2016-2017

China Field Trip by ALEF

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I. Means of transportation used during the field trip

During the ten days traveling China, in order to access the cities and sites planned, we took 5 planes, 2 boats, 21 times 4 different buses and 1 night train. We all knew it, China is such a big country, we were going to spend a lot of time traveling.

The bad point is that every kilometer spent in transportation has a cost for the environment because of the quantity of CO₂ released in the atmosphere. For example, the train is the best cleanest method to travel with 20 grams of CO₂ per kilometer per person in comparison to 145 grams of CO₂ for the flights ...

With 20 people present on this trip, we all together released 23 tons of CO₂ in our planet. It sadly represents one car driving 150,000 kilometers.

But on a positive note for the planet, the 16 students of the 10th ALEF promotion will do their best their entire life to act in the energy field and make the planet great again.

II. Nuclear power plants visits

a) Visit of the Huaneng Shandong Shidao Bay NPP

The Huaneng base includes 3 main projects:
- HTR-PM, 210 Mwe
- 4 AP1000 plants
- 2 CAP 1400
The HTR-PM is under construction and the 2 other projects are planned to have the authorization for construction at the end of 2017. For the future, it is planned to have more than 8000 MW of installed capacity on the site. The central government invested a lot in the 3 projects.

**High Temperature Reactor, Pebble bed Modular (HTR-PM)**

The HTR- PM project is owned by 3 major actors:

- CHNG : 47.5%
- China Nuclear Engineering Corporation : 32.5%
- Tsinghua Holding : 20%

The HTR-PM project consists of 2 pebble bed core reactors, each being connected to a steam generator and then a common turbine and generator. The pressure inside the reactor core is 7.5 Pa and inside the steam generator 45.5 Pa. The coolant used is Helium and the moderator is graphite.

![High Temperature Reactor, Pebble bed Modular (HTR-PM) 3D view](image)

The reaction of fission is initiated because of a source of neutron: Co60. The lifetime of the reactor is 40 years and its electric generation efficiency is around 42%.

**Fuel**

Sphere fuel elements are used for the HTR-PM project: TRISO Coated fuel element. It consists in a fuel with several layers: at the center the U238 (UO2 Kernel), the first layer is Carbon Py low density, the second layer is Carbon Py high density, the third layer is SiC and the last one is PyC. The aim of having such design for the fuel is to prevent radioactive materials dissemination.

The fuel cycling and handling does not need to shut down the reactor.
Safety features

The main safety features of the HTR-PM project are the following:

- To control the power of the reactor, control rods are used, as well as Bore inserted in the graphite moderator. If needed, Bore can also drop by gravity to stop the reaction;
- The HTR-PM project is engineered with passive safety systems such as the use of the Doppler effect and the negative temperature efficiency;
- The reactor vessel is constantly cooled down with water.

Spent fuel

Currently, the spent fuel is supposed to be stored in an adjacent building next to the reactor vessel. No research exists at the moment concerning the recycling of the spent fuel: as a matter of fact, it would be a great challenge to be able to separate the graphite from the spent fuel.

The training Room

The next step of the visit is the training room where several model components of the HTR-PM can be seen: the reactor vessel, the helium pump or the steam generator. The steam generator consists of 650 pipes (19 tubes containing each 35 smaller tubes).
Visit of the control room simulator

The room is used by operators for examinations in order to validate their authorization to drive the reactor: 1 team of operators is composed of 3 operators and 1 team leader (1 for the electricity turbine and 1 for the management of each reactor).

Investment costs

The investment cost is estimated to be around 10 billion Yuan since it is a demonstration project. It is planed that Saudi Arabia would build a 600 Mwe HTR-PM in the near future.

b) AP-1000 nuclear plant (3G) in Haiyang

On March 22, 2017, we visited Haiyang a 3G nuclear power plant in northern Shandong Province (Figure 1). The project is part of China’s energy plan to increase the share of nuclear in the energy mix and thus reduce the use of coal in order to cut GHG emissions. Haiyang will eventually be composed of six AP1000 reactors spread over an area of 160 hectares near the sea (6 reactors are planned currently, but 2 others could possibly be added in the future). The AP1000 is a pressurized water reactor (PWR) with two cooling loops, it is planned to produce a net power output of 1250 MWe, and is considerably more compact in land usage than most existing PWRs. It is an American technology, introduced in China in 2009 after China National Nuclear Corporation (CNNC) had selected a consortium of Westinghouse Electric Company and The Shaw Group to build four nuclear reactors. A key part of the deal was a technology transfer that allowed China to develop its own 3G reactor. Indeed CAP1400 is intended to be an improvement of the AP1000 reactor with a generating capacity of 1400MWe.

