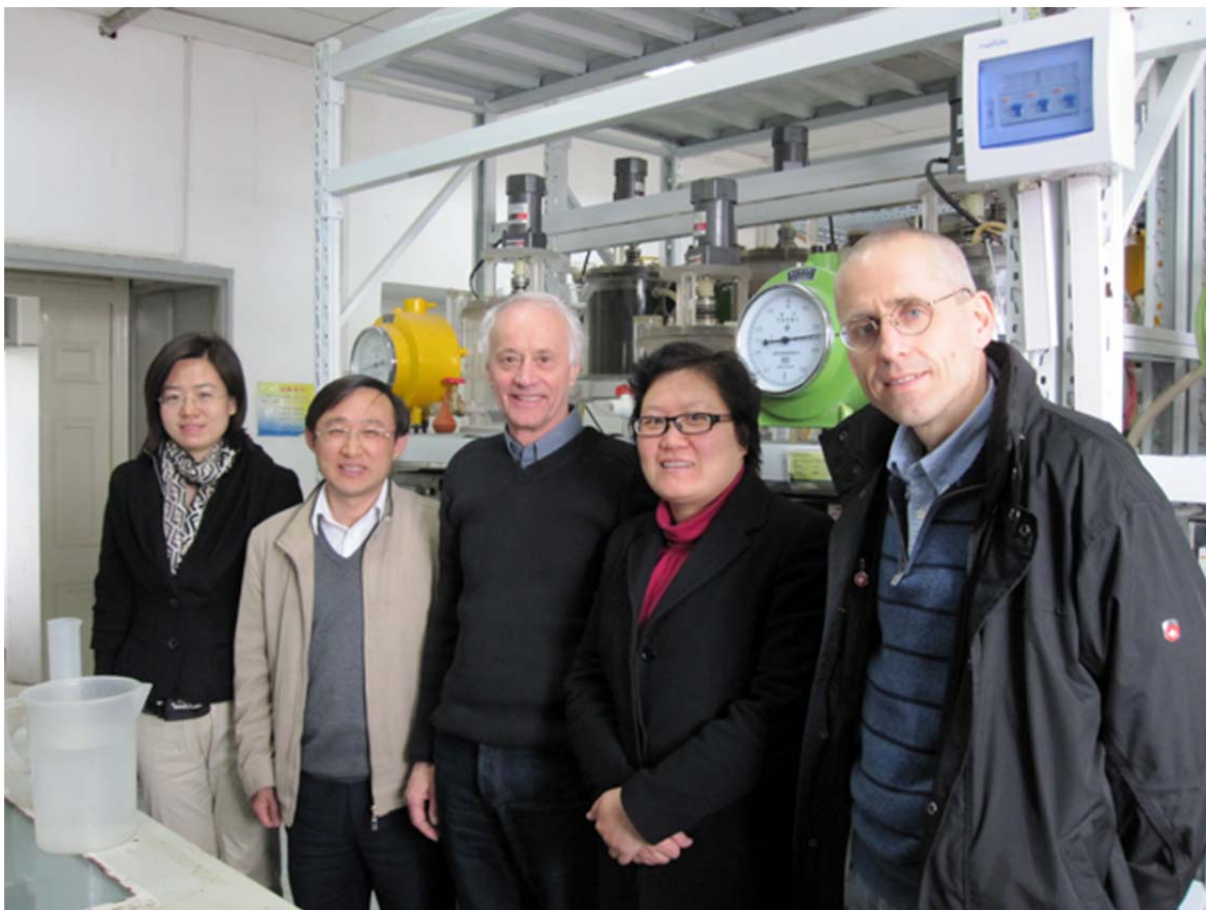




Final Report:

**Urban Waste to Energy
Feasibility Study**



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0. Summary

The basic contents of China's energy policies are: "giving priority to conservation, relying on domestic resources, encouraging diverse development, protecting the environment, promoting scientific and technological innovation, deepening reform, expanding international cooperation, and improving the people's livelihood." The state strives to advance the transformation of its energy production and utilization modes, and builds a modern energy industrial system which features secure, stable, economical and clean development, so as to support sustainable economic and social development with sustainable energy development.¹

A living example of the governments aim to invest into a clean environment is Chengdu city. Here, most of the taxis and public busses run on natural gas and motorized two-wheelers run with electricity. This impression was reflected by all the different meetings we had with Government offices, Universities and partnering NGO's. Government plans and policies increasingly include renewable energy forms in order to reduce pollution. With our project idea, the doors are randomly open and we got access to the information needed to carry out the study.

