School's welding shop, machine shop, and electrical department welded the atrium truss and created joint fixtures. They and all team members have contributed to Solatrium's construction.

团队BEMANY

我们的团队BEMANY由三所大学组成. BE代表比利时根特大学(Ghent University). MA代表美国麻省的伍斯特理工学院 (Worcester Polytechnic Institute). NY代表美国纽约大学理工学院 (NYU–POLY) . 共有25名学生和10名老师。他们分别来自工程. 建筑. 宣传各个系科. 组成四支分队。房屋结构组保证房屋安全坚固. 舒适宽敞. 建筑设计组负责整体房屋和电路的设计. 新型材料组全力研究PCMs （相变材料）. 并设计使其与地板结合. 宣传组负责向大众宣传此次中国太阳能十项全能竞赛和团队的参与. 并制作了团队主页. 宣传手册. 博客等宣传材料. 在伍斯特理工的宣传部和伍斯特科技中学协助下. 团队共同建造测试了<回>家。我们希望向大家展示一个零耗能且美丽舒适的参赛作品. 通过它宣传太阳能及其他绿色能源. 促进能源的可持续发展。

WHAT'S **NEXT**

After the competition in Datong, Solatrium will return to Worcester in Central Massachusetts, where it will be reassembled and used as an interactive exhibit space.

Solatrium will continue to educate students and the general public about green construction techniques, new energy systems, and strategies for sustainable living.

Now that you've seen Solatrium, what will *you* do to promote a more energy-efficient future?

未来计划

在参与中国太阳能十项全能竞赛之后. 我们会将<回>家运回美国麻省中部的伍斯特. 并公开展出. 为学生和大众提供一个互动的教育平台。我们希望通过这次比赛启发学生和公众. 关注新型能源和建筑材料. 积极参与到节能减排中来. 加入我们的行动. 和我们一起把阳光带<回>家!

UNIVERSITEIT GENT WPI NYU·poly

A THANK-YOU TO **OUR SPONSORS**

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谢谢

Generous donations of materials, funds, and time from sponsors and community members built this net-zero home.


中国 SD CHINA
国际太阳能十项全能竞赛
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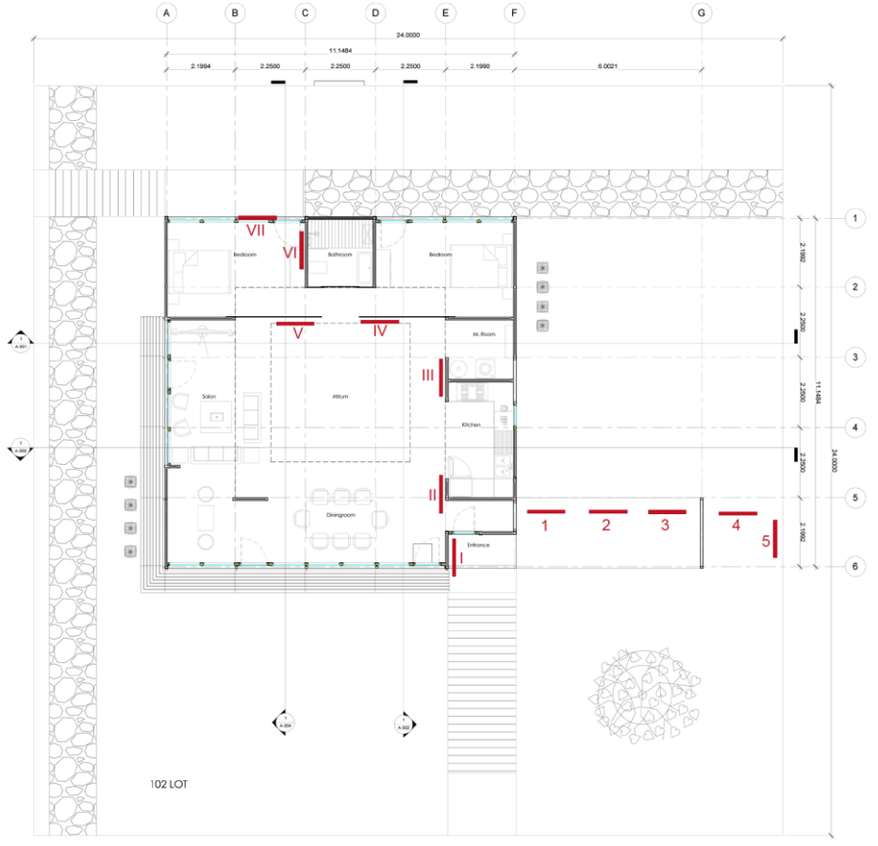
Appendix E

