

The Netherlands  
Member of ICHMT, AIHTC, EOROTHERM  
(1) Overview

(Central European Time, CET: UTC+1, Population: 17.5 million)

## 1. Major Societies



The Netherlands has one large society for all engineering disciplines: the **KIVI** (Koninklijk Instituut voor Ingenieurs). KIVI has 40 divisions, such as **energy and heat technology**, process technology, mechanical engineering. The **energy and heat technology division of KIVI** organizes several small-scale symposia per year on a large variety of specific topics.

Most of Dutch scientists and engineers in heat and mass transfer from the Dutch universities belong together with the scientists in fluid mechanics to the **J.M. Burgerscentrum**.



The **J.M. Burgerscentrum** is the national research school for fluid mechanics. About sixty professors with their groups with a total of 120 senior scientific staff participate in it. With the combined knowledge, skills and facilities of these research groups the JMBC offers a very stimulating, multidisciplinary environment for advanced research in fluid mechanics and heat transfer and for the education of talented graduate and postgraduate students. At present more than 350 PhD-students and 60 postdocs participate in the JMBC. JMBC has contact groups on multiphase flow, CFD, combustion, Lattice-Boltzmann techniques, turbulence, experimental techniques, biological fluid mechanics and microfluidics.

Next to the contact group on combustion within the JMBC in the Netherlands there is also a national section of the Combustion Institute. The main event organized by the Dutch Section is the annually 1-day symposium "Combura" in cooperation with the Dutch Section of IFRF "Nederlandse Vereniging voor Vlamonderzoek" (NVV).

## 2. Major Meetings

The **Burgers Symposium** is the national meeting of the J.M. Burgerscentrum. This is an annual 2-day event at the end of May or early June, with about 200 participants. The program consists of a mix of invited lectures given by (foreign) senior scientists and short presentations by the PhDs from the J.M. Burgerscentrum.

**COMBURA**, the national meeting of the Dutch section of the Combustion Institute (CI). This is an annual 2-day meeting in November with about 60 participants. The program consists of a few invited lectures given by (foreign) senior scientists and lectures from Dutch members of the CI.

## 4. Education (Undergraduate/Graduate School)

- Elementary School, 6 years; High School, 6 years; Bachelor program of 3 years; Master program of 2 years.
- After High School, there is an alternative choice for a HBO (Hoger BeroepsOnderwijs: Higher Professional Education), sometimes called a University of Applied Sciences leading to a bachelor title in 4 years. Since a few years, some HBOs also offer a limited number of Master programs.
- There are 11 regular universities, of which 3 (Delft, Eindhoven and Twente) are technical universities with engineering faculties. The universities of Wageningen and Groningen offer a restricted number of engineering programs.
- There are 37 HBOs.
- All programs start early September, and are divided either in semesters or in quarters.
- All Bachelor and Master programs at the regular universities use the English language. This has led to a large inflow of foreign students in our programs.
- Most of the Bachelor programs at the HBOs use the Dutch language.
- After a Master program our students have the option to apply for a 4-years PhD program.
- In the engineering faculties there still is a severe gender imbalance with a low percentage of female students.

## 5. University System

- Most universities are based upon research groups, which each have one or more full professors (chairs) and some associate and assistant professors, in which part of the latter have a tenure track position.
- The educational part of some of the PhD programs is organized in national research schools, such as the J.M. Burgerscentrum.
- The retirement age in the Netherlands gradually increases towards 67 in the year 2024.

## 6. Foundations of Scientific Research

- Dutch research council NWO (Nederlandse Organisatie voor Wetenschappelijk Onderzoek).
- The ministry of economic affairs sponsors cooperation between research institutes/universities and industry in 10 top sectors. One of these top sectors is Energy.
- There are ample possibilities for research funding by programs of the European Union.

## 7. Major Public/Private Research Institutes

- TNO - Netherlands Organization for Applied Scientific Research
- ECN - Energy Centre Netherlands
- Marin - Maritime Research Institute Netherlands
- Deltares - National Research Centre for Water and Subsurface
- NLR - National Aerospace Laboratory
- ISPT - Institute for Sustainable Process Technology

## 8. Addendum

The Netherlands is member of the AIHTC, where it also represents Belgium, Luxembourg, Denmark, Finland, Sweden and Norway

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**The Netherlands, Member of ICHMT, AIHTC, EURO THERM (2)**

**1. Digital Teaching Heat Transfer with HeatQuiz**  
 Wilko Rohlfis and Reinhold Kneer

**2. Report on 1<sup>st</sup> Eurotherm Seminar on caloric heating and cooling**  
 Mina Shahi, Ekkes Brück, Muhammet S. Toprak

**1. Teaching Heat Transfer with HeatQuiz**



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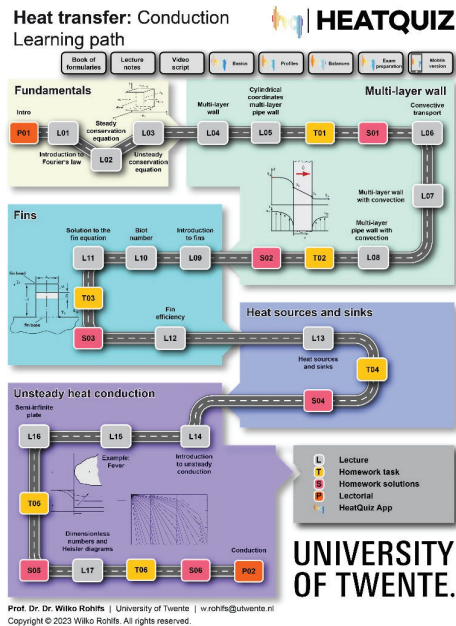
In recent years, there has been a significant increase in interest in digital teaching concepts. Online platforms such as "EDX" and "LinkedIn Learning" are now widely popular tools for education, extending beyond primary education. These platforms provide access to high-quality education from anywhere in the world, making education accessible to people who may have previously had limited access. Moreover, online and hybrid teaching methods have become the norm for active university students, particularly in light of the COVID-19 pandemic.