A huge effort has been taken to research and find solutions in order to treat and convert organic waste into energy. Still, the government, the universities and private companies face many challenges, working in this field. Several Anaerobic Digesters have been built, but did not produce any success story. When it comes to practical solutions in waste management and treatment, the progress is still at the beginning. This study will give some insights into these difficulties and provide solutions, how to overcome these challenges.

The study gave us very good access to all the important information and insights for future planning of the project. The Chinese partners at the different offices were in general very open and provided us beside the asked questions with insights and background information. All the meetings and visits indicated the enormous need for a functioning urban organic-waste treatment solution on one side, as well as the high interest of the government-, university- and NGO partners on the other side to be part to implement such a project.

The study with its positive feedback urged to continue with an economical analysis of the project; in order to present facts to ADRA's desired project partners at the Chengdu City Management departments. This document has been formulated and together with the technical evaluation and a promotional video was handed over to the Chengdu Urban Management Office.

¹ China's Energy Policy 2012

1. Objectives

Overall objectives:

- Provide organic waste solution for urban areas in China (Sichuan Province) with high return on investment.
- Provide opportunities to train local craftsmanship on waste management technologies and add to know-how transfer

Objective of this project:

- 1) Conduct a feasibility study in Chengdu City of Sichuan Province (China), to prove that fermentation of the organic fraction of municipal solid waste (OFMSW) is a suitable technology for urban areas in China, to upgrade and recycle organic waste, produce energy for its citizen and to demonstrate good examples in other areas of the world.
- 2) Create confidence in the technology that will serve as basis for the subsequent planning process. It will attract and motivate investors to commit their financial resources towards this.
- 3) The results of this study will help ADRA and our local partners to meet with all the decision makers in the region (at all levels) and work out a strategic implementation plan with the Government of Chengdu City.

Objective of project future:

- 4) A first demonstration plant will be designed, based on the study results.
- 5) The vision based on this feasibility study is the provision of knowhow that materializes into a demonstration scheme that solves the Chengdu city organic waste problem by closing the bio-cycle in the most economic way with a high return on investment.
- 6) After successful completion and running of the plant, ADRA aims at expanding the technology to neighboring cities and urbanized areas.

Additional questions:

- a) What is the demand of organic waste treatment?
- b) How is the project embedded in the local context (Partners)?
- c) Is the project seeking international support and/or embedment?
- d) How the overall project shall be continued after the end of the project?

The goal and objectives of this study have not changed but its initial results after the study tour show great opportunities and demand for action. ADRA seeks to extend the project with a promotion- and planning phase. The promotion phase aims to inform and attract Investors at government- and private sector level to invest into a medium size demonstration plant. The planning phase will produce all the detailed calculation, design and drawings to sign a project contract and implement the project.

2. Technical Solution / Applied Method

2.1 Problems encountered

At the beginning of our study tour in April 2013 we met with the top level of Biomass scientific research in China. At Tsinghua University, Professor Wan Wei provided us with the most actual figures concerning MSW management as well as the government projects in response to the enormous amount of waste that is being daily produced. At Beijing University, Dr. Li Xiu Jing gave us in details information on the current status and perspective of collection, treatment and utilization of food waste in China. During the second presentation Dr. Li showed us some of the plants that have been built just recently but from which he yet did not hear any success stories.

What seems very successful at household and agricultural level, the efficient treatment of municipal solid waste seems a huge challenge.

The financial means seemed the major obstacle to implement the project, however over the life span of this project it became clear that the major obstacle might be to find a plot of land in Chengdu City. The land prices are increasing every day and the sale of land is obviously the major income for the city at the time being. If the government is not in the position to provide the needed land, ADRA will move the project to the neighboring county level.

There are no fixed procedures to follow in order to achieve the planned partnership (PPP) with the government. Therefore it is difficult to plan a specific time frame. Patience and persistence is needed to reach the goal as it is common for all projects in China. On this way it is an additional challenge to identify and bringing all the decision makers from the different Ministries together. After the first suc-

cess in April we (including our local Chinese collaborators) underestimated the still very rigid protocol that has to be followed with officials.

Information

The access to information in China is not as easy as in Europe. The Internet is mainly used by the private business sector.

