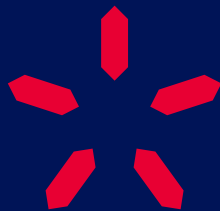


Connect. Exchange. Innovate.



# Water, Energy, Food and Environment Nexus

WEFE



TU Delft  
ETH Zurich  
RWTH Aachen  
Chalmers  
Politecnico di Milano

Want to know more?  
[idealeague.org/wefe](http://idealeague.org/wefe)

# About

## IDEA League

The IDEA League, a strategic alliance between five leading European universities of science and technology, believes that we have the power to shape the future. By joining forces, we will create valuable connections that inspire innovation and the pursuit of ambitious goals towards sustainable and inclusive development.

Through cross-border, bottom-up format the IDEA League provides the platform for students, researchers and staff at partner universities to share a collective wealth of knowledge, experience and resources. By doing so, we aim to connect and inspire a new generation of science and technology graduates, champion innovation and entrepreneurship and steer Europe towards a more competitive and compassionate future.

Each member of the IDEA League strategic alliance is an internationally renowned, research-oriented university and is the largest producer of science and engineering graduates in its own country. The five members of the IDEA League are RWTH Aachen University, Chalmers University of Technology, Delft University of Technology, ETH Zürich, and Politecnico di Milano.

## Collaboration

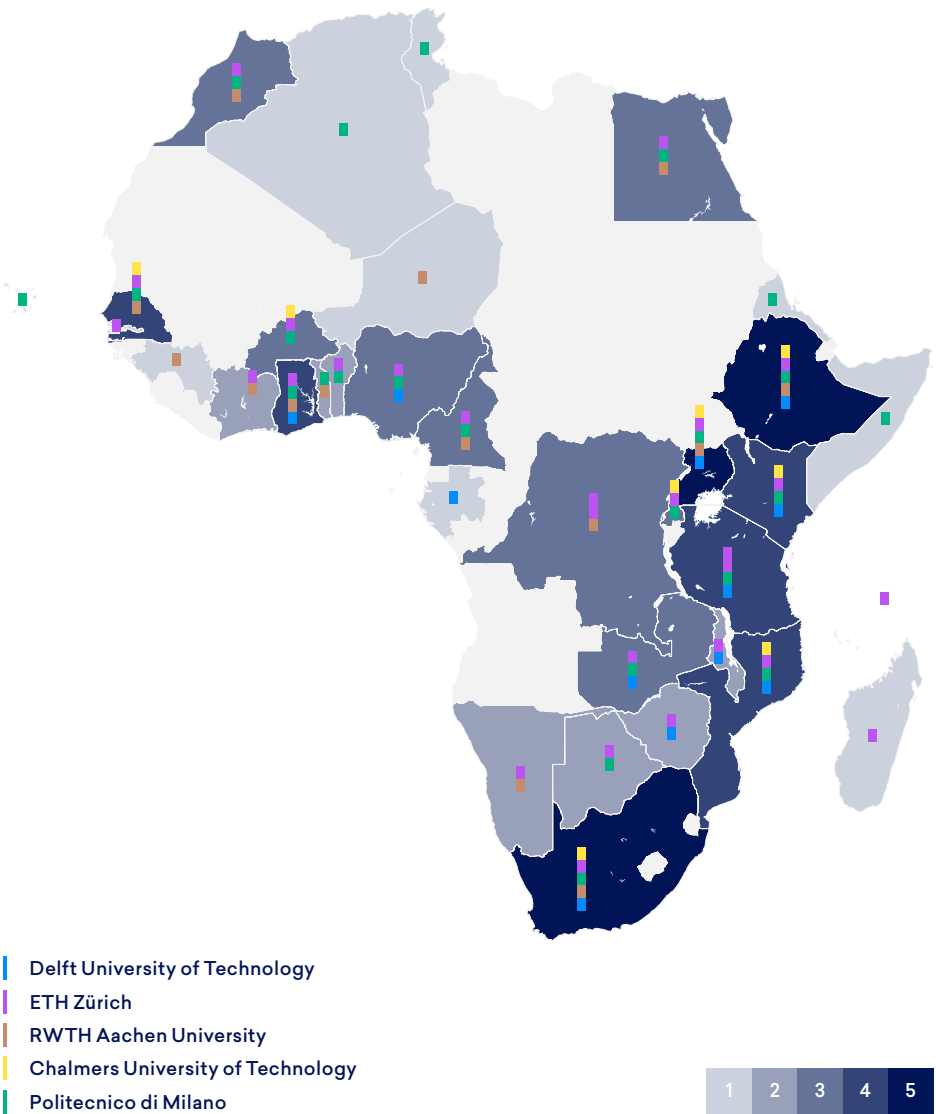
Similar to joining forces between European universities, each IDEA League university is already collaborating on research and education with universities in Africa (Figure 1).

