

Tongtong Gao

Capacity Building for Clean Technology

Research and Education Design among Metropolia UAS, Finnish
Cleamtech Companies and Vantaa City in Asian Market (China)

Metropolia University of Applied Sciences

Bachelor of Engineering

Degree Programme in Environmental Engineering

Thesis

24.08.2017

Author(s) Title	Tongtong Gao Capacity building for clean technology Research and education design among Metropolia UAS, Finnish cleantech companies and Vantaa city in Asian market (China)
Number of Pages Date	26 pages + 2 appendices 24 August 2017
Degree	Bachelor of Engineering
Degree Programme	Environmental Engineering
Specialisation option	Renewable Energy Technologies
Instructor(s)	Riitta Lehtinen, Principal Lecturer
<p>Nowadays, cleantech is a worldwide hot topic. The reason might be its features of high efficiency and minimal negative environmental impacts to the surroundings. By seeing that, private and governmental organization have made numerous investments in this field in Finland. Metropolia UAS is also preparing and seeking for proper cooperation.</p> <p>This thesis was conducted for Metropolia University of Applied Sciences to first find cooperation possibilities with Finnish local cleantech companies and the City of Vantaa to extend into the Chinese cleantech market and then design suitable courses for potential coming delegations from China as an educational media.</p> <p>With much effort of researching and connecting, the potential cooperation partners are listed in the thesis, and support from the City of Vantaa is illustrated as the signature of Director of Business Development on a promotion letter cited at the end of the thesis.</p> <p>Even though the response rate from the target companies was negligible, the products and services of these companies are still analyzed in the paper in order to design suitable courses for the future. All suggested courses are planned to be conducted on the basis of the courses in the curriculum of Metropolia UAS, but with some changes and new ideas added.</p> <p>Further suggestions for Metropolia UAS are also given in the conclusion to monitor this potential project.</p>	

Keywords	cleantech, renewable energy, environmental impacts, Finland, China, international cooperation, one belt and one road

Contents

1	Introduction	1
2	Theoretical Background	2
2.1	Clean Technology	2
2.2	Clean Technology in Finland	2
2.3	Clean Technology in China	3
3	Research and Result	4
4	Analysis of Product and Service	5
4.1	Energy Production and Distribution	5
4.1.1	Burners (Enviroburners)	5
4.1.2	Transformers (Norelco)	6
4.2	Technical Management	7
4.2.1	Waste Management (MariMatic)	7
4.2.2	Information Management (KeyPro)	8
4.3	Industrial Process Essentials	9
4.3.1	Dryers and Portable Dryers (Talas Electric)	9
4.3.2	Monitors and Measurers (Talas Electric)	10
5	Course Suggestions	10
5.1	Introduction to Cleantech	10
5.1.1	Course Content	11
5.1.2	Course Objectives	11
5.2	Waste treatment & Management	11
5.2.1	Course Content	12
5.2.2	Course Objectives	12
5.3	Waste-to-Energy	12
5.3.1	Course Content	12
5.3.2	Course Objectives	12
5.4	Energy Resources	13
5.4.1	Course Content	13
5.4.2	Course Objectives	13
5.5	Energy Storage and Distribution	14
5.5.1	Course Content	14

5.5.2	Course Objectives	14
5.6	Fluid Mechanics	14
5.6.1	Course Content	15
5.6.2	Course Objectives	15
5.7	Mechanical Engineering	15
5.7.1	Course Content	15
5.7.2	Course Objectives	15
5.8	Physics & Electricity Devices	16
5.8.1	Course Content	16
5.8.2	Course Objectives	16
5.9	Lean-Technology	16
5.9.1	Course Content	16
5.9.2	Course Objectives	17
6	Course Selection Guidance	17
7	Conclusion	18
Appendices		
Appendix 1. Promotion Letter (1)		
Appendix 2. Promotion Letter (2)		

1 Introduction

With the pure natural landscapes and over 70% of forest coverage rate, Finland is known as one of the greenest countries in the world (1). What is more than that, this nation ranks the second most innovative cleantech countries in the world (2). With all above advantages, a great potential has been found by Metropolia University of Applied Sciences (Metropolia UAS), supported by the City of Vantaa, to cooperate with Asian countries (China in the first stage) that are suffering from negative environmental impacts, or to help companies or organizations in different countries to improve their energy efficiency. Therefore, a project is created to attract Finnish local companies (specifically in Vantaa area) to join the project where there will be three parties:

- The city of Vantaa
- Finnish cleantech companies
- Metropolia University of Applied Sciences

The Vantaa city support this project with promotions. The Finnish cleantech companies could offer cleantech products and services to the Chinese market. And the Metropolia UAS will work as an educational medium to offer technical training courses or venues for exhibition and trade shows for coming visitors from both commercial organizations and educational institutions.