During the meeting with Mr. He from the City Management Bureau in Chengdu, we got the information about a restaurant waste treatment project within the department of city infrastructure. ADRA asked Mr. He for the contact details of the companies but the CMB refused to provide this contact. This project is related to the department of infrastructure. He kindly asked us to find another way to receive the needed information. ADRA investigated through Mr. Li, Director of Chengdu Environmental Education & Communications Center, but also he was refused to get any information, as the project is a joint venture and the project not yet complete to show results. ADRA is welcome to see the plants after they are finished. The Beijing University was also not informed about this project.

Government projects or project in collaboration with the government are considered a secret as long as the project is not finished. It is very difficult to find out about experiences and best practices in the field of MSW.

Communication and collaboration

In general, the way of communication has more of a vertical movement within a department, office or institution. There is little horizontal communication towards other departments who have no direct link between each other. During our meetings, there was no indication or evidence of collaboration between government entities or dialog between Universities and Government offices. People are mainly focused to their specific work and tasks. They are determined to fulfill research targets and meet government plans.

To meet the responsible persons at government offices and institutions is a major challenge. Meeting appointments cannot always be made as desired. A work-related colleague or friend is needed who knows the desired person and makes a recommendation with reference to ADRA. Strategic networking is required from the hierarchical bottom up to reach and communicate with the decision makers.

2.2 Approach to solve the Problem

The foundation of problem solution is a trusting relationship with the responsible government offices and partners to overcome the many obstacles while introducing a first demonstration plant. Crucial for high sophisticated projects like treatment of MSW is the need of experts from different thematic areas. Successful construction and implementation of MSW treatment plants need specialists and know-how from different areas of expertise.

After the start up of the plant, a reliable partner is needed to run the plant economically and professionally.

Crucial is also the quality of the organic waste, which needs a good dialog with the communities to separate wet and dry waste. This needs a smart behavior change communication program, linked with a smart incentive mechanism initiated by the government to create lasting change of habit at the point of waste production. As it turned out, the introduction of even a rough source separation of household waste going beyond the existing separation of fabrics and cardboard is the major hurdle next to the land availability.

These different aspects of the project need close attention individually but also need to be linked with the other project components to make it a success.

Needs versus solution

At	Needs	Solution
Waste production	<ul style="list-style-type: none"> • Proper waste separation (dry and wet) • Rewards for good separation 	<ul style="list-style-type: none"> • Awareness of environmental protection • Behavior change communication among communities • Smart incentive program
Waste transportation	<ul style="list-style-type: none"> • Shortest distance possible • Reduced amount of waste • Ownership 	<ul style="list-style-type: none"> • Monetize separated waste • Create jobs in the recycling business • Transportation company becomes the MSW plant operator (this will improve the quality of separated waste and increases the efficiency of the plant outputs)
Waste compression	<ul style="list-style-type: none"> • Environmental friendly operation 	<ul style="list-style-type: none"> • Build MSW plant next to the compression unit • Start with central waste separation and reduce the amount to be compressed and transported to the landfill/incineration • Treat press-liquid together with organic waste
Waste treatment	<ul style="list-style-type: none"> • Appropriate technology and careful material selection for construction • Integrated approach to optimize the waste chain • Ownership and knowhow 	<ul style="list-style-type: none"> • Technical training and knowhow transfer

3. Results

The study consisted of 5 Steps; the preparation step, the study tour, the technical evaluation, the economical evaluation and the information dissemination.

3.1 Study Preparation

Reference to the REPIC funded EAWAG Project in Ghana

With great interest we read through the documentation of the Project “Renewable Energy and Waste Management in Ghana, implemented by EAWAG (2011/2012). After studying the report and proposal, we got in direct contact with Christian Lohri, to discuss the project in further details. Christian Lohri kindly provided ADRA with his ‘Feasibility Assessment Tool for Urban Anaerobic Digestion in Developing Countries.

During preparation of our own study together with Arthur Wellinger it became obvious that our two projects, despite of the same thematic area, start at different levels. While there is not much knowhow existing in treatment of organic waste in Ghana, China is already advanced. We knew that several AD plants for urban kitchen waste have been built already, but there seems to be no report of success in hand. We have prepared our study on the assumption, that basic research has been done and a huge quantity of organic waste is waiting to be treated in China. Therefore the study focused on a medium size demonstration plant.

Stakeholder Analysis

In order to prepare meetings with the relevant organizations, University departments and government offices we made a first draft of the stakeholder analysis and arranged meetings with the key persons.

