BBChina

Master Program
on Bio-Based Circular Economy

Sustainability Report

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Introduction

The main result of the BBChina project is the establishment of a Master Program on Biobased Economy (Biomass to Energy and Bioproducts) in the three involved Chinese Higher Education Institutions (HEIs) TJU, ECUST and SCU.

The Master Program is running since September 2019 in the Three Chinese HEIs.

The structure of the Master Program was implemented to fully comply with the Chinese University structure (2.5 years total duration, where the first year is devoted to front lessons, while last one and half year is devoted to projects and thesis).

Furthermore, an Entrepreneurship Course aimed at empowering entrepreneurship attitude in the master students has been developed by the partner CESIE, based on their experience in the field.

The BBChina Master Program was implemented as a “Program on Bio-Based Circular Economy” within the already existing Master Degrees at TJU, ECUST and SCU. Depending on the School or College involved, the Degree offered is Master of Science (M.Sc.) or Master of Engineering (M.Eng.). At Tongji University (TJU), the Master Program BBChina is part of the Master Degree in Environmental Engineering and in the Master Degree in Thermal Engineering. At East China University of Science and Technology (ECUST) it is part of the Master Degree in Mechanical and Power Engineering. At Sichuan University, it is part of the Master Degree in Life Sciences, of the Master Degree in Chemical Engineering and Technology, of the Master Degree in Chemistry, and of the Master Degree in New Energy and Low-Carbon Technologies.

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Aims of the sustainability report

The aim of the present report it is to point out actions that must be put in place to guarantee the long-term sustainability of the Implemented Action in the 3 Universities. Further actions will be proposed to introduce the same Master in other Chinese Universities.

Definitions and rules

To facilitate the understanding of the present report, it is worth point out some definitions related to the Chinese University System, where the developed Master Program is actually Implemented.

The “Second-level discipline” in the Chinese University structure, is what in European terms a “Master Degree in” is, while the “research orientation” is the “Program in”.

The BBChina is a Master Program in Bionased Circular Economy as part of a Master Degree (either M.Eng. or M.Sc.), therefore it is a “research orientation” as part of a “Second-level discipline” following the Chinese definition.

The institution of a new “research orientation” is subject only to an internal approval, and can be independently set by each University. There is no need for an accreditation process at National level.

Regarding the “Second-level discipline” the process is that each university independently sets the second-level disciplines and awards the related degree (such as Environmental Engineering, Thermal Engineering, etc.). The functional

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departments of the Ministry of Education will compile those disciplines that have been set by a certain number of degree-granting units and widely recognized by the society, and have trained large-scale students, into the Disciplines Catalogue. The second-level disciplines catalogue is updated every five years and the first-level disciplines catalogue is updated every ten years. To set up a new second-level discipline, it requires a relatively independent professional knowledge system, and the university should have a team of teachers with a reasonable knowledge structure, age structure and professional technical position structure, which can provide a series of courses, research projects, required for the training of graduate students.

Therefore, it usually takes long time to set up a new second-level discipline, and get accreditation by the Ministry of Education via the Catalogue.

In particular, regarding the involved Chinese Universities:

- at **TJU** the last new version of the catalogue was published, after the approval process, in January 2019; the next update is foreseen in 2024;
- at **ECUST** the last catalogue update was in 2014; the next one was expected in 2020 but it has been delayed to 2021, due to the COVID-19 Pandemic. The next deadline is therefore 2026;
- at **SCU** the last update of the second-level discipline catalogue was published in 2018, and the next update is thus foreseen in 2023.

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Status at the end of the eligibility period

The BBChina program added a new “research orientation” in Bio-Based Circular Economy under the existent “second-level disciplines” (such as Environmental Engineering) already available in the involved Colleges and Schools. The BBChina project added to the educational offer of the involved Chinese HEIs 5 new courses that did not exist in any of the institutions before, while 7 courses already available in one of the three Chinese HEIs were shared across the institution after each course received an improvement following the EU/China collaboration activated by the Project. Both all new and improved courses had assigned a course responsible, with the responsibility to coordinate the teaching activities.