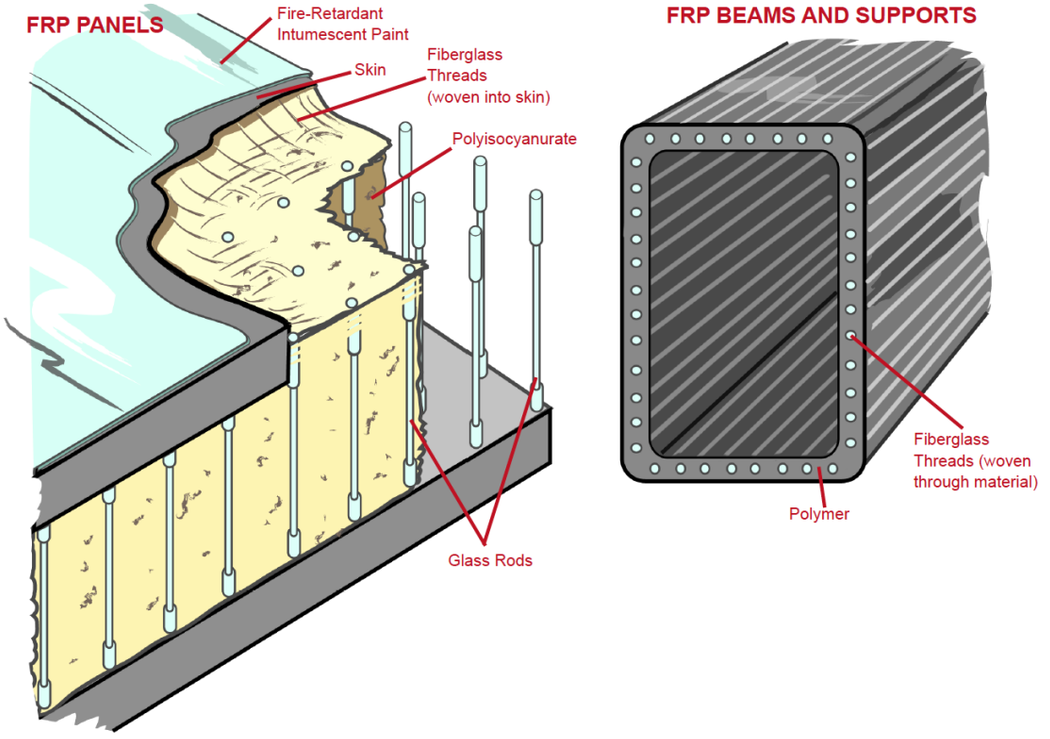
Team BEMANY Exhibition Signage



OUTSIDE SIGNS
1. Structural Support and Insulation
2. Energy-Smart Flooring
3. Beckoning the Outdoors In
4. Powered by the Sun
5. Interactive Sign

INSIDE SIGNS
I. Welcome
II. Energy-Efficient Appliances
III. PCM-Concrete Floor Tiles
IV. Moveable Privacy — Sustainable Bamboo
V. Atrium
VI. Split HVAC System
VII. Windows

Structural Support and Insulation



Composite, fiber-reinforced polymer (FRP) panels, beams, and columns

FRP panels with a polyisocyanurate core are 90 mm thick, with an insulating R-value of 12. These light-weight panels form the sub-floor, walls, and roof—and simplify transport and installation. Intumescent paint on the paneling's surface provides fire-retardant benefits.

Prismatic FRP columns and beams crisscross the entire substructure.

Strong and durable, FRP materials provide structural integrity, so Solatrium can support its own weight and withstand external loads from environmental stresses like wind and earthquakes.