After all the meetings, the stakeholder analysis has been updated and finalized. It provides us now with a clearer picture how to plan each player/party into the future implementation of the project. It also indicated communication gaps that will help us to find ways to include people appropriately to ensure good information communication among stakeholders in order to increase the success rate of the project (see Annex E)

Questionnaire

Part of the study tour preparation was a questionnaire that helped to understand the current situation concerning waste management in Chengdu city (see Annex D). The waste material characteristics could not be tested beforehand. Still the right person at Chengdu University could be found who has the laboratory equipment to perform the tests.

The answers provided already a basic picture of the entire waste chain with its different stages. The accurate statistical figures derive from a project on community waste management done by Roots & Shoots (see para 3.2.3).

Schedule meetings

ADRA China was responsible to arrange and schedule the meetings as outlined in the stakeholder analysis. To get an appointment with Professors and Doctors at the different universities was a big challenge and only possible through the long lasting relationship with the Ministry of Science and Technology (South Centre for Environmentally Sound Technology Transfer department) SCESTT in Beijing.

3.2 Study tour

The study tour took place from Monday, April 8 to Monday April 22, 2013. The trip included meetings at two different Universities in Beijing, different meetings at Chengdu University, government offices and NGO partners as well as site visits. During the study tour we arranged seven meetings with the most important stakeholders to get information from the government, universities and civil society organizations.

Promotional video clip

ADRA China contributed a volunteer from Singapore, who had just finished studying multimedia and a traineeship at the Singapore TV station. This video clip will target potential donors and government partners. The video is entitled: "Waste(d) Energy". It outlines the local environmental challenges and gives some first basic answers around the biomass technology and our proposed project. The video was produced in Chinese and English language.

3.3 Information dissemination

General information

During preparation for the study tour, we tried to find out about current plans and projects in the sector of urban organic waste treatment. This would help us learn about the current state of the technology development. Our Chinese partner asked around among all their contacts but could not find any hints of current projects. During our preparation work in Europe, we found out by chance about collaboration between the German GIZ and the Ministry of Agriculture in Chengdu to establish a Bio-gas-Center in Chengdu. These contacts need to be deepened, to prevent from missing out important information during the planning stage. An alternative way of searing information in country will be the search of projects with international collaboration with European **partners**.

Government Policies and Plans

China Energy Policy: The below content of Chinas' Energy policy clearly indicates the need for clean and innovative energy solutions. This project will be a powerful contribution towards the increasing need environmental sound technologies:

- I. Current Energy Development
- II. Policies and Goals of Energy Development
- III. All-round Promotion of Energy Conservation
- IV. Vigorously Developing New and Renewable Energy
- V. Promoting Clean Development of Fossil Energy
- VI. Improving Universal Energy Service
- VII. Accelerating Progress of Energy Technology
- VIII. Deepening Institutional Reform in the Energy Sector
- IX. Strengthening International Cooperation in Energy

Conclusion:

Energy is the vital material base for China to modernize and build a moderately prosperous society. The Chinese government will strive to address the energy problem properly by following the sustainable road of energy development.

China will still be in a stage featuring accelerated industrialization and urbanization for a long time to come, facing the challenging tasks of developing its economy and improving its people's livelihood. Its energy needs will go on to increase in the future. As a large emerging country with a population of over 1.3 billion, China must rely on itself to increase the energy supply steadily to satisfy such demands.

Energy security is a global issue. Few countries can secure their energy supply without international cooperation. The achievements China has made in energy development are inseparable from its friendly cooperation with other countries. Its future development in the energy sector will need more

understanding and support from the international community. China, with a population of more than one billion, is exploring and practicing a new way in the history of energy development to ensure its sustainable energy development. China did not, does not and will not pose any threat to the world's energy security. Abiding by the principle of equality, reciprocity and mutual benefit, it will further strengthen its cooperation with other energy producing and consuming countries as well as international energy organizations, and work together with them to promote a sustainable energy development around the world. It will strive to maintain stability of the international energy market and energy prices, secure the international energy transportation routes, and make due contributions to safeguarding international energy security and addressing global climate change.²

Chengdu Municipal solid waste separation collection midterm plan outline: The plan objective is to actively carrying out the activities of the MSW separation is to promote the public awareness of it, accelerate the separation, transportation, construction of treatment facilities, and the establishment of relevant policies and regulations on MSW. By the end of 2020, the initial establishment of the city's MSW separation, collection, transportation and treatment system will be achieved and the MSW separation transportation system and recycling network for renewable resources will be linked up.³