Going forward, the members of the IDEA League aim to expand their collaboration with African partners in a spirit of co-creation, innovation and learning from each other.

## Partner universities

The Water, Energy, Food and Environment (WEFE) School is a collaboration between IDEA League member universities and Addis Ababa University, Eduardo Mondlane University, University of Ghana, University of Johannesburg and Stellenbosch University.

**Figure 1 / Where IDEA League universities collaborate with African universities**  
Number of collaborations per country



# The Nexus

Around a seventh of the world's population lacks a secure food supply and has only limited access to clean water, sanitation or modern sources of energy. To tackle this challenge, resources need to be managed and more integrated to avoid over-exploitation and allow more inclusive access for all. The WEF Nexus provides an innovative framework that captures the interrelationships, synergies, and trade-offs between water, energy, and food demand (and supply) in different environmental contexts.

African communities in particular are affected by the availability of water resources for agricultural activities and food production. Poverty correlates directly with this type of energy supply. Energy is provided mainly by biomass through firewood and agricultural residues, which implies further deforestation. These factors increase the pressure on existing forest areas both for the reclamation of new agricultural land and for the production of firewood. More renewable energies could reduce the extent of deforestation. The high deforestation rate reduces the infiltration rate and recharge of underground and increases surface run-off. The latter is leading to higher erosion and loss of soil fertility, thus influencing agriculture and food security negatively.

The “Nexus” can be defined as the place where water, energy and food security intersect. It focuses on the interdependencies between these three elements and provides a framework for allocating and using resources to ensure water, energy and food security for an ever-growing population at a time of climate change, land use transformation and economic diversification.

Therefore, a deep understanding of the interrelationships between water, energy, food and the environment and how they impact ecosystems is key to achieve sustainable development in Africa and globally. Developing integrated management scenarios is necessary to implement the nexus framework in Africa, which requires collaboration between different stakeholders from all disciplines. For the new generation of researchers to develop nexus related solutions, they must develop a common language and acquire the skills necessary to work together.

**Figure 2**  
 Concept of the summer school

	Challenges	Methods	Case Studies
Global			
Basin			
National			
Local			

The summer school will introduce junior researchers to the interdependencies and interconnectedness of the nexus elements at different geographical levels (Global, Basin, National and Local). The tools for managing and assessing these elements and resources will be illustrated. Case studies will be used to demonstrate how the nexus approach could be implemented in different African countries.

At the global level, the nexus helps to address global challenges such as achieving the United Nations Sustainable Development Goals (SDGs) and the goals proposed in the Paris Agreement under the United Nations Framework Convention on Climate Change. At the basin level, the nexus provides an integrated approach for the transboundary water challenges between different nations (e.g. transboundary rivers). At the national level, the nexus helps policy makers to secure any of the three most valuable resources

while considering the others. At the local level, the nexus will be considered from a technological perspective, such as the integration of renewable energies and water treatment/desalination for food production.

At each geographical level, multiple combinations of integrating the nexus elements will be considered. Selected methods and approaches for managing and assessing the integration of different nexus elements at different levels will be covered in the school sessions. At least one case study including tools will be introduced at each level.

## Challenges

At the planetary level, WEFE relationships tend to become more complex and thus less measurable and tangible, but global flows of resources can be conceptualised and mapped. Given the entanglement of these flows with complex cultural, political and economic systems, the traditional lens of purely technological solutions is not enough to understand, let alone to effectively address the WEFE nexus challenges. Issues of governance, justice and cultural sensitiveness come to the fore.

## Methods

Approaches to investigating these challenges include examining the governance of the WEFE systems and the meta-governance of the nexus, the circular economy and the WEFE Nexus index.