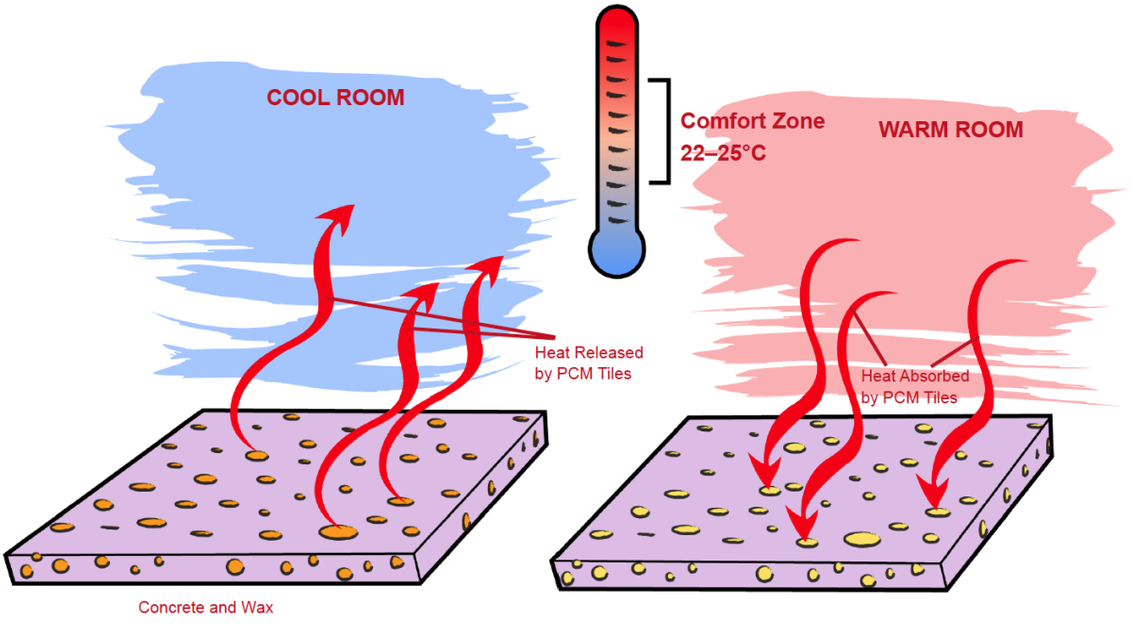
These "lean" materials eliminate the need for additional construction products.

结构材料隔热性能优越

纤维复合材料（FRP）

- <回>家的地板、墙体和屋顶均使用90毫米厚的纤维复合材料板，整体结构由同样材料的横梁和支柱定型。
- 这种材料将房屋各部分巧妙拼接，坚固耐用，可以抵御严重的自然灾害。
- 房屋各部分自成一体，无需额外连接材料。
- 轻质的纤维复合材料板、横梁和支柱，便 于运输和拼接。
- 纤维复合板内置聚异三聚氰酸脂泡沫，热阻值高达12， 有效隔热。
- 板上添加膨胀型防火涂料。

Energy-Smart Flooring



Concrete with phase-changing materials (PCMs)

Solatrium's flooring consists of 62 x 62-cm tiles made with an advanced concrete mix.

Its PCMs melt and solidify at fixed temperatures, allowing them to absorb and release heat in the house when temperatures fall below or rise above 23°C, for a comfort zone of 22–25°C.

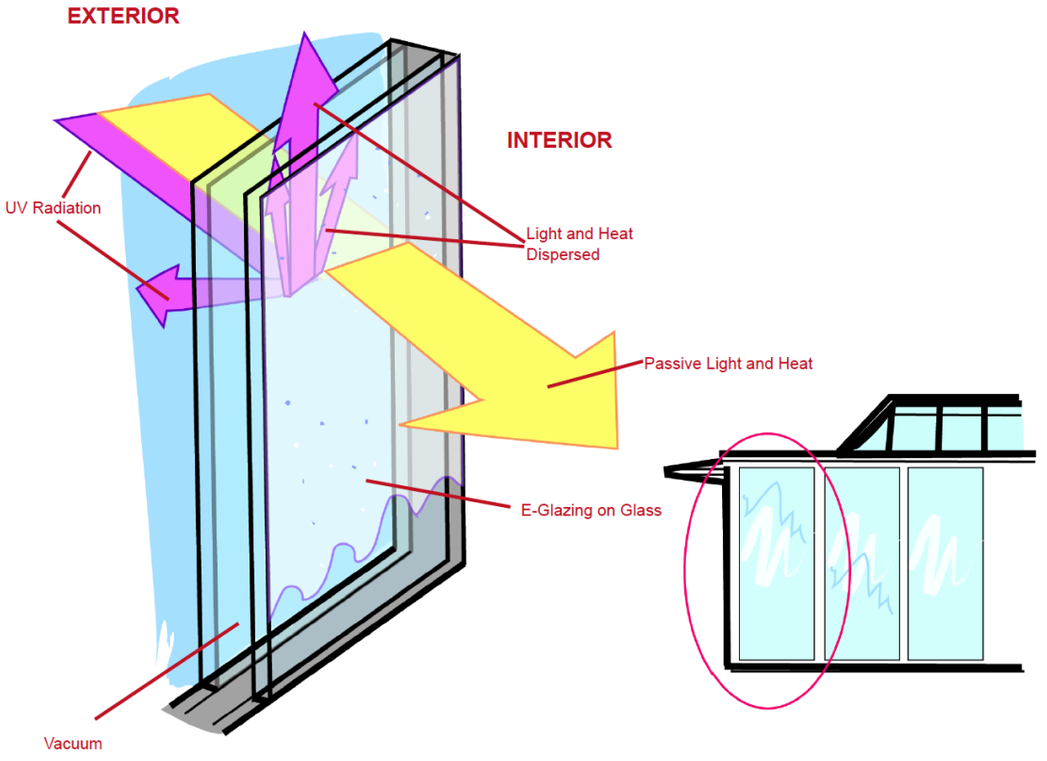
The tiles provide passive heating and cooling, greatly reducing electrical demand on the house's HVAC system.