This thesis focused on the products or services of the target Finnish cleantech companies, which would be a reasonable reference to design suitable courses in the Department of Clean Technology in Metropolia UAS. The aim was also to find cooperative possibilities among the above-mentioned parties. The basic background of clean technology in both Finland and China were studied and the research method and the progress was recorded. The thesis project resulted in a list of companies that are interested in this project, and can be found through the cleantech Finland website. The analysis was conducted for the products or services of the listed companies, after which a suggestion including information on suitable courses was compiled and conclusions were drawn.

2 Theoretical Background

2.1 Clean Technology

Clean Technology, also referred to as leantech or greentech, originally invented in the venture capital investment industries, and later it became the term to describe the significantly developed commercial fields, such as renewable energy industries. Thanks to the founders of Cleantech Group, this term was popularized in many larger scale conferences to represent not only the technologies that are both “clean and green”, but also describes a wide range of products, services and solutions for the global challenges, such as the asset class, environmental and renewable energy sectors and industrial performance of existing products or processes. Generally, cleantech covers the following sectors:

- Energy Generation
- Energy Storage
- Energy Infrastructure
- Energy Efficiency
- Transportation
- Water & Wastewater
- Air & Environment
- Materials
- Manufacturing/Industrial
- Agriculture
- Recycling & Waste (3)

Clean Technology is nowadays a rising topic all over the world due to its high competitiveness compared with conventional opponents, the relatively high efficiency or performance with lower or even negligible negative impacts on environment has made leantech one of those potential stocks in the industry. Therefore, even though there has been a slightly drop in the amount of investment during the past few years, there is still a potential increasing trend in the future (4).

2.2 Clean Technology in Finland

Speaking of Finland, the first thought would be connected with the word *green*. It is not only due to high forest coverage rate that exceeds 70 percent (1), but also due to Finland's clean technology. As Finland was the greenest country in the year of 2016 (5) and is second most innovative cleantech country in the world in 2017 (2), the Finnish cleantech market is blooming.

The total turnover of Finnish cleantech market in 2012 was about EUR 25 billion, where one third of the local R&D (research and development) is aiming to join the cleantech board. About 50,000 people work for cleantech companies or organizations, and there will be 40,000 more positions in this field by the end of 2020 (5).

With only 13% of global energy being generated from renewable sources, the share of Finland, however, surprisingly reached to 38 percent, and in the year of 2030, Finns are heading to achieve half of the ratio to be renewables (6). All above evidences made the cleantech to be one of the focal elements that Finnish government concentrate on.

In order to become one of the leading countries in the cleantech field, the government implemented some actions to promote the local development, one of them is about "taking the promotion of the cleantech business into account in international influencing activities" (7), which means that globalized cleantech cooperation is an obligatory step, or a dose of a cardi tonic at the same time, for the development of Finnish economy.

2.3 Clean Technology in China

As China is one of the fast-growing developing countries, its economy has been booming considerably in the past few years. This dramatically developed economy has not only brought capital to Chinese people; however, it has also brought serious environmental problems that cannot be neglected. The increasing awareness of environmental issues pushed the Chinese government to search for solutions in order to avoid or to solve them.

The emergence of clean technology in China is a piece of stone, and it kills two birds at the same time, since it is the solution for environmental problems and maintains the economic growth. Therefore, China encourages the local cleantech companies and invests in foreign companies in the cleantech field. With the promotion of China's recent

13th Five-Year Plan, the number of cleantech companies in China rocketed from 3000 to 50000 from 2005 to 2015 (8).

Nevertheless, China has limited experience and technologies; therefore, the Chinese market need some time to explore and expand, whereas an advanced partner in this case, would be a development accelerator. The recently launched “One Belt and One Road” initiative (9) claims that the Chinese government is willing and welcoming for all foreign partners and aiming to successful international cooperation, which further facilitates global cooperation in the cleantech market (10).

