

# International Summer School on Sustainable Energy

## 2023

Shandong University  
Mälardalen University  
University of Florence  
Politechnika Wroclawska

China · Sweden · Italy · Poland

JULY 2023



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# Brief Introduction

The summer school on sustainable energy 2023 includes three programs, namely academic seminars on sustainable energy, regular course on bio-economy and international conference on energy, ecology and environment 2023. Both undergraduate and bachelor students from China, Sweden, Italy and Poland will participate the summer school.

(1) Academic seminars. This program includes 10 topics, such as hydrogen energy, energy storage for flexibility, energy policy, energy markets, energy system modelling. International scholars from China, Sweden, Poland, Italy, Denmark, and Singapore will introduce their cutting-edge academic research on sustainable energy.

(2) Regular course. The course of bio-energy and circular economy is online, students can learn the course through the website link  
<http://www.bbchina.eu/elearning/login/index.php>.

(3) International conference. The international conference on energy, ecology and environment 2023 will be held in London during August 14-18. Students can participate the conference through online meeting.



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# SCHEDULE

## 3 July

- Seminar 1** 9:00-11:00(CET)/ 15:00-17:00(BJT)  
Climate change and sustainable development  
*Victor Nian, Centre for Strategic Energy and Resources, Singapore*
- Course 1** 9:00-11:00 (BJT)  
Introduction to the bio-economy + Techno-economic analysis – I:  
Capital cost and the manufacturing cost

## 4 July

- Seminar 2** 9:00-11:00(CET)/ 15:00-17:00(BJT)  
Energy markets  
*Hailong Li, Mälardalen University, Sweden*
- Course 2** 9:00-11:00 (BJT)  
Techno-economic analysis – II: Life cycle cost and learning curve

## 5 July

- Seminar 3** 9:00-11:00(CET)/ 15:00-17:00(BJT)  
Prospects of fuel cell technologies  
*Viviana Cigolotti, ENEA - Italian National Agency for New Technologies, Italy*
- Course 3** 9:00-11:00 (BJT)  
Biomass Market – I: regional and global market, industry supply chain

## 6 July

- Seminar 4** 9:00-11:00(CET)/ 15:00-17:00(BJT)  
Flexibility of energy systems for VRE integration  
*Jakub Jurasz, Wrocław University of Science and Technology, Poland*
- Course 4** 9:00-11:00 (BJT)  
Biomass Market – II: downstream applications, electricity, heat, and transport

## 7 July

- Seminar 5** 9:00-11:00(CET)/ 15:00-17:00(BJT)  
Energy storage for shifting flexibility  
*Leonardo Nibbi, University of Florence, Italy*
- Course 5** 9:00-11:00 (BJT)  
Waste management



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# SCHEDULE

## 10 July

*Seminar 6* 9:00-11:00(CET)/ 15:00-17:00(BJT)

Advances in batteries

*Erik Dahlquist, Mälardalen University, Sweden*

*Course 6* 9:00-11:00 (BJT)

Regulations and policies – I: Standards and labels related to bioenergy and bio-based products

## 11 July

*Seminar 7* 9:00-11:00(CET)/ 15:00-17:00(BJT)

Small World AI- A Modular Metacognitive Digital Twin System for Greener Cities & Cleaner Mobility

*Haoran Zhang, Peking University, China*

*Course 7* 9:00-11:00 (BJT)

Regulations and policies – II: Control of waste and pollutant emissions

## 12 July

*Seminar 8* 9:00-11:00(CET)/ 15:00-17:00(BJT)

Hydrogen energy

*Ronald Wennersten, Shandong University, China*

*Course 8* 9:00-11:00 (BJT)

Bioenergy financing

## 13 July

*Seminar 9* 9:00-11:00(CET)/ 15:00-17:00(BJT)

Mastering complexity of large-scale energy system modeling

*Alexander Kies, Aarhus University, Denmark*

*Course 9* 9:00-11:00 (BJT)

Business model & Green market

## 14 July

*Seminar 10* 9:00-11:00(CET)/ 15:00-17:00(BJT)

Team-based presentation: Our dreaming future energy systems

*Course 10* 9:00-11:00 (BJT)

Circular economy



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# SUMMER SCHOOL

Seminar 1

## ON SUSTAINABLE ENERGY



### Climate Change and Sustainable Development

Speaker: Victor Nian

Time: July 3

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Dr Victor Nian is the Chief Executive Officer of the Centre for Strategic Energy and Resources, an independent Think-and-Do Tank with a global headquarter in Singapore. Dr Nian has been a career advocate for energy transition and sustainable development with a vision of building clean energy ecosystems for empowering and accelerating the global energy transition effort in an equitable way across countries and regions in the world. Dr Nian brings onboard a suite of expertise in energy and sustainable development, especially in policy and strategy, nuclear energy, energy transition and net-zero pathways, technology road mapping, hydrogen economy, and maritime energy transition, among others from his experience in advising public and private organizations on those subject matters. He is recognized as one of the go-to-persons on nuclear energy and sustainable energy related issues in Southeast Asia.