新型地板储存热量

地砖添加相变材料

- <回>家地板使用边长为62厘米的正方形地砖，特别添加相变材料（PCM）。
- 相变材料（PCM）在23摄氏度时发生物理变化，可分别储存和释放热量，保证室内温度维持在22—25度之间。
- 这种特别的建筑材料自动吸收和释放热量，减少了暖通空调的用电量。

Windows: Beckoning the Outdoors In



Windows made for comfort and a view

Floor-to-ceiling windows cover roughly 50% of Solatrium's outer walls, offering an expansive view and a feeling of openness.

Additional acrylic windows are framed by the trussing that supports the atrium roof, showing a glimpse of the sky.

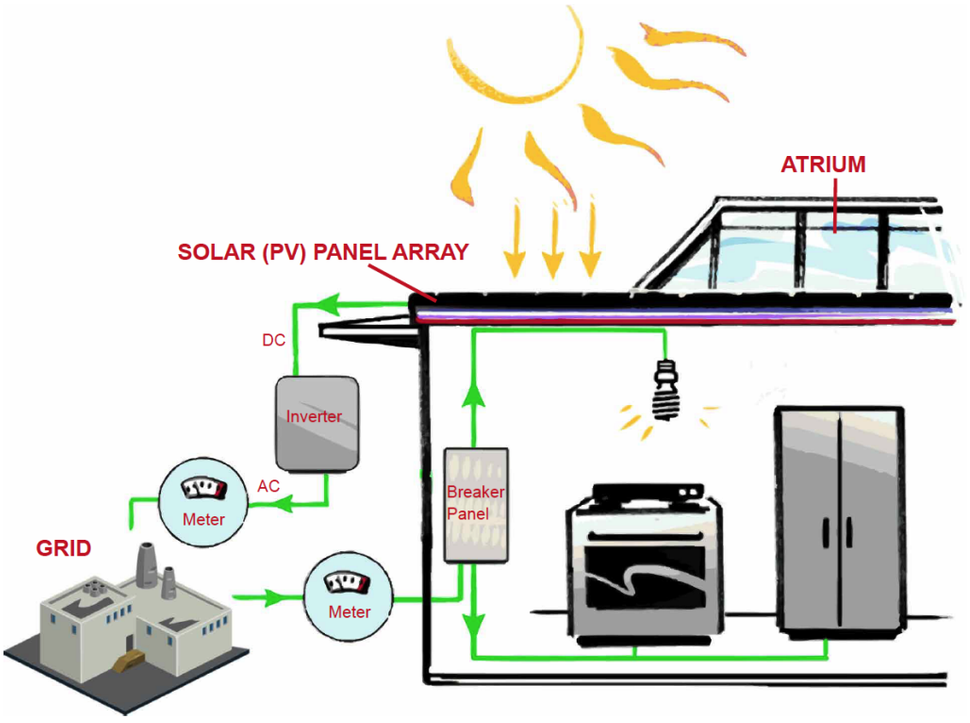
Windows provide passive heating, cooling, and lighting, as well as air circulation.