Due to the extremely high number of inhabitants, the demand for energy and other products in China is higher than other countries. Hence, a huge potential in the cleantech market is available for the world from China for cooperation and communication, which is a good opportunity for China itself and foreign countries to achieve a “win-win” goal.

3 Research and Result

The research of the suitable Finnish Cleantech companies was conducted through the Cleantech Finland website (5). Among over 200 Finnish cleantech companies, there are 11 companies that comply with the requirements that of being located in Vantaa area and of producing cleantech products or offering cleantech services. One of them, however, has moved out from the City of Vantaa, and 5 of the other 10 firms have already started doing business in the Chinese market. Therefore, the remaining 5 corporations, introduced below, are screened with respect to the analysis objectives.

- Enviroburners Oy
- Norelco
- MariMatic
- KeyPro
- Talas Electric

The support from Vantaa City is represented by Mr Jose Valanta, the Director of Business Development in the City of Vantaa. And the support from Metropolia UAS is represented by the thesis student and thesis supervisor Riitta Lehtinen, Principal Lecturer in Metropolia UAS. The promotion letter signed by both the Vantaa City and the Metropolia representatives can be found in the Appendixes at the end of the thesis.

After sending the invitation emails with the promotion letters to the listed companies, there was negligible response from them, which led to a result of no interest in the project.

4 Analysis of Product and Service

With the aim of designing suitable courses or training sessions for any possible visitors from either educational institutions or commercial organizations, in this section of thesis, 6 products from 5 companies were screened out of over 200 products. They were classified into 3 groups and analysed with respect to their functions, utilities and unique advantages, as well as to the academic field they involved in. The results are presented according to products or service, and the name of the company is mentioned in brackets after the respective product or service. Further information of the companies and the products is referenced at the end of the thesis.

4.1 Energy Production and Distribution

4.1.1 Burners (Enviroburners)

Product Description

Enviroburners Oy (11) is a Finnish firm that manufactures environmentally friendly burners and burner systems, which are commonly utilized in several industrial processes. Their burners turn the fuels into useful heat with high efficiency and at low cost in waste treatment, as well as reducing the burden of environmental pollution. The wide range of the burners span from the waste incineration process to the metallurgy, from the wood dust combustion to the biofuel burning, as well as start-up and load burners.

All of the burners (12) from this company are designed according to the customers' requirements for size and utility, which means their products are customer dependent. This makes them applicable to most of the conditions and different plants or process.

Both traditional fuels and waste streams are fed into their burners. Traditional fuels consist of combustible oils or gases. The waste streams include odorous gases, liquid methanol and turpentine, solvent fumes, wood dust, carbon monoxide and hydrogen gas, they are oxidized during the combustion in order to meet the standards of emission.

Advantages

The advantages of the burners from the Enviroburners Oy are listed below:

- Applicable in many industrial fields
- Customized design according to different requirements
- Waste streams as fuels increase the efficiency and reduce the cost for waste treatment.

Related Academic Fields

The academic fields related to burners are given below:

- Mechanical Engineering
- Energy Resources
- Thermodynamics

4.1.2 Transformers (Norelco)

Product Description

Norelco (13) is an energy distribution company; they are experts in transformation devices planning and manufacturing. The wide production range includes switchgears in different voltages, electricity substations and connection systems for heavy power facilities. Power companies and construction firms are their focused customers. In addition to their products, they also offer services of spare parts manufacturing to replace the essential parts of the systems they have designed, and budget planning. Different forms of energy are delivered and distributed into several locations by their products; thus, Norelco produces good transfer media.

Their products and services (14) are carefully designed with full experience and an efficient concept. The good reputation comes from the high standards of manufacture and alternative proposals for each customer, the lean-technology is also applied for each project to lessen the amount of waste during manufacturing and installation.

Advantages

The advantages of the transformers from the Norelco Oy are listed below:

- Good reputation in quality and services
- High efficiency of the product

- Lean-technology leads to minimal waste, which is a good example of cleantech

Related Academic Fields

The academic fields related to transformers are given below:

- Automation
- Mechanical Engineering
- Lean-technology
- Energy distribution system

4.2 Technical Management

4.2.1 Waste Management (MariMatic)

Product Description

MariMatic (15) is a branch under the MariGroup companies, its specialization is automated solid waste collection systems, with an abbreviation of AWCS. This ambitious firm is aiming to become the global leader in the field based on their achievement of innovative products. This confidence came from their unique industrial waste collection system Taifun® (1980) and the special underground carriage of municipal waste system MetroTaifun® (2010), which collect household or industrial waste at a maximum distance of 4 kilometres. Recently, MetroTaifun® products have been extended to more areas such as hospital waste and gym waste.