After a three-year delay, the first phase of the project (reactor 1 & 2) should be completed at the end of this year. Currently, 70 milestones over 84 have been done. According to CNNC’s managers phase 2 (reactor 3 & 4) will be launched once the first two reactors have been connected to the grid. While the last phase (reactor 5 & 6) is still waiting for a political decision expected in 2020. The project also includes 6 electric lines of 220 kV each, which will allow the connection of the plant to the grid.

Concerning the cost of the nuclear plant, the information wasn’t easy to get. But a rough estimation of 50 billion RMB for the first phase was mentioned, which means 20 000 RMB/kW.
III. Boat cruise between two dams and in one river gorge

On Wednesday 24th, a boat trip was planned in order to discover the magnificent landscape the Xiling Gorges, 西陵峡 in Chinese, can offer. Starting from Yichang city we embarked heading up to the Yangtze River and more precisely to the Tribe of the Three Gorges.

**The Yangtze River**

With a length of about 3,964 miles the Yangtze River is the largest river in China and the third largest in the world after the Nile and the Amazon. Starting from the Qinghai Province in western China, it goes through eleven provinces including Tibet, Sichuan, Yunnan, Chongqing, Hubei, Hunan, Jiangxi, Anhui, Jiangsu and Shanghai. Finally it ends in the East China Sea in Shanghai. As the largest water system in China, the Yangtze River is historically, economically and culturally important to the country. The Three Gorges Dam on the river is the largest dam project and hydropower station in the world.
As the largest water system in China, the Yangtze River is historically, economically and culturally important to the country. The well-known Three Gorges Dam is the biggest hydropower station in the world. In order to reach the Xiling Gorge the final point of our cruise, the boat had to pass through a lock close to the Gezhouba dam which was part of the Gezhouba Water Conservancy Project in Yichang city. It consists of two hydroelectric dams, three locks, and several sluice-gates.

The Xiling Gorges

The Xiling Gorge length is about 49 miles. This is the longest one among the three gorges of the Yangtze River. Scenery and landscape along the Xiling Gorge are magnificent. Some renowned streams, springs, stones and karst caves can be found along this section. Xiling Gorge is mainly composed of smaller gorges such as the Longjin Brook. At a point the flow was really fast in the gorge but thanks to the Gezhouba Water Conservancy Project the water now has been slowed down which allows easier navigation and to enjoy the scenery more.
After a two and a half hour cruise the ALEF Team finally arrived at San Xia Ren Jia, which is really famous for its scenery.

**The Tribe of the Three Gorges**

The Tribe of the Three Gorges Tribe in Hubei Province is a good place to enjoy the wonderful natural landscapes and to discover the culture of the Tujia ethnic minority. It stands between Gezhouba dam and Three Gorges Dam Project the natural scenery remains as a painting. At this point of the day the ALEF team climbed the mountain until the Shaseng Stone. This stone is really famous because of the way its 100 tons stay really close to the cliff without falling.
After lunch at the Ancient Ba village we had a walk through the Longjin Brook also known as Dragon Stream. 'Long' means dragon and "Jin" here refers to the action of jumping. At the very beginning of the brook there is a mountain range opposite where it is possible to admire a giant dragon about to jump in to the river. Visitors coming here may hear the folk songs, see the small paths crossing, enjoy the waterwheels rotating slowly over the clear water and have a look at the Yellow Dragon Waterfall.

![Figure 9: Longjin Brook](image)

At the end of the day we had the luck to attend a folk show about Marriage in the Tujia Ethnic Minority. The goal of the show is to find a husband to a wonderful girl mixing songs and acting. Hopefully one of us, Arthur Condette, has been picked by the crowd to be the one. As always an ALEF student has won the price but that was not so surprising knowing the determination of our colleague.