The online platform HeatQuiz, developed collaboratively by RWTH Aachen University (Germany) and the University of Twente, offers a comprehensive self-study course covering the topics of heat and mass transfer, as well as thermodynamics. It is freely accessible and uses a visual learning path to guide learners through a series of micro-lectures, quiz questions as well as tutorial questions with solutions. It also provides access to classical lecture notes, and a book of formularies. While HeatQuiz is designed for self-directed learning, it also forms the basis of a flipped classroom concept for large courses (with 250 students at the University of Twente and over 1000 students at RWTH Aachen University). During classroom sessions, students are encouraged to recapitulate and deepen their knowledge through discussions and everyday examples.

One of HeatQuiz's unique features is its collection of over 900 quiz questions, which train students to draw temperature profiles, define view factors and surface brightness, recapitulate dimensionless numbers, and develop energy balances.

The analysis of student performance in the HeatQuiz learning tool and its comparison with their exam results highlights a strong correlation between success rates and active participation. In fact, for certain question types, students who practiced with HeatQuiz achieved a success rate that was twice as high as those who did not.

This platform has been proven to be a highly effective tool for enhancing self-directed learning for students and other interested learners. In the upcoming years, the concept is planned to be transferred to more engineering courses such as mechanics, fluid mechanics, and elasticity theory. The collaboration between the universities is an excellent example of teaching partnership in the digital era.



**2. Report on 1<sup>st</sup> Eurotherm Seminar on caloric heating and cooling (CHC 2021)**



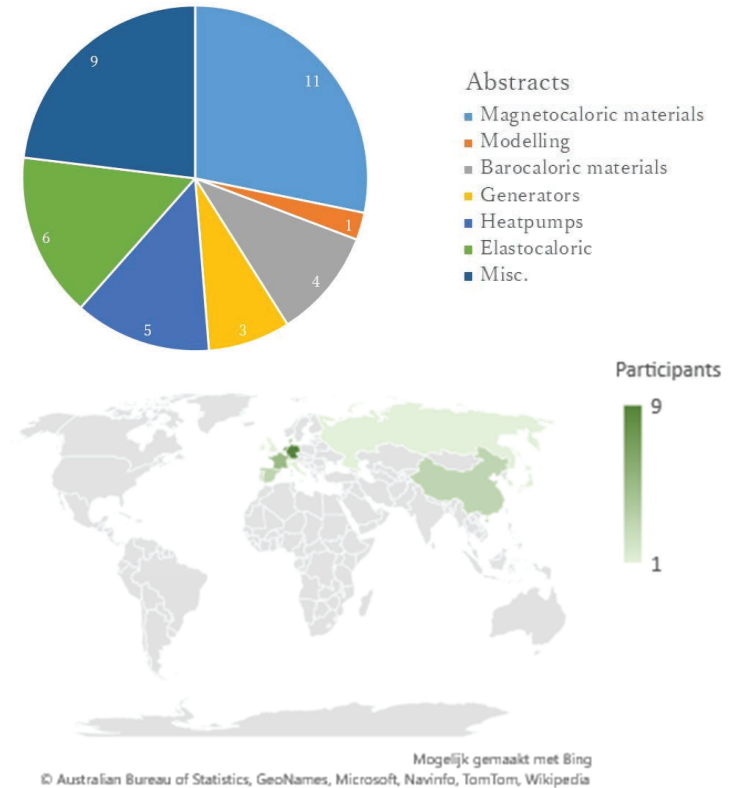
**Prof. Dr. Ekkes Brück**, Technical University of Delft, The Netherlands

**Dr. Mina Shahi**, University of Twente, The Netherlands

**Prof. Dr. Muhammet S. Toprak**, KTH Royal Institute of Technology, Sweden

The CHC 2021 conference (<https://eurotherm.et.utwente.nl>), originally planned to be held in the Netherlands but conducted virtually on 13th-15th July 2021 due to COVID-19 restrictions, was sponsored by the 4TU Center of Energy, BDR Thermea Group, Oversluizen Thermal Engineering, and Ferro Tec. The event featured 41 presentations, including 3 plenary talks, and a poster session. To enhance the interactivity of the poster presentation session, a brief pitch was recorded for each poster.

The presentations covered theoretical, numerical, and experimental approaches to the development of Caloric Materials & Devices, with a focus on recent developments and challenges in the fabrication of magnetocaloric, Barocaloric, and Elastocaloric devices, as well as advances in caloric-based devices such as heat pumps, refrigerators, and generators. The need for fostering collaboration within Europe was emphasized. The conference successfully brought together scientists and engineers from around the world to exchange knowledge and ideas. A breakdown of the number of presentations and participants by topic and country is provided in Figure 2.1.



**Fig. 2.1** Share of presentations and the participations per countries