The two systems are good examples to replace the traditional waste collection system with less harmful impacts to the environment, for instance, reduced noise and energy consumption, and less cost in investment and in the amount of materials consumed for the system. With their own quality assurance system that addresses to all stages in the manufacturing process, all products and services are ensured to reach the customer's requirement.

MariMatic has also developed the vacuum waste collection system, which is a pioneer in the waste management market.

Advantages

The advantages of the waste management from the MariMatic Oy are listed below:

- Less negative environmental impacts
- Material saving
- Energy saving
- Cost saving
- Space saving

Related Academic Fields

The academic fields related to waste management are given below:

- Waste classification
- Material Engineering
- Fluid Dynamics

4.2.2 Information Management (KeyPro)

Product Description

Keypro is a network information management corporation. They offer information management solutions for many industries with their own solution packages (16). The KeyAqua is designed for water asset management, the KeyEnergy works in energy industry, the KeyLight offers useful information of street lighting, the KeyCom connects the networks and supervises the assets, and KeyMap is a joint utility mapping solution that combines all owner information within a certain area and reflecting to a concentrically map version.

This company supplies a 24-hour service. With more than 20-year experience on telecom network planning, they offer their customers the most effective proposal with minimal investment. The documentation and maintenance are performed through network system updating. Thus, there is no need to worry about the bias caused by lapsed data.

Advantages

The advantages of the information management from the KeyPro Oy are listed below:

- Intelligence networking
- Effective management system for many industries
- Simpler network asset
- Cost saving

Related Academic Fields

The academic fields related to information management are given below:

- Information technology

4.3 Industrial Process Essentials

4.3.1 Dryers and Portable Dryers (Talas Electric)

Product Description

In term of dryers and other electrical facilities that are designed for pulp, paper and saw mills and for other companies which have underground working space, the company Talas is a reasonable first choice. With the clear aim of avoiding the process failures caused by the humidity or wet condition, the Talas Electric produced their own dryers (17) with fully automated operations and flexible to be installed to common motors. This dryer need no maintenance and could also work as a heater when needed. By simply conveying the direct current impulse to the windings when the insulation resistance is measured as low, the motor is then kept in an optimal humidity condition for daily usage.

The portable dryers (18) are also the highlight of this company. In case of electric motors are located in some tough areas that differentiate from the factory process, this portable device will measure and dry the AC (Alternative Current) driven motors and send data back to the computer with the cellular modem. The users could monitor the dryer from any computer or intelligence device.

Advantages

The advantages of the dryers from the Talas Electric Oy are listed below:

- No need for maintenance
- Cost effective device
- Convenient usage in different condition

Related Academic Fields

The academic fields related to dryers from Talas Electric Oy are given below:

- Basic physics of electricity and electrical devices

4.3.2 Monitors and Measurers (Talas Electric)

Product Description

Talas Electric does not only produce great dryers, but measurers (19) and monitors are also in their production list. Their measurers are under Modbus protocol, which enables communications among electrical devices in the industrial environment. The measure package usually contains many measuring units for a few motors, and the monitoring system allows the monitoring of insulation resistance of any electric motor by customers from any PCs (personal computers) or intelligence units.

Advantages

The advantages of the monitor and measures from the Talas Electric Oy are listed below:

- Allow monitoring from any computer or smart unit
- Able to apply in multi-motor condition
- No need for maintenance

Related Academic Fields

The academic fields related to monitors and measures are given below:

- Basic physics of electricity and electrical devices

5 Course Suggestions

Based on the product and service analysis in the previous section, some suggestions on the courses that could be offered by Metropolia UAS are presented in this chapter.

Metropolia UAS has been known for a long time for its high quality education and innovative development in several academic fields and applied sciences, some of the suggested courses are already in the curriculum of different degree programmes. Therefore, the suggestions are given either based on the existing courses, or on brand new point of views.

The courses are listed below with details including the content and objective.