## Case studies

- Transforming rural livelihoods and well-being in Southern Africa
- Food security in South Africa
- WEFE nexus innovations from European countries



# Trans-boundary River basin level

## Challenges

At the river basin level, the Nexus challenges are shaped by the global context, but the influence of basin management decisions is felt at all scales from basin down to the local level. For transboundary basins, the international cooperation aspect becomes prevalent, as riparian countries have to integrate not just their water/energy/food/environment needs within the basin, but also within the context of their national needs and strategies for sustainable development. Developing and maintaining robust quantitative tools (at all relevant scales with the basin), in order to design and inform future infrastructure developments and management strategies are the primary challenge at this scale.

## Methods

The approach is based on the principles of the Participatory and Integrated Planning and Management of Water Resources, which emphasizes the role of stakeholders throughout the process of formulating and selecting the most interesting and sustainable development pathways.

## Case studies

- Zambezi River Basin
- Omo-Turkana Basin





## Challenges

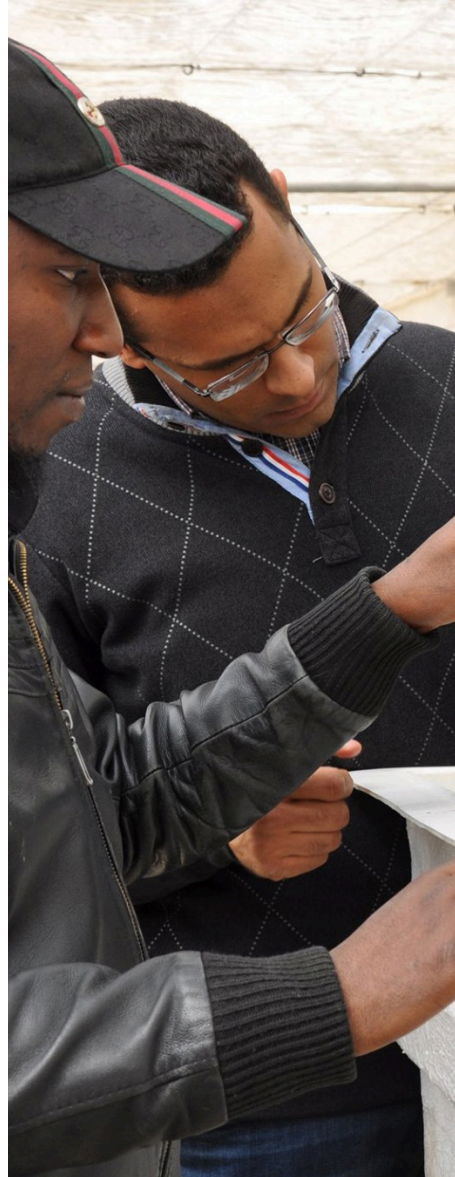
The WEFE nexus is increasingly used for policymaking to address complex grand challenges that require a multi-disciplinary approach, such as the United Nations Sustainable Development Goals (SDGs). While policy for resources must be developed at the national level, it is also dependent on regional cooperation. Access to food and water resources is unequal across countries and within countries, which is especially true in South Africa, where the geographical area with the greatest food production is the same area that produces the majority of the country's energy.

## Methods

Methods of tackling these challenges include catchment management, exploring drinking-water management and treatment options, and conducting a health risk assessment.

## Case studies

- Olifants and Berg Rivers (RSA)
- Atlantis (RSA)
- Göthenburg (SWE)







## Challenges

Small-scale farmers constitute an important segment in the economies of Africa as they help in addressing food and nutrition insecurity, unemployment, whilst ensuring socio-economic cohesion on the continent. Their farming is based on traditional and basic techniques. Therefore, their farm outputs are relatively very low. An improvement in the productivity of small-scale farmers in Africa is one of the surest routes among others, in achieving self-sufficiency in food on the continent.

## Methods

On this level, the focus will be on supporting small-scale farmers technically to maximize productivity through: introducing aquaculture-agriculture integration to enhance the efficiency of consumed water (i), using various crop varieties that are more tolerant to different environmental conditions and/or salt stress to have a higher productivity as well as early maturity (ii).