![Figure 10: Yellow Dragon Waterfall](image)
After such a great experience the group came back to Yichang with a new goal: Getting inside the Three Gorge Dam.

IV. Hydropower plants:

a) Three Gorges dam

We had the chance to visit closely the famous Three Gorges Dam, going through the buttresses of the dam and visiting it from the inside.

Located in the heart of China in Hubei Province, the Three Gorges dam is set on the Yangtze River. It is particularly well known for being the largest hydraulic dam and the largest hydroelectric power plant in the world. It was put into production in stages from 2006 to 2009 and created a reservoir of 600 kilometers in length.

It is a weight barrier, 2,309 meters long and 185 meters high. The maximum water level of the reservoir in relation to the sea is 175 or 185 m. Its construction required twenty-seven million cubic meters of concrete, with a drop high of 90m. The dam consists of several parts from west to east:

- A hydroelectric plant with fourteen turbo-generators with a unit capacity of 700 MW;
- A weir section;
- A second hydroelectric plant with twelve turbo-generators with a unit capacity of 700 MW;
- The section dedicated to navigation with its boat lift and its cascade of locks;
- A third hydroelectric plant composed of six turbo-generators with a unit capacity of 700 MW and two groups of 50 MW each.

The 26 generators of 700 MW have a total installed capacity of 22,500 MW, which represents 10% of China’s installed capacity (or the equivalent of about twenty nuclear power plant units, for our French readers). The idea of constructing a dam in the Three Gorges is an old one, since the first proposal was elaborated in 1919 with the development plan of the Sun Yat-Sen industry in order to facilitate river navigation on the Yangtze River and allow a better allocation of its resources. The Chinese
government was also claiming that the dam would help achieve a more effective control of river flooding downstream, aiming at securing the many populations usually affected by floods.

After the coming to power of the Chinese Communist Party and new deadly floods like the one in 1954 that killed 30,000 and resulted in 19 million homeless, Chairman Mao Zedong brought up the project. In 1958, the Ministry of Water and Electricity announced on the basis of 2,600 reports that the construction would take about twenty years and could start in 1962-1963. But lack of engineering skills and technological deficiencies delayed the project, which was reactivated only in the late 1970’s.

The final decision was taken on 3 April 1992. Nevertheless, it was adopted with only two thirds of the votes, reflecting the internal oppositions to the project. Indeed, the construction of the Three Gorges dam caused a great controversy, both in China and all over the world, with the opposition of many scientists and international organizations.

First count: natural disasters. The accumulation of too much water in the reservoir, which is 660 km long and has a capacity of 39 billion cubic meters, increases the risk of landslides and earthquakes, according to geologists. The Chinese government acknowledged that the creation of the reservoir has increased the frequency of earthquakes.

Irreversible damage to the ecosystem is also a major concern. Species, such as the Yangtse River dolphin, were declared officially extinct due to pollution and algae, which accumulate as a result of the dam, instead of being drained by the river. On the social side, the building resulted in the displacement of no less than 1.4 million people, too close to the Three Gorges, and the destruction of a thousand towns and villages.

Finally, the decline in the level of water downstream of the dam, on which whole populations depend for agriculture, is particularly pointed out, whereas an unprecedented drought affects the country. Nearly 1,400 reservoirs in Hubei province have been drained, affecting the supply of drinking water to more than 300,000 people. Many farmers openly accuse the Three Gorges of aggravating the climatic phenomenon and diverting the water of the dam in recent months.

To sum up, the Three Gorges dam is a colossal engineering structure that humans have edified to challenge Mother Nature, for better or for worse. There is even a rumour that NASA Scientists calculated that shift of such as mass would increase the length of day by 0.06 microseconds and make the Earth only very slightly more round in the middle and flat on the top... Without confirmation at this time!

b) Gezhouba Dam

As the experimental dam of the Three Gorges Dam Project, Gezhouba Water Conservancy Project is located in Yichang City, in the northern part of Hubei Province on the Yangtze River.

