



**VIU**  
Graduate  
Seminar  
**CLIMATE**  
**CHANGE**  
**MITIGATION:**  
**carbon**  
**capture and**  
**utilization**

**Climate Change Mitigation:  
Carbon Capture and Utilization**

**November 15-19, 2021**

**Venice International University  
Isola di San Servolo, Venice**

VIU Graduate Seminar

## **Climate Change Mitigation: Carbon Capture and Utilization**

November 15-19, 2021

Venice International  
University

Scientific coordinators:

Prof. Renato Baciocchi

Prof. Giulia Costa

Tor Vergata University of  
Rome

This program is a  
VIU Global Challenges  
Initiative

Finding and implementing effective climate change mitigation measures in order to stop the mean temperature increase to below 2 °C is one of the greatest global challenges that humankind must face in the next few years. The transition to a low/zero carbon energy economy is already taking place but probably only at the end of this century renewable sources will be able to provide all the energy required for power and materials production. Since during the transition fossil fuels will still be necessary to satisfy a relevant fraction of the world's energy requirements, solutions for decoupling carbon dioxide emissions from fossil fuels use are urgently in need. In this regard, Carbon Capture, Utilization and Storage (CCUS), may play a relevant role, also in view of attaining net negative emissions, which the recent IPCC special report deems necessary to limit global warming to 1.5°C.

In particular, there is growing interest toward solutions aimed at obtaining products and/or fuels using CO<sub>2</sub> instead of fossil resources as carbon source, or at converting CO<sub>2</sub> in a solid and stable form within products to be used in civil engineering applications. These strategies, besides contributing to climate change mitigation, can be considered also as clean growth approaches, as they may reduce the use of natural resources, allowing to produce goods and services in a more environmentally sustainable way. Furthermore, CCUS can be coupled to waste management strategies to obtain multiple benefits. For example: CO<sub>2</sub> may be employed as a valorization treatment for waste materials such as steelmaking slag; negative carbon emissions may be achieved by accelerated weathering of mining waste tailings that captures and stores CO<sub>2</sub> directly from the atmosphere, or by separating and storing/using the CO<sub>2</sub> content of biogas from waste anaerobic degradation processes yielding biomethane, a renewable fuel.

In addition, the recent rapid decrease in the price of renewable energy may enhance CO<sub>2</sub> utilization, since the use of renewable energy for converting CO<sub>2</sub> into high value chemicals and fuels may allow to address both energy storage and carbon management issues.

The aim of this graduate seminar is to provide the students with a comprehensive overview of carbon capture and utilization strategies with regard to their current stage of

development and implementation, focusing on scientific and technological aspects, but also environmental, social and economic sustainability issues.

Although geological storage will not be specifically addressed during the seminar, permanent storage of CO<sub>2</sub> by natural and accelerated weathering will be examined together with other utilization processes. As CO<sub>2</sub> may be used in many different applications, the seminar will have a multidisciplinary approach involving professors and students from different disciplines, from chemistry and biology, to civil, mechanical and environmental engineering, and earth science. The aim is to encourage and stimulate discussions from students from different backgrounds to allow them to individually and collectively identify synergies and possible new approaches and strategies in the developing field of CCUS.

This Graduate Seminar will be led by:

- Tor Vergata University of Rome, Italy
- Institut National de la Recherche Scientifique (INRS), Canada
- Tsinghua University, China
- KU Leuven, Belgium

### Faculty

Renato Baciocchi, Tor Vergata University of Rome

Giulia Costa, Tor Vergata University of Rome

Louis-César Pasquier, Institut National de la Recherche Scientifique

Ming Zhao, School of Environment, Tsinghua University

Tom van Gerven, KU Leuven

### Methodology

The one-week seminar is conceived as a series of lectures by participating faculty and invited speakers, followed by discussion and question time, during which the students will identify specific topics to address during the student activity session. During this latter activity, which will take place on the afternoon of the fourth day, the students will break up in groups and discuss specific topics that they have identified as critical for the development and deployment of carbon capture and utilization technologies. These discussions will be led by students and involve faculty and will be aimed at collectively

identifying a potential roadmap/pathway for the deployment of carbon capture and utilization technologies.

### Topics

- Role of CCUS within climate change mitigation strategies
- CO<sub>2</sub> capture processes (including solid sorbent-based processes)
- Strategies for achieving negative emissions: air capture and BECCS
- CO<sub>2</sub> utilization and storage
- CO<sub>2</sub> to fuels
- CO<sub>2</sub> to chemicals
- Biotechnologies and catalysis for CO<sub>2</sub> conversion
- CO<sub>2</sub> to materials: carbon mineralization
- Carbon mineralization applications in the construction sector, for industrial residues and mining residues
- Process intensification and its application for CO<sub>2</sub> capture and utilization

### Learning outcomes for participants

At the end of the course students will be familiar with technologies to separate CO<sub>2</sub> from different sources including power generation, industries and the atmosphere (direct air capture), as well as the main processes for converting CO<sub>2</sub> into valuable products such as hydrocarbons and polymers, but also calcium and magnesium carbonate based materials. The students will also understand the positive impacts deriving from the application of the proposed technologies but also the critical issues that must be addressed before their large scale adoption.



### Who can apply?

This Graduate seminar is offered to both Master's students and young researchers early in their PhD in the following fields: engineering – in particular chemical, civil, environmental, mechanical,

materials; chemistry; biology; environmental science; earth science.

This Graduate Seminar is a postponed 2020 activity. Applications are currently closed, however, should any places become available, a new call for applications will be opened.

Updated information will be available on the dedicated webpage.

### **Fees & Grant Support**

Students from the VIU member universities will pay no participation fees. Grant support is also available to support, partially or fully, the costs of international travel and accommodation.

The participation fee for students of non-member universities is Euro 1.100 VAT incl. The fee is inclusive of tuition, course materials, accommodation, lunches, social events and taxes. Students from non-member institutions are not eligible for VIU grant support.

VIU Alumni are eligible for a reduced fee.

### **Credits**

Participation in the Graduate Seminar is considered equivalent to 2 ECTS.

### **VIU Graduate Seminars**

These are thematic intensive seminars given in a concentrated period on subjects of universal interest, open to a broad spectrum of disciplines. They are suited to both Master's and PhD students and are open to candidates from all the VIU member institutions. The young researchers will receive support in defining their research proposal. Significant cooperation among departments in the member universities is expected.

[www.univiu.org/study/graduate-seminars](http://www.univiu.org/study/graduate-seminars)

*As the COVID-19 pandemic is ongoing, VIU will continue to monitor the situation, and in the event that it is not possible to confirm the program on the VIU campus as scheduled, other practicable solutions will be evaluated. Applicants and confirmed participants will be informed of any changes.*

**Venice International University** is a consortium of 20 universities, representing 15 countries throughout the world.

The mission of VIU is to foster cooperation among VIU member institutions while facilitating the exchange of knowledge and ideas, by developing, promoting and organizing joint academic, research and training/capacity-building program. Students from non-member universities may participate in selected academic programs. The academic programs at VIU are distinguished by a markedly interdisciplinary approach to the topics, and by the international perspectives that the participants contribute to the discussions. The VIU campus is on the island of San Servolo in Venice, Italy.

### **Location**



### **Venice International University**

Isola di San Servolo  
30133 Venice

Italy

T +39 041 2719511

F +39 041 2719510

E [summerschools@univiu.org](mailto:summerschools@univiu.org)

[www.univiu.org](http://www.univiu.org)