#### Lecture description:

As recently seen in the 26th Climate Change Conference, policymakers are increasingly discussing the role of nuclear and renewable energy in achieving the Sustainable Development Scenario. Renewable and nuclear energy, along with changes in consumer behavior, can enable the zero-emission target by 2100 set by the Intergovernmental Panel on Climate Change. With the fast-rising energy demand, the dominance of fossil energy, and the urgency to address self-sufficiency, high and potentially rising fossil energy prices due to geopolitical turbulence, and net-zero targets, many countries are turning to alternative energy options. This lecture on future sustainable energy ecosystems will discuss topics on the various energy options, energy transition pathways, and policy and strategic issues around energy and sustainability.



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## ON SUSTAINABLE ENERGY

Seminar 2



### Energy Markets

Speaker: Hailong Li

Time: July 4

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Dr. Hailong Li is a professor at Future Energy Center, Mälardalen university, Sweden. His research interest mainly lies in the development of innovative low carbon emission energy technologies, including both renewable energy and CO<sub>2</sub> capture and storage as a major topic. He has been leading and involved in some projects funded by EU, Swedish energy agency and Swedish knowledge foundation. Prof Li has published more than 100 scientific articles in peer reviewed journals and international conferences, with an H-Index of 53 (Google scholar). He is currently serving as associated editor of Applied Energy (IF: 9.746, 2021) and the senior editor of e-Prime – Advances in Electrical Engineering, Electronics and Energy. Prof Li has been leading the organizing committee of International Conference on Applied Energy (ICAE) since 2018. He is also the member of scientific committees of ICAE and Applied Energy Symposium: Low Carbon Cities & Urban Energy System (CUE) since 2018.

### Lecture description:

The increasing penetration of intermittent renewable energy has caused huge challenges in the modern power system, which make the balance of energy supply and demand extremely difficult. Energy prices have been considered as an effective measure to regulate the energy supply and demand. Usually, the price is determined by the market. In order to optimize the operation of energy systems and develop new business models to promote the commercialization of newly developed energy technologies, it is of importance to understand how different energy markets work. This lecture gives a brief introduction about the markets related to energy, such as electricity market, heat market, and gas markets, including natural gas, CO<sub>2</sub> and H<sub>2</sub>. It contains basic concepts, trading mechanisms and price models.



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**Seminar 3**

## ON SUSTAINABLE ENERGY



### Prospects of Fuel Cell Technologies

Speaker: Viviana Cigolotti

Time: July 5

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Viviana Cigolotti. Head of Laboratory for energy storage, batteries and hydrogen production and utilisation technologies in ENEA, Italian National agency for new technologies, Energy and sustainable economic development. She received her PhD in Industrial Engineering in 2009 from University of Naples Federico II (Italy). Her PhD research focused on the use of alternative fuels from biomass and waste for stationary applications. Her research activities focused on the study of hydrogen and fuel cell technologies for different applications and uses cases, integration of FCH in real ecosystems as island and ports. Her main experience is in hydrogen production, hydrogen storage and use in stationary applications and for mobile and / or transportable applications. She is coordinator and participant in several National and European projects focused on the implementation of Hydrogen and Fuel Cell technologies in different applications and in different environments.

#### Lecture description:

Hydrogen has emerged as a new energy vector. It can help tackle various critical energy challenges. It offers ways to decarbonise a range of sectors, mobility, stationary, chemicals, and iron and steel. It can also help improve air quality and strengthen energy security. Technologies already available today enable hydrogen to produce, store, move and use energy in different ways.

In this context, fuel cells are regarded as the most promising energy-conversion strategies for the sustainable energy development. Considering the energy crisis and fast economic growth, the demand for clean alternative power sources for applications in stationary, transportation, and the portable sectors is increasing continuously. In this regard, fuel cell technology has already proved its potency as an alternative power unit for several applications.