Construction started in 1970 and was completed in 1991, with a global cost of 4,848 million Yuan (713 million dollars) it is the first dam ever built on this emblematic river. The project is composed of the dam, the spillway, sand sluicing gate, power houses and the navigation facilities. The dam is
about 2,600 meters long (which is 300m more than the Three Gorges Dam) and the crest is at an
elevation of 70m.

The power station is composed of 22 turbines made in China (19x125MW, 2*170MW and 1x20MW for self-consumption especially for the excitation of the generators). Altogether, the installed power capacity of the hydropower plant reaches nowadays 2,715 MW but it is planned to upgrade the nineteen 125MW turbines up to 150 MW, increasing by 475MW the power capacity of the hydropower plant.

As the Three Gorges Dam, the main purpose of this construction is the flood control which used to be devastating along the Yangtze river killing more than 33,000 people in 1954 and affecting dozen of million.

Finally, despite its advantages regarding flood control and power generation, this dam has also the major drawback of the decline and probable extinction of Chinese paddlefish.
V. Solar power plants run by Huaneng Golmud Company

*Figure 14: Picture of the Solar power plants run by Huaneng Golmud Company*

**General organisation**

During the field trip we made in China, we also had the opportunity to visit a solar farm run by the Huaneng Golmud Company, and located in Qinghai province. This region is one of the sunniest provinces in China allowing for the production of solar and clean electricity.

The solar farm represents a total installed capacity of 180 MW, and was developed in five stages:

- 1st stage: 20 MW on a surface of 0.96 km²
- 2nd stage: 30 MW on 1.25 km²
- 3rd stage: 20 MW on 0.43 km²
- 4th stage: 65 MW on 1.31 km²
- 5th stage: 45 MW on 1.19 km².

In the solar farm of Golmud, we can find different kinds of energy production assets:

- Inclined photovoltaic panels
  - Automated: They are equipped with tracking systems that adapt to the sun’s position by rotating on a vertical axis every five minutes.
Figure 15: Automated Inclined photovoltaic panels

- Manually inclined: The inclination of the panels can either be realized manually every season (4 times per year) or 8 times per year. This is made in order to have the highest irradiation and optimize energy production on an annual basis.

Figure 16: Manually Inclined photovoltaic panels

- Highly concentrated panels, equipped with tracking systems. The latter are currently on the trial phase.

Technical specificities and maintenance

The photovoltaic assets are equipped with polycrystalline panels that present an average conversion yield of 18% (Xi Jing and Jing An manufacturers). The peak power is equal to 230 W/cell and the capacity factor is equal to 20% (one of the highest in the world and comparable to what can be found in very favourable areas in Spain or Italy). The total annual energy production is thereby equal to 316 GWh.

In order to properly maintain the photovoltaic park, the panels are washed eight times per year (because of underground water). As the solar farm is located in a sand desert, it should be noted that sand has a negative impact on the panels yield and the cleaning process is important. Besides, the presence of sand makes the area topographically unstable (land subsidence phenomena) which makes it hard to equip all panels with tracking systems.

A monitoring room is present on site in order to follow real time production, react in case of problems and compare it to forecasts.

In terms of transport, the produced electricity (at 35 kV) is amplified at 110 kV and can thereby be connected to the electric grid.

Economic considerations
The project cost is estimated to be 1.8 billion yuan (with ten years of depreciation) and the energy cost is equal to 7000 yuan/kWh. No feed-in tariff exists to sell generated electricity, and it is sold at 0.6 yuan/kWh to small consumers and 0.7 yuan/kWh for industrial customers.

VI. Wind farms

a) Wind farm state power inv. Corporation

The wind farm project is located in the Qinghai province in the North-West of China, and is realized in two phases:

- **Phase n°1** (in operation since 2014) with a total installed capacity of **49.5MW**, composed of 33 wind turbines of 1.5MW each;
- **Phase n°2** (under construction and planned to be operational in June 2017) with a total future capacity of 50MW, composed of 25 wind turbines of 2MW each.

The wind farm is now functioning 2400 hours per year at its optimal power (capacity factor of 27.4%), which is very elevated for a wind plant. The electricity produced is sold **0.61 Yuan/kWh** generated.