5.1 Introduction to Cleantech

Since the potential visitors or training participants are coming for those Finnish cleantech companies and their advanced technologies, the basic information of the development of cleantech market in both Finland and China should be mentioned in the introduction part of this course. Meanwhile, some technical terms are better to be familiar with before the session starts. Thus, a list of terminology would be a good way to start the course so that the participants would not panic due to unfamiliar words and spend time on searching for the meaning during the session and possibly miss the important content.

5.1.1 Course Content

The course content is listed below:

- List of terminology of related academic field
- Basic information of cleantech development in a globalized version, and domestic ones
- Cleantech definition and involved industrial fields with examples

5.1.2 Course Objectives

After this course, students are familiar with the most common cleantech terms in different industrial fields, they know the basic background information of the development globally and domestically. They know clearly what cleantech is and which industries need and use cleantech products or services. The general regulations and governmental policies related to the cleantech industries are also highlighted for the participants.

5.2 Waste treatment & Management

Municipal waste collection is common in the Europe, but might not be so clear for foreign countries, and how to classify the waste and what is needed for the waste treatment are classic problems for all the waste management firms and waste experts. This course will explain the waste fractions with their features and relatively dealing methods.

As a good example, the MariMatic company is analysed on this course to explain to the students what a waste management company does and what kind of technologies they have. More specifically, if the experts from the company will be available as a guest lecturers, the logistics of their waste management flow are claimed as well.

5.2.1 Course Content

The course content is listed below:

- Waste classification
- Waste treatment process
- Logistics of waste collection
- Different kinds of waste treatment

5.2.2 Course Objectives

After this training course, students or participants will know how to classify the waste into different groups with various treatments. The working flow of a typical waste treatment plant is a learning outcome, as well as other treatment technologies are also learned by the students.

5.3 Waste-to-Energy

As one of the waste treatment method, waste-to-energy is rising in the waste treatment market. This course will generally introduce different waste-to-energy power plants with their pros and cons, the classification of energy waste is also included in the learning process, where the student will get to know how to deal with the calculation of energy balance of a simple waste-to-energy power plant. Another highlight would be several waste-to-energy technologies.

5.3.1 Course Content

The course content is listed below:

- Waste to energy technologies with their advantages and disadvantages
- Typical waste-to-energy power plant work flow
- Energy balance calculation method

5.3.2 Course Objectives

After this training course, the students will name out different waste to energy technologies with corresponding benefits and negative influences; they can choose suitable technologies based on different conditions. They will also know clearly how a waste-to-energy power plant works in a logical flow. Calculation of energy balance in the waste-to-energy plant is another harvest from the course. Therefore, some thermodynamics is also included in the course.

5.4 Energy Resources

There are many types of energy that come from different resources, both traditional ones and renewables. This course will introduce participants to basically all types of energy resources with their pros and cons and their ratio of utilities both internationally and locally. The special features of each type of fuels are explained. Thus, the students will know when to apply them into practical usage and working life. Emissions after the combination of each fuel should be known by students with the consideration of environmental regulations and legislations.

Renewables such as wind power and solar power are also mentioned in this course, but further training is required for renewable specializations.

5.4.1 Course Content

The course content is listed below:

- Different types of fuels with their end-usage
- Fuels with both physical and chemical features
- Emissions of fuels after combustion (reaction and calculation of emission)
- Renewable energy sources with their pros and cons

5.4.2 Course Objectives

After this course, the students are able to differentiate between the traditional fuels and renewable energies, and know their corresponding advantages and disadvantages. They could also find what emissions will be generated after each fuel combustion, and the reaction of emission production. With an industrial version, course participants should be able to know which fuels or energies is suitable for which industrial process.

5.5 Energy Storage and Distribution

With the basic knowledge from the previous course, the students already know where the energy comes from and how to utilize it. This following course will then explain how to distribute the energy to domestic use and how to possibly save and store energy during those processes. General energy balance calculation procedure with some basic thermodynamics are introduced in this course.

The distribution and storage techniques are included in this session, examples could be transformers and substations, which are main products from the Norelco Company (Experts from the Norelco company could be invited if it is possible). The burners from Enviroburners Oy and dryers from Talas Electric Oy are also case studies for the participants.

5.5.1 Course Content

The course content is listed below:

- Energy distribution systems with different purpose
- Energy distribution techniques and units
- Energy Storage techniques and units
- Energy balance calculation

5.5.2 Course Objectives

Students should be able to choose the suitable distribution systems and storage techniques for different energy systems.