The plan outlines the following steps to achieve the plan up to 2020:

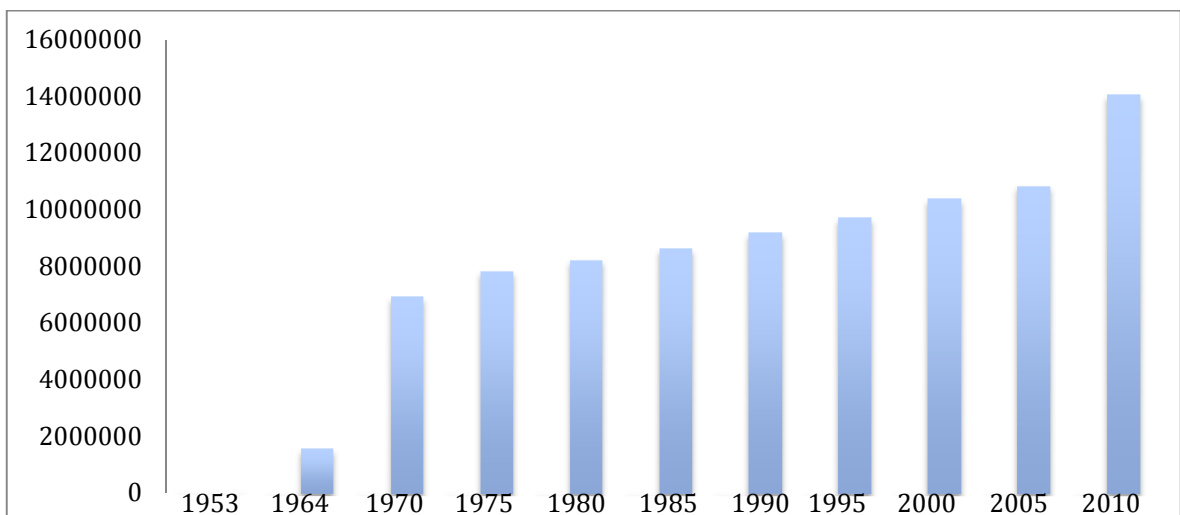
- (i) Establish sound legislative regulations and relevant set of policies
- (ii) Promoting Municipal Solid Waste Source Reduction
- (iii) Scientifically Formulated Method for Municipal Solid Waste Separation
- (iv) An excellent municipal solid waste collection, separation and transportation method
- (v) Reasonably allocate the container for municipal solid waste, make a timely purchase of a collection and transportation vehicle

The plan is fully in line with the findings of this feasibility study and the planned next steps and phase to support the City Management Bureau in its effort to achieve its objectives. ADRAs planned project as follow up of this study will actively supports the steps i-v. For further details see the translated government waste plan Annex F.

Statistics

Over the past 20 years the urban population of Chengdu has doubled from three million in 1990 to over six million today and is on course to becoming a megacity by 2025. Much of this urban growth has been driven by migrants from the countryside seeking better-paid jobs⁴.

The figures below show a fast growing urban population in Chengdu city after 2005 (see details Annex F). While driving through the city for meetings and visits, this growth rate is reflected by many construction sites in and around the city where huge living areas grow like mushrooms out of the still empty spaces in the city.



Besides the many other challenges, the city government of Chengdu will face in a short period of time great difficulties to manage all the daily produced waste by the rapid increasing population. Chengdu is an increasing attractive working place for many different light industry sectors (further details and reports see Annex G).

² China's Energy Policy 2012

³ Excerpt (objective) Chengdu Municipal solid waste separation collection midterm plan outline

⁴ China Daily - Chengdu paying a heavy price for rapid growth - by Karl Wilson, 1 February 10, 2012 (see full article Annex G)

Waste chain

The waste produced at household level is in general not separated. There were several attempts by the government to separate dry and wet fraction at source but during transportation the waste was again mixed together as transportation cost for the separate wastes was too high, as we were told. Soon after, households stopped to separate their waste. We know of one exception at a community in Beijing where the household waste is being separated in wet and dry matters. And the dry matters are further separated into glass, metal and paper, which are monetized before it leaves the compound (see 'green-house project' annex A). Each community has its own community management company, responsible to keep the public space within the compound clean and transport all the waste from the doors of residence to the collection point within the compound.