## Case studies

- Aquaculture-Agriculture Integration
- Desalination Technologies using Solar Energy
- Aquaponics and Sandponics

# Program

	Thursday 21/10/2021	Friday 22/10/2021	Wednesday 27/10/2021	Thursday 28/10/2021	Friday 29/10/2021
09:00 - 10:30	WEFE School Opening IDEA League Partners	Approaches: Green Economy	Transboundary river basin management in a changing world: challenges and opportunities	Downscaling techniques for climate scenarios and strategic vs high resolution modelling of the WEFE nexus	Interactive session on the Zambezi and Omo-Turkana basin case studies
	30 minute break	30 minute break	30 minute break	30 minute break	30 minute break
11:00 - 12:30	Introductory module: WEFE Nexus state of affairs Introductory module: Trade- offs and impacts	Approaches: Values, Ethics and Justice	A decision-analytic framework to support participatory and integrated transboundary river basin planning	Energy modelling and issues at the river basin scale	ICT tools to support decision-making and negotiations
	90 minute break	90 minute break	90 minute break	90 minute break	90 minute break
14:00 - 15:30	Approaches: Systems Governance and meta- governance	Case study: Southern Africa / Europe	Drivers of change in trans- boundary river basins	International water law and treaties	WEFE Nexus in the Zambezi and Omo-Turkana basins: from models to negotiations
	Thursday 04/11/2021	Friday 05/11/2021	Saturday 06/11/2021	Thursday 11/11/2021	Friday 12/11/2021
09:00 - 10:30	Catchment management	Drinking-water management, treatment options	Health risk assessment	Plant Breeding for Climate Smart Crops Development	WEFE Nexus at Local Level
	30 minute break	30 minute break	30 minute break	30 minute break	30 minute break
11:00 - 12:30	Catchment management	Drinking-water management, treatment options	Evaluating and prioritising mitigation measures	Building resilient and robust food systems for a hungry, growing and changing world	Aquaculture-Agriculture Integration
	90 minute break	90 minute break	90 minute break	90 minute break	90 minute break
14:00 - 15:30	Catchment management	Health risk assessment	Evaluating and prioritising mitigation measures	Entrepreneurship for addressing water, energy and food scarcity	Closing Session

# Practical

## Approach

The WEFE Nexus School offers students the possibility to gain a comprehensive understanding of the interconnections between water, energy, food and the environment and to develop new ideas for sustainable solutions. In addition to acquiring theoretical knowledge, a focus is placed on practical solutions and case studies that enable participants to apply their knowledge and foster interdisciplinary collaboration between people from different backgrounds.

The WEFE Nexus School brings together students and faculty of European and African universities for a unique learning experience. Students will benefit from the wide range of expertise and diverse perspectives on pressing challenges and emerging solutions. The diversity of case studies allows students to explore the WEFE Nexus in different geographic contexts.

## Intercultural learning

The coming together of students and faculty from ten universities provides a chance not only to engage in an academic exchange but also to learn from each other's cultures. The school's programme supports intercultural learning through a social kick-off event where students have the chance to (virtually) introduce their university, regular "open coffee hours" where students can discuss topics and ask questions outside of the academic setting and two workshops on intercultural skills and working in diverse teams.

## Format

This summer school will be held digitally. In order to ensure social and intercultural engagement, several team-building and more casual social activities are planned.

## Goals

- Preparing junior researchers to deal with the scarcity of resources
- Understanding the interrelationships between water, energy, food and environment
- Understanding the WEFE challenges and solutions at different geographical levels
- Getting introduced to different tools necessary to deal with WEFE challenges
- Bringing researchers from different backgrounds to foster teamwork for solving multidisciplinary problems

## Who can apply?

MSc and/or PhD researchers from IDEA League or African partner universities that:

- Operate in a WEFE (Water/Energy/Food/Environment) related field.
- Are willing to extend their knowledge about the WEFE Nexus and interdisciplinary research.
- Are motivated to engage with integrated approaches and system thinking.
- Have excellent communications skills.
- Are able to clearly communicate in spoken and written English.

## Certification

Participants will receive a certificate of participation issued by IDEA League at the end of the school. To receive this certificate, participants have to attend all live sessions as outlined in the program.

## Application requirements

- Curriculum vitae & publications list
- Letter of motivation
- Letter of recommendation (optional)

## Registration

Eligible MSc and PhD students from IDEA League and African partner universities can apply before 06.09.2021 - 12:00 (CEST) through our website:

<https://idealeague.org/wefe>



Connect. Exchange. Innovate.

The IDEA League offers you the chance to be a part of something bigger. We believe that combining the strength of five leading European universities of science and technology creates unique opportunities to connect, to be inspired and to innovate.

Joining IDEA League is a fun and rewarding experience where you can learn from each other, develop friendships and broaden your professional network.



Want to know more?  
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