5.6 Fluid Mechanics

With the basics from the previous course, students already have a sense of energy storage and distribution. However, to implement this in practical work, piping, valves and other units are involved in the process. This course will teach students how to dimension flow in the pipes and pumps and provide a basic knowledge of vacuum systems.

5.6.1 Course Content

The course content is listed below:

- Fluid flow equations
- Dimensioning of pipes and pumps
- Information about vacuum systems

5.6.2 Course Objectives

After the training in this session, participants are able to apply fluid flow equations into real problems, dimensioning the pipes and pumps in a common flow process such as heat distribution, and know the basics of vacuum system in order to learn how MariMatic company running the underground waste collection system utilizing vacuum piping.

5.7 Mechanical Engineering

Mechanical Engineering should be a base course for anyone who is willing to know how the basic technical equipment works in theory and in real life. To offer this course in the curriculum, the students will be able to learn how the main products from the listed companies work and professional symbols of other assemblies.

5.7.1 Course Content

The course content is listed below:

- Working principal of burners, and in which process it is needed
- Working principal of Dryers, and in which process it is needed
- Working principal of switchgears, and in which process it is needed
- Technical symbols

5.7.2 Course Objectives

After this course, participants are able to tell how burners, dryers and switchgears work in the real industrial process, and have the ability to recognize the symbols of different units.

5.8 Physics & Electricity Devices

Since the analysed products include electrical dryers and monitors, this course is suggested for the students who are targeted to be familiar with different types of current and to know how to connect them into use.

5.8.1 Course Content

The course content is listed below:

- Current impulse
- unit connections
- common electrical devices introduction

5.8.2 Course Objectives

After this course, students are able to understand the difference between AC (Alternative Current) and DC (Direct Current) and know when to utilize them in real life. They will also be familiar with several electrical units and know correspondingly how to connect them to motors and other measuring facilities.

5.9 Lean-Technology

With the same aim of producing minimal waste and improve production performance, companies are under heavy completions. The lean-technology would be helpful for them to save costs, reduce waste and being productive at the same time. This course will introduce the concept and principals as well as suitable applications for each process with their pros and cons.

5.9.1 Course Content

The course content is listed below:

- Lean technology concept
- Lean technology principal
- lean technology applications with pros and cons

5.9.2 Course Objectives

After this course, the participants are able to tell what lean technology is and how to eliminate the waste during production process, they are supposed to find proper applications of lean technology and implement them in different processes.

Another series of courses related to information management are also suggested for the coming students. This course package could be offered by the English Degree Program of Information Technology including basic computer skills and the access to some professional work field applications or soft wears, for instance, AutoCAD and ArcGIS, where the former is utilized in most of the mechanical works to design and make 3D drawing of the assemblies or spare parts, and the latter is a geographic information system that is applied to analyse, store and manage the geographic data. This course is recommended for all participants due to its wide utilization in work field.

6 Course Selection Guidance

Due to different interests of participants, the target courses should be correspondingly different, so that the training process could be more concentrated to the specific company, which lead to more productive study progress. Therefore, the course selection for participants who are from educational institutions should be based on individual interests, and the training selection for others from organizations or foreign companies should be dependent on which company the participant is interested in or is going to be a cooperative partner with.

There is a course selection guidance table illustrated below, participants could take it as a recommendation. The decision, however, would still highly depend on individuals.

Table 1. Course selection guidance.

	Product A	Product B	Product C	Product D	Product E	Product F
Course 1	√	√	√	√	√	√
Course 2			√			
Course 3			√			
Course 4	√					
Course 5	√	√				

Course 6					√	√
Course 7	√	√			√	√
Course 8		√			√	√
Course 9	√	√	√	√	√	√

In order to understand the guidance table clearly, there is an extra table below explaining the names of both courses and products:

Table 2. Courses and products names

Course Number	Course Name	Product Number	Product Name
1	Introduction to Cleantech	1	Burners
2	Waste treatment & management	2	Transformers
3	Waste-to-Energy	3	Waste management
4	Energy Resources	4	Information management
5	Energy Storage & Distribution	5	Dryers & Portable Dryers
6	Fluid Mechanics	6	Monitors & Measures
7	Mechanical Engineering		
8	Physics & Electrical Devices		
9	Lean-Technology		

7 Conclusion

The goal of this thesis was to create a cooperation stage, where the Finnish cleantech companies located in the City of Vantaa and the Metropolia University of Applied Sciences would cooperate and extend their products and services into Chinese market. Another aim of this thesis was to analyse the products and services from the screened companies in order to design or complete a set of training courses for the coming visitors of both educational institutions and commercial organizations from China.