The companies implicated in this project are the SDIC Qinghai Wind Power Co., GD Power and UPC Renewables, and other Chinese manufacturers. And there are about 22 employees working on site in order to ensure the proper functioning of the wind farm.

For now, the main issues on the installed power plant are:

- **The connection to the grid.** PV and wind projects are therefore slowed down or blocked because of this bad grid management, in the Qinghai province. Because of congestion into the electrical grid, the wind farms’ phase n°1 has lost **4GWh** during the year, over its 120GWh produced. In order to solve this problem, the Chinese Government will invest in DC transmitting (800kV).
- **The cold weather** in winter, with the snow blocking the road and the traffic, and the low wind speed stops the wind turbines production (less than 3m/s). Concerning the wind speed, the wind farm is located in a region where there is a lot of wind during the year, but never
exceeding more than 27m/s. As we can see on the next graph, the wind turbines start producing electricity from 3m/s to 25m/s. Once the wind speed reaches 11m/s the production is maximal.

![Graph showing the wind turbine power according to the wind speed](image)

**Figure 18: Graph showing the wind turbine power according to the wind speed**

b) Chaka lake wind farm

On our last fieldtrip day, we went to visit the Chaka Lake Wind Farm. This farm is located next to the highway, but as it was blocked, we had to take a non-paved passage and finally had to stop, as it was too dangerous for the bus to continue. We therefore continued by foot and soon realized that the distances seemed, once again, much smaller than they actually were. As time was pressing, we stopped halfway and had a discussion on the road with some experts of the wind farm.

![Some of the wind turbines at the Chaka lake wind farm](image)

**Figure 19: Some of the wind turbines at the Chaka lake wind farm**

The farm is located in an area with strong winds, with wild fauna (antelopes) and next to breeding grounds so that the farm cannot be expanded more than the original plans. Furthermore, the access is, as described before, quite difficult with tough road conditions. Nevertheless, the highway blockage being only temporary, this is a minor problem and construction trucks can pass and the grid connections are present and sufficient.

There are 7 construction phases, each phase having approx. 50 MW capacity and covering 30 km2. From the total 350 MW capacity, only 100 MW are in operation right now because currently, only 5
phases have been initialized, and from these, only the first and second are in operation. The repartition of the phases is the following:

- Phase 1: 29 turbines, some 1.5 MW, some 2 MW
- Phase 2: 33 turbines of 1.5 MW
- Phase 3: 25 turbines of 2 MW
- Phase 4: 25 turbines of 2 MW
- Phase 5: 25 turbines of 2 MW

The turbine manufacturer is Shanghai electric and Goldwing Huanrui and there are more than 20 people working at the plant, in shifts.

With respect to the dimensions of the turbines, the 2 MW ones are 80 m tall with a blade diameter of 111 m while the 1.5 MW ones are 70 m tall with a blade diameter of 90 m approximately. The distance between the turbines is of 500 m.

The turbines are working an average of 1600 h per year, whereby shut offs because of strong winds above 20 m/s are, contrarily to the first wind plant visited, a necessity at some times. The plant could be economically viable if not for the maintenance costs that occurred for phase 1 turbines after only 5 years of operation.

Even if the visit was short, it was possible to see that there are many challenges such as access, wind speeds and hostile environments when coping with wind power.

VII. The magnificent Qinghai Lake

Located in the Erlangjian park of National Geological Park in Qinghai province, this lake is one of the biggest in China. Seated in the northeast of Tibetan Plateau, Qinghai lake is in above an intermontane basin enclosed by high mountains, from 3,600 meters to 5,000 meters. These famous mountains are Qinghai Nanshan mountain in the south, the Riyue mountain at the east, the Xianpi mountain at the west and the Datong mountain in the north of the plateau. From the east to the west this huge lake is 106 km long and up to 63 km from the south to the north. The mountain and the specific climate of this region allow to have a cool summer with an average temperature of 15°C.
In this part of China, the Buddhism religion has an impact on inhabitants day life. That is why nearby the lake we can find some impressive Tibetan Stupa. As believers of Tibetan Buddhism have for a longtime considered the construction of stupas as an approach of cultivating the morality and accumulating blessings. That is why Tibet is one of the areas in the world where it is possible to find lots of stupa. Different styles and sizes of stupa can be found everywhere in Tibet. In appearance it represents the distinctive architectural art of Tibetan Buddhism, in terms of deep meanings it carried. The stupa is a very important symbol for Tibetan Buddhism.