From there a private company, engaged by the CMB, collects the waste and drives it to the district compression station. There, all the waste is compressed to one third of its volume. The run-off liquid leaves the station untreated. Each of the 6 central city districts (total 5,3 million population) has one compression station. Between 13 and 15 sub-districts compose one district. The sub-district contains a varied numbers of communities.

The compressed waste (less wet) is transported in big and closed containers around 30 kilometers outside the city to the landfill or nearby incineration plant. From the compressing station to the end of the chain, the government handles the waste only.

3.4 Technical Evaluation

A separate technical evaluation has been written by Triple E&M, Consultant for the Feasibility Study, Arthur Wellinger (see Annex C and the Chinese translation Annex L).

3.5 Cost/Benefit Analysis

Work done in Chengdu

- **Information collection;** Price collection at different companies and information collection for cost/benefit analysis.
- **Networking;** In the process of networking with the specific government offices, ADRA decided to move hierarchical from the bottom up, which is strategically more efficient as the contacts and recommendation of other offices is easier managed than from the top down. It is likewise very difficult to get in direct with upper level of governmental decision makers and hard to network from top down. The needed contacts are increasing gradually.

We had important internal meetings to raise the understanding of the project and who is doing what, how to approach the government and inform the decision makers to promote the project. We learned that all decision maker need to understand the benefit of the project and support it from all the different direction. There is land needed, many different permissions to get the project started.

Work done in Switzerland

- Plant design and detailed price calculation for three different types of digester
 - a) CSTR vertical cylindrical digester
 - b) CSTR horizontal semi-plug-flow digester
 - c) Horizontal plug-flow digester with gas injection
- Evaluation of Chinese prices of material and components either directly or over Chinese companies
- Formulating cost/benefit analysis
- Prepare PowerPoint presentation to present findings

Meetings

During the second visit in Chengdu we met with the Chengdu Biogas Research Center, the Chengdu Urban Management (CDUM) and the Department of Chengdu Academy of Urban Environmental Management (CDUM). More detailed minutes are written in the trip report (see Annex K).

Cost/Benefit Analysis

The cost/benefit analysis (see Annex M and Chinese Translation Annex N) proposed 3 different types of AD plants for treating MSW:

- Option 1: Type CSTR vertical cylindrical digester
- Option 2: Type CSTR horizontal semi-plug-flow digester
- Option 3: Horizontal plug-flow digester with gas injection

After the calculation of these 3 options, the option 2 is the favorite for the following reason; Horizontal digesters are known to treat both, liquid and solid substrates. The design of options 2 and 3 are comparable.

They belong to the oldest digester design developed in the fifties of last century, formerly called "Braunschweig System". Today they are applied in both agriculture and municipal solid waste. The advantage is that they are not critical to sand as it can be removed together with the waste. Because they can handle solid and liquid waste they would be well suited for the wet waste in Chengdu. The waste would not have to be chopped finer than 400mm.

The most appropriate design for the demonstration unit of 10'000 tons per year (28 tons per day) is the horizontal continuous plug-flow digester (option 2). It is the most versatile of all designs when it comes to bulky material or mixture of wet and dry material and undesired material.

In a region with heavy earthquakes like Chengdu the horizontal steel tank is the most robust and safest. Additional tanks next to each other can easily extend the design.

The Chengdu City Management officers told us that independent of solutions for the organic waste, the city is building and operating incineration plants.. Actually three are in operation, two privately operated plants, the newest one operated by the government. Following the government officers request to receive a business proposal, ADRA will use the opportunity to include valuable information that outline the benefits of AD to treat organic household waste.

4. Impacts

In preparation for the study and during the study, we tried to collect as much information as possible at all the different levels of involvement.

Strategic approach of potential investors

There are two potential types of investors: the government and/or private companies. When outlining the return on investment, an anaerobic power plant is different from the two perspectives:

Potential return	Government investor	Private investor
Financial return	<ul style="list-style-type: none"> • From electricity production • From selling fertilizer • From bus or car fuel • Saving transportation cost 	<ul style="list-style-type: none"> • From electricity production • From selling fertilizer • From bus or car fuel
Environmental return	<ul style="list-style-type: none"> • Treat run-off liquid during waste compression – no need to build a separate waste water treatment unit • Less CO2 emission • After separation of dry and wet it is much easier to separate in between the different dry waste styles to monetize part of it. 	<ul style="list-style-type: none"> • None
Other return	<ul style="list-style-type: none"> • Saving land space • Easier to further separate the dry waste and monetize glass, paper, metals 	<ul style="list-style-type: none"> • None

A first demonstration plant with the current investment (cost versus gain for the kilowatts fed into the city grid) is only promising on a long-term perspective. This is not very attractive for most private investors in China and Hong Kong. Therefore the priority is to address the Chinese Government.