The vacuum between the larger windows' double-paned glass provides insulation. E-glazing incorporated into glass windows allows sunlight in and blocks out harmful UV rays, helping moderate indoor temperatures.

落地窗融入自然

- 南北两面和东西部分的落地窗占墙体面积50%，消除隔离感，使住户置身自然之中。
- 中心天井式屋顶的玻璃窗由钢筋支撑，住户可以从室内仰视天空。
- 窗户由两层玻璃制成，中间的真空层能有效隔热。
- 窗户玻璃上釉，阳光通过的同时隔离紫外线，控制室内温度。
- 透过窗户可以自然取暖和照明，打开窗户可以加速空气流通。

Powered by the Sun



How photovoltaic (PV) panels work

Solatrium's 42 rooftop PV panels can generate 290 watts each, a total of about 12 kW—enough for an average three-person family.

In sunlight, the panels' solar cells absorb photons and release electrons that semiconductors capture to create direct current (DC).

An inverter transforms DC to alternating current (AC), which feeds into the competition's grid. Solatrium then draws on that power to run utilities and appliances. SD China monitors each house's power use.

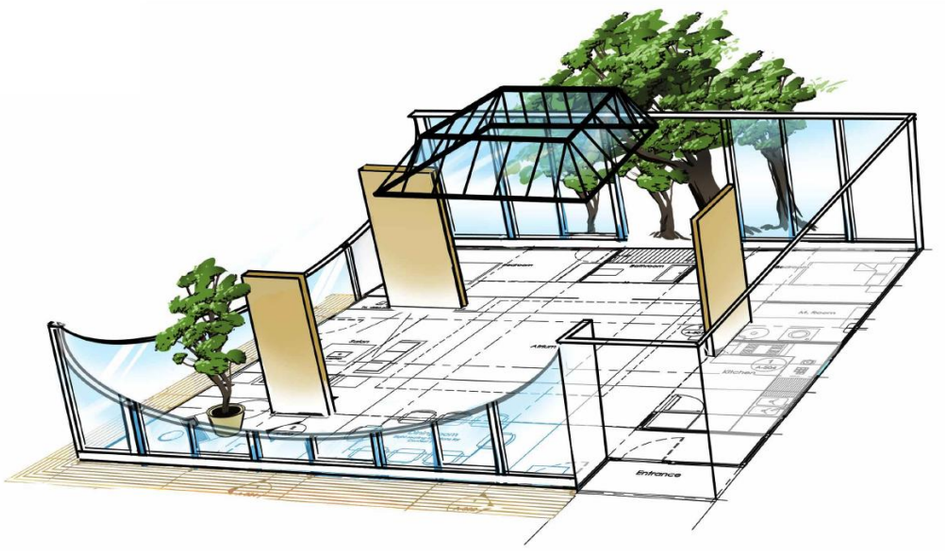
In communities, power generated by solar homes is fed into a larger grid that stores power and carries it to the entire community. Meters track how much each creates and uses. Solar homes can use as much power as they generate at no cost, lowering their electric bills. Homes that generate more than they use may be credited for the extra energy they produce for the grid.

名副其实的太阳能房屋

太阳能光伏板

- 屋顶上共安置42块太阳能光伏板，能保证三口之家的日常用电。
- 正常情况下，每块光伏板可以提供功率为290瓦的电能，整体功率约12千瓦。
- 阳光照射到光伏板上时，太阳能电池吸收光子释放电子，半导体收集自由电子形成直流电，室内的两个转换器再将直流电转换为日常使用的交流电。
- 转换器将直流电转换为208伏、50赫兹的交流电，并入电网后转化为美国标准的120伏， 60赫兹的交流电，保证家用电器的正常运行。
- 太阳能转化的电能输入社区电网，住户可以通过电表查询其房屋生产和使用的电能。太阳能转化的电能不计入电费账单，生产的额外电能可以一并纳入电网。

What Do You Know?



Choose the correct answer from those given for each question.

1. What can you do to save energy in your home?
   A.) Insulate
   B.) Turn off lights, TV, and other equipment when not in use.
   C.) Dry clothes outside, not in your dryer.
   D.) All of the above.