FC technologies can be categorized according to the nature of the electrolytes, including low-temperature proton-exchange membrane fuel cells (PEMFCs), alkaline fuel cells (AFCs), phosphoric acid fuel cells (PAFCs) to high-temperature molten-carbonate fuel cells (MCFCs) and solid-oxide fuel cells (SOFCs).



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## ON SUSTAINABLE ENERGY

**Seminar 4**



### Flexibility of Energy Systems for VRE Integration

Speaker: Jakub Jurasz

Time: July 6

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

PhD title awarded by AGH University (Poland) in 2016. Later on, a postdoctoral researcher at MDU University (Västerås, Sweden). Currently an assistant professor at Department of Environmental Engineering (Wrocław University of Science and Technology). Dedicated researcher and lecturer with 7+ years of experience in the field of energy engineering. Experienced in teaching undergraduate and postgraduate students in area of environmental engineering, simulation, optimization, renewable energy sources and water-food-energy nexus. Passionate about linking modern science and concepts of the economy and environment applied to the ancient civilizations in particular Western Roman Empire.

#### Lecture description:

Join us for a lecture that delves into the exciting world of renewable energy and its seamless integration into our power systems. In this captivating session, we will unravel the untapped potential of flexibility within energy systems, paving the way for a sustainable and efficient future. "The Flexibility of Energy Systems for VRE Integration" explores the game-changing role of Variable Renewable Energy (VRE) sources, such as solar and wind power, and the innovative strategies to maximize their integration into the grid. With VRE becoming increasingly dominant, we face the pressing need to adapt our energy infrastructure to accommodate their intermittent nature. Discover how advanced energy storage systems, intelligent demand response mechanisms, and smart grid management techniques unlock the true potential of VRE integration. Immerse yourself in the captivating discussion on the benefits and challenges of integrating VRE into existing power systems. Gain insights into the flexibility measures that facilitate the seamless balancing of supply and demand, ensuring a stable and reliable energy grid even during periods of peak demand or low VRE output. Don't miss the opportunity to be part of this engaging lecture that redefines the future of energy systems. Join us as we explore the boundless possibilities of VRE integration, shaping a sustainable world powered by renewable energy. Together, let's harness the flexibility of our energy systems and propel ourselves into a greener, cleaner, and more resilient future.



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# SUMMER SCHOOL

Seminar 5

## ON SUSTAINABLE ENERGY



### Energy Storage for Shifting Flexibility

Speaker: Leonardo Nibbi

Time: July 7

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Leonardo Nibbi, PhD in Industrial engineering, is currently a grant researcher at the Department of Industrial Engineering of the University of Florence. His experience in the field of renewables, started in 1999 and, although initially dedicated to biomass energy supply chain logistics with particular attention to the use of the GIS tool for its correct planning, has extended over the years to all the problems related to biomass (estimation of productivity, conversion technologies, sustainability etc.) and also wind energy (wind resource measurement and assessment, and micrositing). He is presently working on the storage and integration of Variable Renewable Energy into the energy systems. He is also EU Grants & Fundings R&D at the RE-CORD Research Centre, Italy, and a lecturer for "Wind Energy" at the Technische Hochschule "Georg Simon Ohm" Nürnberg, Germany.

### Lecture description:

Several countries at the global level set up ambitious decarbonisation targets, whose achievement relies on the large-scale deployment of variable renewable energy sources (VRES), such as wind and solar. High penetration of VRES may lead to balancing problems on the grid, which can be compensated by increasing the flexibility of the system, e.g., installing additional electricity storage for the so-called shifting flexibility. Starting from the role of Offer and Demand on the Grid, the concept of flexibility, and supply and demand, balancing will be presented and discussed, together with the ancillary services necessary to ensure stable and reliable electric power. The lecture will present the most advanced storage solutions, apart from battery storage which will be the focus of a specific seminar, able to provide the necessary shifting flexibility, including a specific focus related to the European and Chinese scenarios.



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## ON SUSTAINABLE ENERGY

Seminar 6



### Advances in Batteries

Speaker: Erik Dahlquist

Time: July 10

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Started work at ASEA/ABB Research Sept 1975 in Nuclear power. Technical PM for development of Cross Flow Membrane filter and ABBs Black Liquor Gasification project. 1992- 1995 Department manager at ABB Corporate Research. 1996-2002 General Manger for the Product Responsible Unit “Advanced Control, Diagnostics, Optimization, Process Simulation in Pulp and paper” globally within ABB. Adjunct professor KTH. Chair professor at Malardalen University since 2000. Have built the research profile Future Energy with focus on process development and energy efficiency improvements including AI technology. Dean of faculty 2004- 2007. Member of editorial board for Journal of Applied Energy since 2007. Member of Swedish Royal Academy of Engineering (IVA), since 2011. Chairman IVA department Electrical Engineering 2023- . Coordinator EU Horizon 2020 project FUDIPO on learning systems for process industries. Strong focus on battery modelling and development and second life of batteries last 10 years. 20+ patents and 300+ Scientific publications.