The Chinese staff also took part to the staff mobility action and the new knowledge achieved during this action was transferred into the BBChina courses.

The BBChina project also implemented an Entrepreneurship Course, to be held during the second year of the Master Program. A total of 6 selected trainers were trained during Summer 2020, and they also participated to the development of the course, under the coordination of the partner CESIE.

The status at the end of the eligibility period is then:

1. The Master Program was included as a new “research orientation” under the existing “second-level disciplines” involved.

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2. The permanent academic staff in charge of coordinating and running the university courses is selected and involved.
3. The course material is available and updated, and it is shared by means of the BBChina e-learning platform.
4. The Entrepreneurship Course is run by a Chinese trained staff.

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Long term sustainability

The Master Program is a “research orientation” and is well established in the Educational Offer of the involved Schools and Colleges in the involved Chinese HEIs, where the Program is presently running for its Third Edition (Academic Year 2021/2022), that are:

- **Tongji University (TJU)**:
    - College of Environmental Science and Engineering
    - School of Mechanical Engineering
- **East China University of Science and Technology (ECUST)**:
    - School of Mechanical and Power Engineering
- **Sichuan University, Chengdu (SCU)**:
    - College of Life Sciences
    - College of Chemical Engineering and Technology
    - College of Chemistry
    - Institution of New Energy and Low-Carbon Technologies

Furthermore, at TJU the program is extended to the foreign students from UNEP-Tongji Institute of Environment for Sustainable Development (IESD), which are mainly from Europe, South Africa, and South Asia.

The basis of the sustainability is given by the fact that all the courses are established, including the materials, the teachers are already within the

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Universities' staff, and the Degrees the Program is part of, are active and well established. All the BBChina courses will remain in the educational offer in the Chinese HEIs. The research groups of the involved staff members can recruit the BBChina students continuously.

In the context for China of achieving the carbon neutral goal as soon as possible, students with relevant backgrounds have more opportunities to obtain their ideal careers if involved in a Program like the BBChina. Therefore, the Program courses are very attractive to students, even for students outside the Program to take elective courses. Furthermore, a training in the field of the Entrepreneurship is not common in the Chinese Universities and seemed very attractive for the students as an additional opportunity to improve their job market attractiveness.

The interest in choosing the BBChina Program is confirmed after the starting of the third edition. The numbers are in line with the standard enrolment figures: as a matter of example, there are around 13 research orientations at the College of Environmental Engineering at TJU. Each year around 70 students are enrolled, therefore the number of enrolled students in the third edition is in line with the expected numbers.

There is also interest at University level to improve the Project. As a matter of example, at TJU the course "Integrated Solid Waste Management" (under the TJU responsibility under the BBChina) is financially supported by the university for improving the materials and teaching method in 2021-2022. Furthermore, TJU has funds for the graduate students to attend international conferences or for organizing international seminars. A successful application was submitted in

2019, and got approved, for funding 15 students to travel to Europe in 2020, as a form of co-financial support for the student mobility besides BBChina fund. The funds were not actually used as the travel was cancelled due to the COVID-19 pandemic, but the plan for the future is to apply for the fund for international travels to UNIFI, UROS, and MDH, as soon as the travel restrictions will be removed. At SCU, the importance of the topics related to the BBChina research orientation (Program) is strongly in line with the already existing second-level disciplines (Degrees). As a matter of example, in 2013, under the school's first-level discipline catalogue "Biology", the New Energy and Low-carbon Technology Institute set up six second-level disciplines including "Biomass Energy" discipline and the Degree is presently active. The other five secondary disciplines are "Low-carbon technology and engineering", "Energy and environmental engineering", "Low-carbon and long-life building materials", "Low-carbon economy and policies", "New energy materials and devices". Thus, the contents overlap greatly with the results of the BBChina project. Though the name of the discipline "Biomass Energy" is not exactly the same as BBChina project, the goals and scope are quite similar and will be keeping to be adjusted in the context of striving to achieve the goal of "carbon neutrality" proposed by the Chinese government.