Much effort was made to reach both of the mentioned targets. After the research of over 200 Finnish cleantech companies, there is a list of 10 companies as the targets, and only 5 of them qualified as final result since the other 5 had already built their relationships with local customers in the Chinese market. In terms of starting the cooperation among the above-mentioned parties, the achievement was so inspiring that the City of Vantaa showed their interest in the topic and offered help with the promotion letter of the project. However, even with the signature of the Director of Business Development of the City of Vantaa and the support from Metropolia UAS on the promotion letter, the response from the Finnish cleantech companies was negligible. Regarding the analysis of products and

services, the result lead to several useful course-design suggestions based on the existing courses in Metropolia UAS. What is more, a corresponding course selection guide was also made in this thesis with the aim of helping the participants choose suitable and determined courses.

To explain why the local cleantech companies did not show their interest in the project, there are few possible reasons listed below:

- The author of this thesis is a bachelor student who is not influential in the market at all
- The companies are getting along with Chinese market with their own process
- The companies are concentration on Finnish market right now
- The invitation letters are sent during the summer time (holiday period for most of the companies)

Therefore, there are some further suggestions for Metropolia UAS if this project is still considered to be valuable to realize and monitor. First, make up a marketing team of this project, and it is better that someone influential (e.g. Head Teacher) could be the leader of the project since the leader might have few connections in local companies or government. Second, an attempt should be made to attract some delegation groups from China to visit the campus so that the school could show the local companies that they have potential customers and that they have experience in meeting delegations and in improving education. The last, visit the companies with already developed course design would be a plus preparation to show the determination and confidence from Metropolia UAS to the local companies.

In conclusion, even though there was no interest showed by the Finnish cleantech companies to join the board of cooperation, the analysis of products and services was still effective, and the suggestions offered in this thesis are still valuable for the course design in the future.

References

- 1 Finnish forests resources - Finnish Forest Association [Internet]. Smy.fi. 2014 [cited 8 July 2017]. Available from: <https://www.smy.fi/en/forest-fi/forest-facts/finnish-forests-resources/>
- 2 Sworder C, Salge L, Soest H. The Global Cleantech Innovation Index 2017 [Internet]. WWF & Cleantech Group; 2017 [cited 8 July 2017]. Available from: <https://wwf.fi/mediabank/9906.pdf>
- 3 Dikeman N. Fostering sustainable growth - Cleantech Finland [Internet]. Cleantechfinland.com. 2008 [cited 8 August 2017]. Available from: <http://www.cleantechfinland.com/web/cleantech>
- 4 The Global Cleantech Innovation Index 2017 [Internet]. WWF & Cleantech Group; 2012 [cited 10 August 2017]. Available from: <https://wwf.fi/mediabank/9906.pdf>
- 5 About us - What's Cleantech Finland? - Cleantech Finland [Internet]. Cleantechfinland.com. [cited 8 August 2017]. Available from: <http://www.cleantechfinland.com/what-s-cleantech-finland>
- 6 Cleantech - Invest in Finland [Internet]. Investinfinland.fi. 2017 [cited 10 August 2017]. Available from: <http://www.investinfinland.fi/cleantech>
- 7 Jokinen J. Government Strategy to Promote Cleantech Business in Finland [Internet]. MINISTRY OF EMPLOYMENT AND ECONOMY; 2014 p. 2-3. Available from: https://ec.europa.eu/environment/ecoap/sites/ecoap_stayconnected/files/documents/government_strategy_to_promote_cleantech_business_in_finland.pdf
- 8 Chinese Cleantech Market Opportunities [Internet]. pwc; 2017 p. 2. Available from: <https://www.pwccn.com/en/energy-utilities-mining/chinese-cleantech-market-opportunities-2017.pdf>
- 9 B & R Initiative-Belt and Road Portal [Internet]. Eng.yidaiyilu.gov.cn. 2017 [cited 15 August 2017]. Available from: <https://eng.yidaiyilu.gov.cn/ztindex.htm>
- 10 Yang V. China Will Honour Its Commitment to Clean Technology [Internet]. World Economic Forum. 2017 [cited 15 August 2017]. Available from: <https://www.weforum.org/press/2017/06/china-will-honour-its-commitment-to-clean-technology/>
- 11 About us - Enviroburners Oy [Internet]. Enviroburners.fi. [cited 18 August 2017]. Available from: <http://www.enviroburners.fi/en/about-us>
- 12 Products - Enviroburners Oy [Internet]. Enviroburners.fi. [cited 18 August 2017]. Available from: <http://www.enviroburners.fi/en/products>
- 13 Company Profile – Norelco [Internet]. Norelco.fi. [cited 19 August 2017]. Available from: <http://www.norelco.fi/en/tietoa-norelcosta/yleistietoa/>