Tibetan Stupa has not only a long history and various style, but also multiple functions. In appearance, it is a religious construction used to keep Buddhist relics of religious saints or eminent monks. But is also serves a practical purpose of warding off evil spirits. In Tibet, the stupa is a way of conveying profound Buddhist teachings and hence evolved to become a symbol for many worshippers.

The prayer flag also called religious flag provides peculiar attraction on Qinghai-Tibet plateau where the color is prevalent along the mountain passes, lakeside and temples. All the prayer flags come in five colors which are blue, white, red, green and yellow. Each color contains some special meanings: The blue symbolizes the sky, the white symbolizes the clouds, the red is for the flame, for the clear water there is the green and the yellow is dedicated to the earth. The prayer flags are decorated with Buddhist scriptures, figures or mascot design, to give an authentic spirit. For Tibetan people, the flags are like a wave in wind, which means that they pray for blessing and increase merits.

VIII. Chinese Sturgeon
The artificial propagation and protection of Chinese sturgeon is taken into account by the government and the leaders of the nation; notably Hu Jintao, Xi Jingping, Li xiannan inspected the ICS.

For 20 years, 130 million person-time have visited the ICS, including domestic and foreign government officials, experts and scholars, dignitaries and the public.

1982-1983, the ICS mainly engaged in series research, including artificial propagation, releasement technology and ecology of Chinese sturgeon. From Oct. 1982, the Chinese sturgeons began being caught by the net and taken across the Gezhouba Dam to the Jinsha River, so that natural propagation could be carried out, this action ended in 1988. In 1984, the experiment of the artificial propagation succeeded and 6000 fingerlings were released into the Changjiang River. Before 1985, the artificial propagation had used the sturgeon pituitary as oxytocin, thus many wild Chinese sturgeon had to be killed for the sturgeon pituitary. In 1985, IRHA, which replaced the sturgeon pituitary, was developed successfully. The history of using the sturgeon pituitary as oxytocin ended with the development of IRHA, the artificial propagation of Chinese sturgeon was a step in a well-ordered progress track. This achievement, which was significant for protection of Chinese sturgeon, was awarded the first prize for “scientific and technological progress” by the Department of Water Resources and Hydropower in 1986.
For 20 years, the ICS has established assorted facilities for research and release of Chinese sturgeon. Up until January 2008, 4750 thousand juvenile Chinese sturgeon-excluding 1467 subadults of one year old and 40 bigger sturgeons after propagation-were released into the Changjiang River and the Pearl River, 36 thousand juvenile mullet and 300 thousand larvae of Amur sturgeon were released into the Changjiang River too.

**IX. Xian visit**

After having visited the Three Gorges Dam and spent one night into a train, we arrived at Xi’an around 8am. Before the Ming dynasty, Xi’an is the capital of Shaanxi Province, People's Republic of China. It is a sub-provincial city located in the center of the Guanzhong Plain in Northwest China, as
shown on the Figure 1 below. One of the oldest cities in China, Xi’an is the oldest of the Four Great Ancient Capitals, having held the position under several of the most important dynasties in Chinese History, including Western Zhou, Qin, Western Han, Sui, and Tang. Xi’an is the starting point of the Silk Road and home to the Terracotta Army of Emperor Qin Shi Huang.

Since the 1990s, as part of the economic revival of inland China especially for the central and northwest regions, the city of Xi’an has re-emerged as an important cultural, industrial and educational center of the central-northwest region, with facilities for research and development, national security and China's space exploration program. Xi’an currently holds sub-provincial status, administering 9 districts and 4 counties. Xi’an has a population of 8,705,600 and the Xi’an-Xianyang metropolitan area has a population of 13,569,700. It is the most populous city in Northwest China, as well as one of the three most populous cities in Western China. According to a July 2012 report by the Economist Intelligence Unit, it was recently named as one of the 13 emerging megacities, or megalopolises, in China.