#### Lecture description:

Batteries have been used for more than 150 years. At the end of the 1900th century even electric cars were almost as common as internal combustion vehicles, but lost the fight as Ford started to produce cheap cars. Still batteries have been used for many other applications and we all have them in our mobile phones and laptops and many other appliances. Today Litium ion batteries are the most common, but earlier we first had the lead-acid batteries in the vehicles. For many other small scale applications alkaline batteries with potassium hydroxide in the electrolyte and reactions at electrodes of zinc metal and manganese dioxide, nickel and cadmium, or nickel and hydrogen. In this overview we will discuss the different type of batteries – how they work and what they are used for. Examples of applications are combinations with renewable energy like solar power and wind power, use in vehicles and in different appliances.



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## ON SUSTAINABLE ENERGY

Seminar 7



### Small World AI- A Modular Metacognitive Digital Twin System for Greener Cities & Cleaner Mobility

Speaker: Haoran Zhang

Time: July 11

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Haoran Zhang, Assistant Professor at School of Urban Planning and Design, Peking University. He got double bachelor's degrees in Industrial Engineering and Economics, and double Ph.D. degrees in Industrial Engineering and Sociocultural Environment Studies. He has published about 125 journal articles, with 80 ones as first/corresponding authors. He is the editor-in-chief of Handbook of Mobility Data Mining (3 volumes) and Big Data and Mobility as a Service. He is also the subject editor of Advances in Applied Energy. He led Small World AI project incubation, which received the 2021 Smart 50 Awards and 2021 R&D 100 Awards (IT/Electrical category). In 2020, he received the project of Leading Initiative for Excellent Young Researchers supported by the Ministry of Education, Culture, Sports, Science and Technology, Japan.

#### Lecture description:

Digital twin technology can improve the level of refined and intelligent management of cities, and has wide applications in urban planning, epidemic and disaster prevention, smart logistics, and sustainability assessment. Cell phone mobile data, as a more accessible fine-grained data set at the city level, has high mining value. However, the seemingly massive and huge cell phone mobile data actually contains serious problems such as sample scarcity, sampling bias, and heterogeneous errors. Then, how to simulate the real "big world" based on the "small world" constructed by the rough cell phone data and guided by the physical constraints of urban population movement behavior becomes one of the research bases of the digital twin city. This talk will focus on our recently built small world AI model - cell phone mobile data processing and analysis system, and its application to smart stations, smart energy and urban sustainability indicators assessment.



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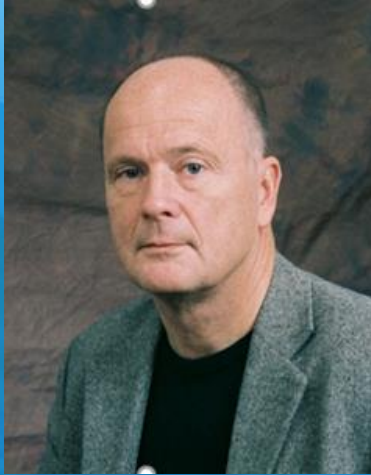


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## ON SUSTAINABLE ENERGY

Seminar 8



### Hydrogen Energy

Speaker: Ronald Wennersten

Time: July 12

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Ronald Wennersten, has earlier served as professor in KTH Royal Institute of Technology, Sweden, and now he is the Chair professor in Industrial Ecology, Shandong University. He is China's national distinguished professor. He proposed the theory of Industrial Ecology at the end of the century, and founded the department of Industrial Ecology at KTH Royal Institute of Technology. He served as a consultant to the international Society of Industrial Ecology, and an advisor to the United Nation's 2030 agenda for sustainable development, the Chair of the Swedish Association for Sustainable City Development.

### Lecture description:

The use of electricity is increasing in the transport sector, industry, and for heating/cooling. Electricity is not a primary energy source but just an energy carrier. In order to produce electricity without utilizing carbon sources, and thus emitting carbon dioxide, we have to turn to non-fossil sources. These can be nuclear energy, hydro power, wind power, and solar power. The introduction of variable sources like wind and solar power implies challenge 's for the power grid. A solution for this is to store the electricity energy in some way as batteries or as chemical energy like hydrogen. The use of hydrogen produced from renewable power sources will be discussed and compared to other solutions. Important aspects are cost and energy efficiency.