2. China produced ___% of the solar panel technology sold in 2010.
   A.) 1
   B.) 21
   C.) 51
   D.) 82

3. PV solar panels are the only means of generating electricity without any…
   A.) Water
   B.) Moving parts
   C.) Wiring
   D.) Sunlight

4. What typically consumes the most energy in a house?
   A.) TV
   B.) Computer
   C.) Cooling and heating
   D.) Cooking

你知道吗?
选择下列问题中正确的选项

1. 日常生活中，以下哪些方法可以节能？
   A) 使用隔热材料。
   B) 不使用电器时关闭电源。
   C) 将衣服自然晾干，避免使用烘干机。
   D) 以上所有。

2. 2010年，中国生产了世界上百分之____的太阳能光伏板。
   A.) 1
   B.) 21
   C.) 51
   D.) 82

3. 太阳能发电是唯一不需要____的发电方法。
   A.) 水
   B.) 可移动部件
   C.) 电线
   D.) 阳光

4. 所有家用电器中哪个最耗电？
   A.) 电视
   B.) 电脑
   C.) 空调
   D.) 厨房电器

Welcome to Solatrium

欢迎<回>家

Totally powered by the sun, our 120-m2 home is designed to draw the outdoors in—to blur the boundaries between the interior of the home and its natural surroundings, providing a sense of ease and openness to those who live here.

Solatrium's sleek, open floor plan features two bedrooms, one bathroom, versatile dining and living room areas, a utility room, and a kitchen, all of which border its crowning centerpiece—a spacious indoor atrium.

Solatrium's green technologies offer the homeowner energy independence. Built with PV panels, energy-efficient windows, composite structural materials, and innovative flooring, Solatrium harnesses sunlight and moderates the indoor climate almost effortlessly.

Welcome in, and see how comfort, affordability, and responsible use of the Earth's resources can be achieved by combining green technologies and intelligent design.

团队BEMANY的参赛作品取名为<回>家，是一个120平米的单层住宅，两室两厅，一卫一厨，房屋宽敞舒适，采光良好。全屋围绕中心客厅，客厅屋顶加高，视野开阔，四面大量落地窗和屋顶窗户消除与外界隔离，使住户身处自然之中。全屋使用多种高科技节能建筑材料，尽可能地利用自然能源以节约用电量。

欢迎大家参观<回>家，感受建筑设计和高科技带来的便利与舒适。

中国 SD CHINA
国际太阳能十项全能竞赛

Other Signs

Moveable Privacy

Panels of sustainable bamboo balance the composite structure's strength with the beauty of a natural product—and can be designed as movable for customized interior living space.

Sustainable Bamboo

Bamboo is a fast-growing, durable construction material now used in many homes. The bamboo trim above the windows with southern exposure and along the perimeter of the roof truss provide shade from intense sun. Outside the home, it offers some protection from the elements. Two fixed walls of laminated bamboo soften the ambience and provide privacy for the bedrooms.

“竹”文化

房屋使用的屏风和遮阳篷均为竹制。住户可以通过调整竹制屏风改变房屋空间格局，卧室外部的竹墙将其与客厅隔开，使住户独享私人空间。竹子绿色环保，坚固耐用，与中国诗歌书画和园林建设有源远流长的关系，且与人民生活息息相关。

Energy-Efficient Appliances

Solatrium's appliances are Energy Star compliant. Our hybrid electric water heater uses up to 62% less energy than a standard 50-gallon (190-liter) electric water heater.

Atrium

The atrium's elevated roof with tinted windows provides passive heating and ambient daylight.

中心天井

房屋设计加高了中心的天井式屋顶，屋顶四周的窗户可以采集阳光并开阔住户视野。

Windows

These double-paned windows are well-insulated and made with *e-glazing* that lets in warmth and light while blocking harmful UV rays.

窗户玻璃

双面真空玻璃隔热性能良好，表面上釉可以在阳光通过的同时隔离紫外线。

PCM-Concrete Floor Tiles

These floor tiles, designed with *phase-changing materials*, absorb and release heat as needed when indoor temperatures fall outside the comfort zone of 22°C-25°C.

新型材料地砖

地砖上添加相变材料（PCM），在23度时发生物理变化，储存和释放热量，自动调节室内温度。

Split HVAC System

The split heating, ventilation, and cooling system uses two 9000-BTU heat pumps, one in each bedroom, and two 12,000-BTU units outside. Using several pumps reduces duct-work, minimizing air loss and maxi-mizing energy efficiency.