The further step for a long-term sustainability would be the establishment of a new "second-level discipline" in bio-based circular economy, i.e. the establishment of a new Master Degree said in "European" terms. As previously explained, this process needs a long time to be accomplished, and can be activated only every five-years, it requires a relatively independent professional

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knowledge system, and the university should have a team of teachers with a reasonable knowledge structure, age structure and professional technical position structure, which can provide a series of courses, research projects, required for the training of graduate students.

The issue of establishing a new “second-level discipline” has been discussed already during the PAU Meeting in Chengdu, May 2019, and the option will be taken into consideration in the next years, depending on each HEIs deadlines and available resources.

Europe-China Collaborations

Regarding the collaboration between European and Chinese HEIs, the experience of the project implementation created opportunities of collaborations and exchange that the COVID-19 Pandemic only paused.

As a matter of example, a collaboration agreement is under conclusion between the University of Florence, Department of Agricultural, Environmental, Food and Forestry Science and Technology (DAGRI) from one side and the College of Chemical Engineering and the College of Life Science on the other side. The aim of the agreement is to combine efforts and resources to develop projects of Specific Scientific and Technological Research in the biomass sector including agricultural, chemical engineering and comprehensive utilization contents. This will include academic and technical exchange in research, in professional and technological developments within the sector of the collaboration agreement. In particular the agreement foresee:

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- exchange visits of members of teaching and research staff of the involved units. Visits are intended to promote seminars, courses, conferences, lectures, to carry-out joint research projects, to discuss experiences in fields of common interest, and so forth;
- circulation of publications and information on the specific fields of study and research included in this agreement and on any other subject of relevant interest;
- student exchange for periods of study and research and other educational activities;
- exchange visits of members of technical or administrative staff when considered a profitable experience.

The details of the agreement were discussed, apart from the Project activities, during the staff mobility in Florence, in October 2019. The COVID-19 Pandemic paused the agreement finalisation, that will start once again as soon as the Travel restrictions will be cancelled, since an important part of the activities that are under the agreement foresee mobility exchanges between Europe and China.

Stakeholders role

The network established within the project with Chinese and European stakeholders (i.e. enterprises working in the biobased economy that host internships) can represent a strong basis also for EU HEIs to establish new research projects and Industry/University cooperation activities.

Companies have been involved in the network in different ways. Some of them are involved on the basis of an Expression of Interest, some others are involved since part of an already existing network with whom an agreement has been

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signed. In Particular, 5 Companies (1 European and 4 Chinese) were directly involved via the signature of an Expression of Interest, while 44 Companies were involved involved by mean of the signature of a wider Memorandum of Understanding. Therefore, a total of 49 Companies are involved as external stakeholders. The external stakeholders are also involved by specific cooperation agreements between the colleges and the non-university partners, cooperation projects committed by the companies, and annual recruiting events held by the companies (usually taking place during the period October-February).

In summary, the links established with the non-academic world will be attractive for the students and for their plans for a future career.

Beyond the Chinese HEIs

Several opportunities to promote the adoption of the Program or only part of it by other Chinese HEIs exist.

During the Panel discussion at CUE 2021, in September 2021, Prof Li Ji-hong from the China Renewable Energy and Education Union (CREEU), was invited to actively take part to the discussion. The China Renewable Energy and Education Union (CREEU) was founded in May 2013 by 22 Chinese universities with new Energy science and engineering majors. As of August 2018, the alliance has a total of 88 member HEIs, as well as relevant enterprises and publishing institutions engaged in the new energy industry. Apart from the valuable contribution to the panel discussion, the invitation of Prof Li Ji-hong had also the aim to disseminate the Project to the Union.

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The Master Program was reported and publicised by Sichuan University responsible staff as one of the annual work summary contents at the "China Renewable Energy Annual Conference". Participants in the annual meeting included Guangzhou Institute of Energy, Tianjin University, Chengdu Institute of Biology, Henan University and many other organizations and companies in the field of renewable energy.

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