Due to the decision of the central Government, that the provinces have to find MSW treatment solutions to reduce landfilling, the municipalities are eager for solutions. During the study tour, it became evident that the government budget provides the provinces with sufficient financial resources in order to achieve successful results in waste treatment. Therefore the provinces/cities have resources to contribute to the cost of this planned demonstration plant. This money is only available on the basis

of a trusting relationship between the partners. A successful step has been taken during our study tour while showing genuine interest to work together on a solution rather than just making business. This builds on a long lasting relationship between ADRA China and the government. This dialog will help us introduce and include other partners who are essential for the success of the project.

The City Management Bureau (CMB) Chengdu expressed interest in collaboration if promising plans are presented. Nevertheless, private companies and investors will be kept in mind, in case of need.

5. Future Prospects

This feasibility study with all the gathered information and insights reveals enormous potential to build an anaerobic digester plant to treat urban organic waste produced at households. There is random high motivation by the responsible government offices as well as the universities to be part of a future project to build a demonstration plant. This motivation derives from an increasing amount of waste production, a decreasing availability of space for landfill as the city grows rapidly. Waste treatment cost need to be reduced, while the environment needs to be protected. The production of energy is another motivator that includes the planned project

5.1 Result based 2nd project phase with the government and investors

ADRA and Triple E&M are very much confident that the proposed plan will be well received and appreciated by the government. A signed letter of intent that outlines all the parties interest and pre-condition that lead towards a collaboration, will lead us to the next phase of detailed planning and calculation with accurate information for a final decision by the investor. Upon positive answer of financial coverage and availability of land, draw a full set of drawings for an anaerobic digester demonstration plant as proposed in the technical evaluation (see Annex C). Submit all the documents to sign a contract with the investor.

5.2 Perspectives after Cost/Benefit Analysis

There is more strategic networking needed among the government departments and offices of Chengdu City. Several more meetings are needed to build up the dialog and strengthen the relationship, before collaboration agreement can be signed. In case the government is not in a position to contribute the property towards this project, ADRA needs to move to the surrounding counties of the capital. The built relationships are still of highest value as they are needed when negotiating with county government, where the central government is still part of the decision making process in a consultative role. As soon as agreement is reached between the responsible government party and ADRA, details of a public-private partnership (PPP) will be planned and donors/investors contacted.

6. Conclusions

6.1 Lessons Learned

- Chinas eating culture requires a lot more food than what guest can eat. This leaves plenty of food not consumed, creating a huge amount of organic waste at homes and in restaurants. Currently there are two main practices to treat waste, one is landfill the other is incineration. Landfill won't be a long-term solution for environmental reasons and space limitation. The incineration of wet waste needs additional energy to burn. Considering these two challenges and the rapid population increase for the years to come, a sustainable waste treatment technology is urgently needed to cope with the overwhelming amount of waste produced.
- Waste Separation; Waste separation at source is crucial, because a central mechanical sorting of wet and dry matters with a rotating drum sieve will leave around 80% wet fraction. Hand sorting of wet and dry waste at household will have a much better effect. Source separation will take out about 68% wet waste according to an accurate assessment by Roots & Shoots at household level. It is crucial to start working with the waste producer intensively in order to raise the efficiency of the waste treatment process. To change the habit of waste producers to separate their waste into wet and dry matters effectively needs several years. Therefore it is very important to start intensively work with the communities to separate waste. A separate waste transportation system has to be introduced parallel with the private transportation companies.
- Information and Communication; The different government departments are not very much linked and there is very limited information sharing. Once a department makes business with a private company it is considered to stay internal.
- Plans and policies; The energy policy as well as the Chengdu Municipal Solid Waste Separation and Collection Midterm Plan Outline (see Annex F), are very much in line with the goal and objectives of this project. A master plan is needed to combine all components of the project.