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Seminar 9

## ON SUSTAINABLE ENERGY



### Mastering Complexity of Large-Scale Energy System Modelling

Speaker: Alexander Kies

Time: July 13

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

Alexander Kies is an esteemed Associate Professor of Electrical Energy Technology at Aarhus University and an Honorary Associate Professor at the University of KwaZulu-Natal. Specializing in energy system modelling and analysis, his cutting-edge research has earned him international acclaim, with his publications receiving around 2000 citations. His pioneering work, often featured in top-tier journals, continues to shape the landscape of sustainable energy solutions and inspires the next generation of researchers in the field. His commitment to the advancement of electrical energy technology is paving the way for more sustainable and efficient global energy systems.

#### Lecture description:

Climate change is a central challenge of humanity. To tackle this challenge, energy systems need to transform. Policy advice for the energy transition is based on energy system models that are becoming increasingly complex and are notoriously hard to solve. These energy models model various parts of the energy system such as different types of generators, transmission infrastructure or storage element and can investigate competing concepts (such as wind energy + transmission grid reinforcements vs. solar energy + batteries) with respect to objectives like cost, reliability and sustainability.

In this lecture, we will see

- how large-scale energy system models are build,
- how they can be used
- discuss their complexity and ways to approach the complexity challenge
- show a variety of different applications
- discuss results and their implications.

After the lecture you will be able to understand how large-scale energy system modelling works and what the challenges in this particular field of research are.



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# SUMMER SCHOOL

**Seminar 10**

## ON SUSTAINABLE ENERGY

### Team-based Presentation

#### Our Dreaming future Energy System

Participants: all students + professors

Time: July 14

09:00-11:00 (CET)

15:00-17:00 (BJT)

Zoom meeting ID: 665 3182 2261

Passcode of meeting: 2023

#### **Task description:**

The last seminar will be a team-based discussion and presentation. Students from different countries and universities will be divided into several teams to discuss their dreaming scenario of future energy system. Several professors will join in the discussion and give some comments on their presentation.



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## ON SUSTAINABLE ENERGY

Course

### Bioenergy and Circular Energy

To cope with the rapid depletion of many resources, increasing environmental pressures, and climate change, the world needs to establish a bioeconomy that reduces fossil fuel dependence and improves economic and environmental sustainability.

This course will provide the principles for understanding the bio-based economy and introduce to the students how to analyze the impacts of energy and environmental policies on the demand and supply of different types of bio-based products, with a special focus on bioenergy-related products.

Students can acquire compulsory knowledge in the field of energy, economy and environment engineering.

#### Content of the course:

- **Economic analysis**
  - Capital cost and manufacturing costs
  - Time value of Money, and equivalence
  - Depreciation, inflation, and taxation
  - Cash flow, payback period, and life cycle cost
- **Market**
  - Supply and demand
  - Business model
  - Excludability and rivalry
  - Productive and growth
- **Regulations and policies**
  - Control of waste and pollutant emissions
  - Incentive strategies
- **Circular economy and Green market**

#### Webpage of the course:

<http://www.bbchina.eu/elearning/login/index.php>



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Conference

## ON SUSTAINABLE ENERGY



ICEEE 2023

The International Conference on Energy, Ecology and Environment

Clayton Hotel Chiswick, London, United Kingdom

Aug 14-18, 2023

## International Conference on Energy, Ecology and Environment 2023 (ICEEE 2023)

The International Conference on Energy, Ecology and Environment 2023 (ICEEE2023) will be held in London, UK, during August 14-18, 2023. ICEEE2023, with a theme of New Energy, New Ecology and New Environment, is a restart of the conference. Due to the COVID-19 pandemic, ICEEE was temporarily suspended in last three years, finally it is coming this year! The pandemic has deeply affected and changed the whole world, and brought us new challenges and opportunities in energy, ecology and environment. ICEEE will create such a forum for scientists, researchers, engineers and government officials home and abroad with cross-discipline concerning energy shortage, ecosystem degradation and environment deterioration, coming together to discuss and present the latest technology, new environmental policies as well as future direction and trends in energy, ecology and environment.

**Conference Chair:** Prof. Coffman DMaris, University College London, UK

**Conference Co-chair:** Prof. Bin Chen, Beijing Normal University, China

**Date:** August 14-18

**Location:** London, United Kingdom

**Website:** <https://iceee.info/>



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