When we arrived at Xi’an, our target was the very well reputed Muslim Quarter. After having a little breakfast all together, we went to this famous place and the smartest one decided to go there using bikes, as you can see on Figure 2.

*Figure 25: Top= Benjamin, Tony, Romain and Arthur (the smartest ones) on yellow bikes/ Below= Bell tower of Xi’an*
On our road, we met The Bell Tower of Xi’an (Chinese: 西安钟楼), built in 1384 during the early Ming Dynasty. It is a symbol of the city of Xi’an and one of the grandest of its kind in China. The Bell Tower also contains several large bronze-cast bells from the Tang Dynasty. The tower base is square and it covers an area of 1,377 square meters. The tower is a brick and timber structure and close to 40 meters high.

There are several legends regarding the Bell Tower, one of them tells that, in Ming Dynasty, several earthquakes struck Guanzhong area, thousands were dead and injured. Then a legend appeared: There was a great river flowing across the center of Xi’an City. A dragon in the river was always active and caused trouble, so an earthquake occurred. An official of Xi’an government believed these words, so he ordered the blacksmiths of the whole city to make a several thousand feet of long iron chain in order to lock the dragon and sink it to river. He then ordered 5,000 craftsmen to repair the Bell Tower day and night in order to use the tower to restrain the dragon. He believed this would suppress the dragon firmly under the river and so it would no longer be active and cause trouble again. After establishing the Bell Tower, earthquakes never occurred in Xi’an again.

After losing, searching and finding Mr NEIRAC (who didn’t like seeing us on bike), we arrived all together at the Muslim Quarter. Just as its name implies, the Muslim Quarter is the hub of the Muslim community in Xian City, Shaanxi Province. Located to the north of the West Street in the city center, the quarter covers several blocks inhabited by over 20,000 Muslims. Because of a lack of time, we focused our visit within a small area of the Muslim quarter, concentrated around a main street, full of stores, restaurants and others, always linked to the Muslim tradition. The F below gives an idea of the dominant ambiance in this quarter.

![Figure 26: The Muslim Quarter of Xi’an](image)

Xi’an was the first city in China to be introduced to Islam. Emperor Gaozong of the Tang dynasty officially allowed the practice of Islam in 651 AD. Xi’an has a large Muslim community, the significant majority are from the Hui group, and there are an estimated 50,000 Hui Muslims in Xi’an. There are seven mosques in Xi’an, the best known being the Great Mosque.
The Great Mosque of Xi’an (Chinese: 西安大清真寺; pinyin: Xīān Dà Qīngzhēnsì) is the largest mosque in China. An active place of worship within Xi’an’s Muslim Quarter, this courtyard complex is also a popular tourist site. The majority of the mosque was built during the early Ming dynasty. It now houses more than twenty buildings in its five courtyards, and covers 12,000 square meters. The Figure 4 shows just a little part of the Muslim site. If a girl want to come and visit the Great Mosque, she has to wear decent clothes. Obviously, it was not the exactly the case for Alice and Julia...as consequences they had to wear a black dress that fitted very well with them. An advice not to pay the entrance: speak Arabic with the guardian. It worked well with Tony (it could be not any different...). Zeineb tried to do the same but the guardian was not very convinced by her knowledge of this language (it could be not any different).

After few of us visiting the Great Mosque and other visiting other part of the Muslim Quarter, we met together in order to have lunch in a Chinese restaurant, where we tasted and savored the
Muslim kitchen. Look how we are happy on Figure 5. This is how we finished our trip in Xi’an before flying to Golmulde and the Gobi desert.

X. Thanks
Throughout this experience, we were awed by how China is big and rich. Their willingness to be a world economic leader clearly appears through the advanced technologies used, the amount of renewable energies deployed and the big projects achieved. Thanks to Tsinghua university network and partners, we had a great opportunity to widen both our technological and human knowledge. For that, as ALEF students, we really thank the organization team for their time, kindness and passion for sharing information. Also, special thanks to our professors at Mines Paris School and Tsinghua University:

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