- 14 Products and services – Norelco [Internet]. Norelco.fi. [cited 19 August 2017]. Available from: <http://www.norelco.fi/en/tuotteet-ja-palvelut/>
- 15 MariMatic - MariMatic [Internet]. Marimatic.com. [cited 19 August 2017]. Available from: <http://www.marimatic.com/company/index.php/en/>
- 16 Frontpage - Keypro [Internet]. Keypro.fi. [cited 20 August 2017]. Available from: <https://www.keypro.fi/en/frontpage#products>
- 17 Dryer test - Talas Electric [Internet]. Talas Electric. [cited 20 August 2017]. Available from: <http://talaselectric.com/dryer-test/>
- 18 Talas Portable Dryer - Talas Electric [Internet]. Talas Electric. [cited 20 August 2017]. Available from: <http://talaselectric.com/product/talas-portable-dryer/>
- 19 Talas Measurer - Talas Electric [Internet]. Talas Electric. [cited 20 August 2017]. Available from: <http://talaselectric.com/talas-measurer/>

Appendix 1. Promotion Letter (1)

Dear cleantech company,

Do you want to make some effort for the clean technology field?

Are you interested in exploring market in Asian countries?

Here, we have a good opportunity for you to meet suitable partners both governmental and educational!

Project

Great but not surprised, Finland ranks the 2nd most innovative cleantech country in the world. With this advantage, we, Helsinki Metropolia University of Applied Sciences, with the support of the city of Vantaa, are looking for companies who would be interested to join the board to attract customers from Asian countries, where nowadays there are rising environmental problems so that clean technologies are exactly what they are seeking for!

Aim

Create a brand-new cooperation possibility among Finnish cleantech companies, Helsinki Metropolia University of Applied Sciences and the city of Vantaa, in order to extend the clean technology market in China.

Target customers

Delegation groups, educational institutions as well as business investors from China and other Asian countries.

What we offer

Helsinki Metropolia UAS

The department of clean technology in Metropolia focus on higher education in variety of technical fields including Energy technology, Environmental Engineering, chemical engineering, etc. Industrial services are also included with the competencies of clean technologies, sustainable management of natural resources and sustainability in production, energy plants and distribution, material and corrosion technology.

Metropolia could work as an educational medium that offering:

- technical/cultural training for visitors,
- venue and showroom for the techniques or products

for the coming visitors.

City of Vantaa is also promoting this thesis-work of Ms Tongtong Gao from Metropolia University of Applied Sciences. It is on it's share a good example of living co-operation between the city, companies and educational sector in Vantaa. It can also provide practical information for the companies about the business-possibilities of Asian markets.

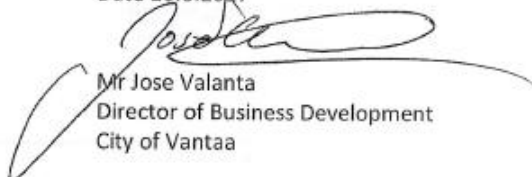
Who am I

A Bachelor student who is working on her thesis based on this project. The topic of the thesis is "Capacity building for Clean Technology research and education among Metropolia UAS, Finnish Cleantech companies and China (Asian market)". The aim is to figure out potential cooperative opportunity among Cleantech companies (offices or headquarters) in Vantaa city and Asian countries. The result of the thesis is a list of

Appendix 2. Promotion Letter (2)

companies, whose products or techniques are analysed by the student to prepare proper training courses or technical education for incoming visitor in Metropolia.
Research has been done by the student, which lead to a list of 11 companies in Vantaa.

Date 20.6.2017



Mr Jose Valanta
Director of Business Development
City of Vantaa

Date 21.6.2017
Riitta Lehtinen
Principal lecturer
Metropolia University
of Applied Sciences