分离式暖通空调

暖通空调用于制冷制暖以及加速室内空气流动，各个房间使用不同电泵，减少能量损失，提高用电效率。两间卧室分别使用9000BTU（英热单位）的电泵，房屋其他部分使用室外安装的两个的12000BTU的电泵。

Appendix F

Team BEMANY Video Walkthrough Text and Translation

Solatrium
Video Commentary Narration (Animated)
04/28/13 — Diane

Segment	**Time**	**Subject/Commentary**
0:00 – 0:04	*0:04*	*Opening credits (Team/3 univ names/SD China 2013 text & logo)*

Welcome to Solatrium, a home built by the three-university Team BEMANY *(pronounced Team Be-many)*…
欢迎<回>家，这是由三校联合的队伍 BEMANY 设计建造的参赛作品。

0:04 – 0:21 *0:17* *House rotation then enter through main door*

…to compete in Solar Decathlon China 2013. As we enter this house—named for its solar power and central, open atrium—up the ramp through the door near its carport, we begin to see the spaciousness within.
<回>家鸟瞰图形如"回"字，全屋围绕中心客厅，宽敞舒适，由车棚进入正门，室内一览无遗。

0:21 – 0:44 *0:23* *Dining room*

Inside, we feel a sense of ease, protected from weather but not separated from the environment outdoors and above. The open floor plan allows some walls to be movable, to accommodate changing light and temperatures—and to fit residents' needs. Lines of sight in this home may be uninterrupted and uncluttered.
室内安逸舒适，视野开阔，与自然融为一体。室内格局可以根据不同场合做相应调整。

0:44 – 1:08 *0:24* *Living Room*

As we move past the atrium, sun may shine through tinted acrylic panels above, around the covered center. The system allows passive solar heat and light, and opening panels ventilate the home with fresh air. The living room has comfortable furniture and an entertainment center, to enjoy movies and companionship.
中心天井之下，阳光明亮温暖，通风良好。宽敞客厅配有舒适的沙发和娱乐设备，家人朋友可以共同欣赏电影，共度好时光

1:08 – 1:27 *0:19* *Pan around living room, dining room, to kitchen*

Walls are of a fiber-reinforced polymer or FRP, with four inches of insulating polyurethane inside. Lightweight and durable, they are easily assembled and shipped, and are finished with a flame-retardant paint for safety.
墙体使用复合纤维材料（FRP），内置四英寸的隔热聚氨酯纤维，外表添加膨胀型防火涂料，轻质耐用，便于组装和运输。

1:27 – 1:40 *0:13* *Kitchen*

The kitchen has energy-efficient appliances and a window looking out past the carport.
厨房使用节能电器，窗户向外可以看到车棚。

1:40 – 1:47 0:07 Pan past utility room wal
As we turn, we see the wall of the utility room, where the energy-efficient water heater, washer, and dryer are housed with an electrical control panel.
转弯即可看到杂物间，里面有智能热水器、洗衣机、烘干机和电闸。

Here, we can begin to let one narrative flow into the next, since our film isn't yet complete.
1:47 – 1:55 0:08 Turn, pan past bedroom behind wall, view into bathroom

Past one bedroom is the bathroom, with a double sink. *[PAUSE]*
卧室隔壁是卫生间，里面有两个洗手池。

1:55 – 1:58 0:03 Dining room

Glaze on floor-to-ceiling glass windows and doors shades activities while still revealing natural surroundings.

落地窗上釉并安装百叶窗，住户可以边欣赏外界风光边避暑。

1:58 – 2:04 0:06 Bathroom, then turns toward bedroom at 2:03

Bamboo is a sustainable grass material seen in the shower flooring and throughout the home.
浴室地板和室内很多其他结构均使用住址用品，绿色环保。

2:04 – 2:14 0:10 Bedroom 1

Under the floor is an insulating FRP panel. The floor itself is a cement-mix tile whose phase-changing material moderates inside temperatures naturally.
地板使用纤维复合材料，加铺添加相变材料的地砖，自动储存和释放热量，调节室内温度。

2:14 – 2:19 0:05 Living room still

This innovative material means less work for the heating and air conditioning system.
新型节能建筑材料减轻了暖通空调的负担。

2:19 – 2:29 0:10 Pan into then around bedroom

Doors around the house in several rooms let us go in and out, and provide easy exit in case of emergency.
住户可轻易通过落地窗的开关进出房屋。