- Relationship and trust; When it comes to work and business related collaboration, the Chinese culture is deeply rooted in relationships and trust. ADRA has good relationships with the different government offices for many years but no direct working relations as ADRA worked mainly in rural areas. In order for the government to invest, they need to experience a genuine interest to mutually solve the problem rather than just come and make business. Therefore it is very important to provide the governmental decision makers with reliable and good quality information to build mutual trust and confidence into a successful first demonstration plant.
- A very careful stakeholder analysis is needed before starting the project. ADRA needs to bring the right people together in order to have the right people included in the project from early planning until completion. A local partner is crucial to coordinate, communicate and link people, institutions, Universities and companies during planning as well as running the plant before it can be transferred. Too many stakeholders can destroy the project, when partners try to take out benefits instead of giving their expected contribution.
- The meetings during our first visit had a mainly technical character. These stakeholders are very well aware of the need of a well functioning AD technology for MSW treatment. They all expressed this need and fully support our project idea. During our second visit our key meetings took place at higher level government offices where we realized that the decision makers for our project have different priorities. These offices receive different proposal for such projects and the officers focus on big waste treatment plants regardless whether the technology is proven for Chinese conditions or not (according to our network partners none of the MSW digestion plants built in China so far is fully operational if at all). Their interest for demonstration units serving to increase trust in the technology and training people is limited.
- There seems no regular dialog between the technical departments and universities on one side and the government decision makers on the other end. The government officers are not sensitized about the most suitable technology versus the needs of economy, environment, logistics and other aspects.
- During our first visit, the availability of land was discussed but not outlined as a major issue. Half a year later on our second visit, the land issue is a major concern. To get land from the city government in the capital seems almost impossible. More important than having the project finances secured are the personal connections to the main decision makers in order to get the support from the government for a property.
- Our good contacts to the City Management Bureau initially promised to be the key contacts through which the project could get approved and collaboration secured. However, there are a number of other offices and especially the top level to be included to get a final decision. Still the decision to network from the bottom up proves to be the right direction, although it will take considerable time to get to know each of the decision makers well enough to move forward.

6.2 Conclusions:

This initial study leaves us with a high motivation to continue with the next phase of planning together with our government partners. In order to indicate all the stakeholders our genuine interest to put plans into practice, we need to move ahead without any delay. ADRA's future project will be planned on the most economic side with an empowering approach among all local stakeholders. This means, we do not pay incentives to residents to make them separate their waste, nor do we give gifts to officials to promote the project. We will very carefully select the project partners and stakeholders in order to reach our goal, i.e. to build a most reliable and economically feasible platform allowing to share know-how and train local people.

At our meeting with the City Management Bureau we realized that the needs for taking action focuses on kitchen waste. The CMB stated they are working on a solution with restaurant waste with two private companies currently building an anaerobic digester and a composting plant respectively for organic restaurant waste. The challenge is waste separation at source and the CMB openly states they have no solution for the treatment of organic household waste. This project will implement a demonstration plant that provides a sustainable solution together with the attempt to start waste separation at source.

The Chengdu Municipal Solid Waste Separation and Collection Midterm Plan Outline is fully in line with the findings of this feasibility study. The planned next steps and phase of ADRA's project fully supports the City Management Bureau in its efforts to achieve its objectives.

ADRA is very grateful for the financial support from REPIC. The project is at a stage where all the basic information has been collected and disseminated to present the project technically and economically to the decision makers. ADRA will deepen its networking, presenting the project with the promotion video, the technical evaluation and the cost/benefit analysis.

ADRA will continue to inform REPIC about the process and is hoping to formulate another project once the agreement with the government has been achieved.

7. References

7.1 Annexes

- Annex A – Trip Report (Beijing – Chengdu, April 2013)
- Annex B – Picture Report
- Annex C – Technical Evaluation (Triple E&M)
- Annex D – Questionnaire
- Annex E – Stakeholder Analysis
- Annex F – Chengdu Municipal Solid Waste Separation and Collection Midterm Plan Outline
- Annex G – Maps and Demography
- Annex H – Gantt chart
- Annex I – Promotional Video Clip-script
- Annex K – Trip Report (Chengdu, December 2013)
- Annex L – Translation of Technical Evaluation (Triple E&M)
- Annex M – Cost/Benefit Analysis
- Annex N – Translation of Cost/Benefit Analysis
- Annex O – Presentation of ADRA and Triple E&M to CMB/CDUM (project promotion)
- Annex P – Presentation by Biogas Research Center (BIOMA)
- Annex Q – Promotional video clip

7.2 Reference Documents

- a) China Energy Policy
- b) The Strategic Alliance on Technological Innovation of Urban Biomass Gas Industry; chair by Tsinghua University
- c) Economic analysis for recycling biodegradable municipal waste with garage dry fermentation technology; by Sichuan University