2:29 – 2:39 0:10 Pan out bedroom window then around house

Bamboo panels around the inner atrium filter sunlight coming inside, and panels surrounding the home above the windows provide shelter and shade from bright sunlight.
室内竹制屏风可用于遮挡阳光，窗户上方亦安装竹制遮阳篷。

2:39 – 2:57 0:28 Rises up over house and around

Forty photovoltaic panels provide 300 watts of power each, for a total of 12 kilowatts, more than enough for the energy needs of three in this home, just over 11 kilowatts. The panels are placed on the rooftop surrounding the atrium, easy to service, yet out of sight. *[4-BEAT PAUSE]*
屋顶上方安装40块太阳能光伏板，共产生功率为12千瓦的电能，满足三口之家的用电量。

2:57 – 3:01 0:04 Still of house – keep going through following shots

Students and faculty from Ghent University provided the original design of the house and its structural support. NYU-Polytechnic teammates worked on designing and producing the phase-change material in the cement that is used as floor tiles. Solatrium was built in Worcester, Mass., with WPI students in civil

engineering, architectural engineering, and other disciplines taking the lead, testing safety, and working alongside students from Worcester Technical High School, teammates, and volunteers to erect the structure.

三校分工明确，比利时根特大学负责房屋设计和整体结构，纽约大学理工学院设计生产了地砖上添加的相变材料(PCM)，伍斯特理工学院在伍斯特科技高中的协助下建造、测试、展出了<回>家。老师和学生来自不同系科，包括了土木工程，建筑工程，电子工程，防火工程和通信科学。

3:01 – 3:18 0:17 Above and around house

3:18 – 3:24 0:06 Still of house

3:24 – 3:30 0:06 Photo of Team BEMANY

Team BEMANY is proud to have built a home for the future—Solatrium.
<回>家将为参观者展示未来之家的蓝图，我们为<回>家而自豪!

Appendix G

Team BEMANY Dinner Menu

FIRST DINNER	套餐
Appetizers Crackers with Olive Spread and Dried Tomato Spread	开胃菜 薄脆饼 蘸料：橄榄涂抹酱，干番茄涂抹酱
Soup Carrot Soup *Ingredients: Carrots, Salt, Onion, Garlic, Olive Oil, Croutons, Milk*	汤 胡萝卜汤 食材：胡萝卜，盐，洋葱，大蒜，橄榄油，碎面包干，牛奶
Main dish Penne with Neapolitan Sauce *Ingredients: Penne, Canned Tomatoes, Garlic Olive Oil, Basil, Salt, Black Pepper*	主菜 那不勒斯风味意面 食材：意面，番茄，蒜味橄榄油，紫苏，盐，黑胡椒
Dessert Rice Pudding with Milk *Rice, Milk, Cinnamon, Sugar, Condensed Milk, Cinnamon Powder, Raisins*	甜点 牛奶米布丁 食材：大米，牛奶，肉桂，白糖，炼乳，肉桂粉，葡萄干
Coffee or tea	饮料 咖啡，茶

SECOND DINNER

套餐

Appetizers
Crackers with Olive Spread and Dried Tomato Spread

开胃菜
薄脆饼
蘸料：橄榄涂抹酱，干番茄涂抹酱

Soup
Vegetable Soup
Ingredients: Zucchini / Italian Squash, Carrots, Potatoes, Onion, Green Pepper, Tomatoes, Olive Oil, Salt, Noodles, Chicken Flavor Bouillon

汤
蔬菜汤
食材：意大利西葫芦，胡萝卜，土豆，洋葱，青椒，番茄，橄榄油，盐，意面，浓缩鸡汤

Main dish
Spaghetti with Tuna
Ingredients: Spaghetti, Garlic, Canned Anchovies, Canned Tuna in Olive Oil, Olive Oil, Canned Tomatoes, Salt, Black Pepper

主菜
经典三文鱼意面
食材：意面，大蒜，凤尾鱼，三文鱼，橄榄油，番茄，盐，黑胡椒

Dessert
Rice Pudding with Milk
Rice, Milk, Cinnamon, Sugar, Condensed Milk, Cinnamon Powder, Raisins

甜点
牛奶米布丁
食材： 大米，牛奶，肉桂，白糖，炼乳，肉桂粉，葡萄干

Coffee or tea

饮料
咖啡，茶