

HORATES

NEWSLETTER #1 2021

Hybrid and ORGAnic ThermoElectric Systems

The ongoing development of the **internet of things (IoT)** leads to completely new opportunities for **thermoelectric generators** based on **organic and hybrid materials**.

Our **mission** is to **train young professionals** that will be able to operate into this highly interdisciplinary field.

HORATES training will develop along three main guidelines:

Acquiring solid background in different **scientific and technological fields**, all related to hybrid and organic thermoelectrics;

Exposing HORATES ESRs to **diverse sectors**, such as academia, technological research centers and industrial nodes;

Fostering the development of **transversal competencies**.

HORATES Mission

HORATES is a **Marie Skłodowska-Curie Innovative Training Network (MSCA-ITN-ETN)** aiming to train the **next generation of R&D innovators in hybrid and organic thermoelectrics** and develop prototype energy harvesters, inspired by actual market demand.

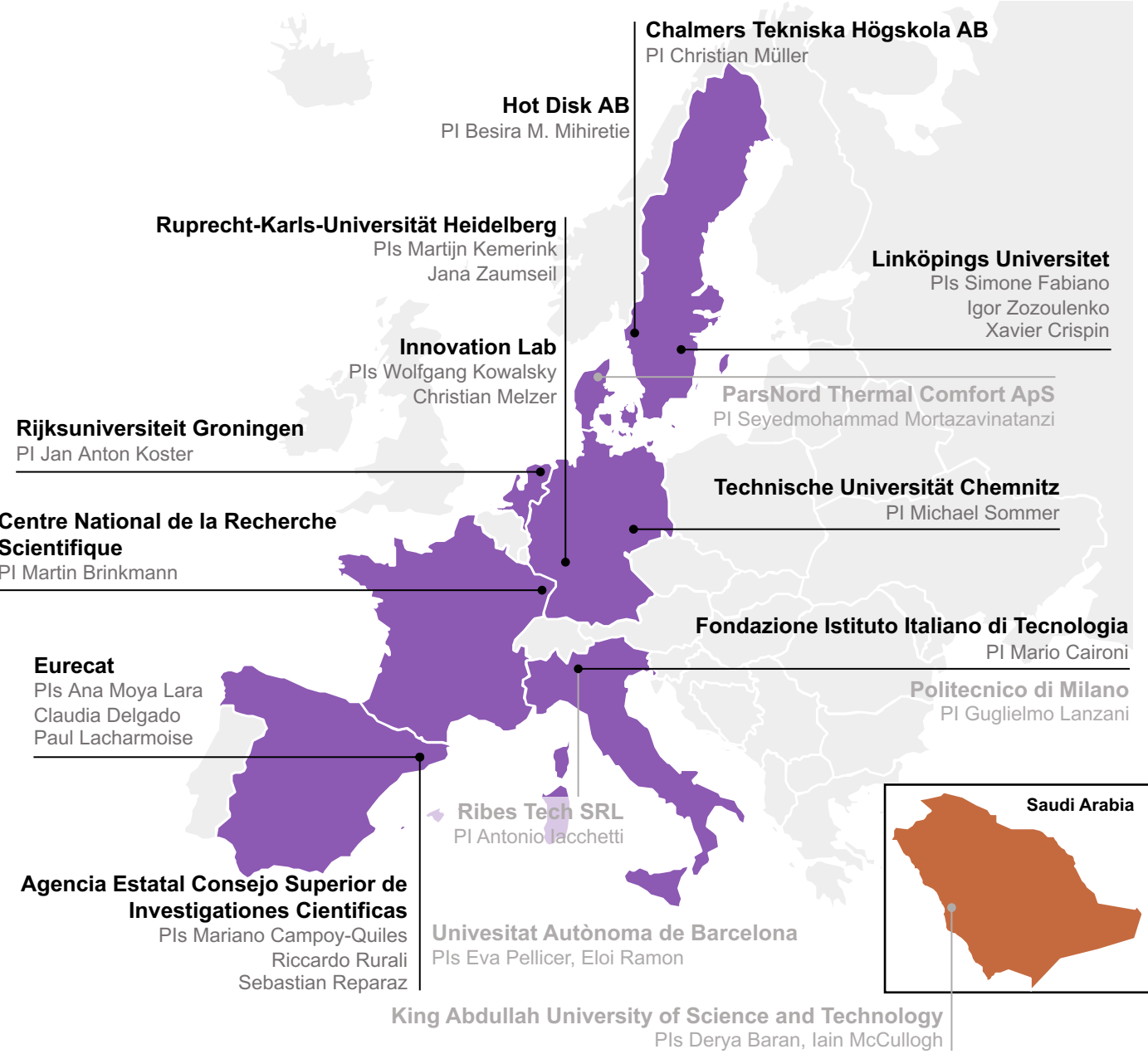
































The HORATES consortium has identified **5 objectives**, which are critical for the consolidation and advancement of EU leadership in this field:

- ✓ Synthesis of new, **thermally and electrochemically stable organic materials and composites** with record zT values significantly beyond the state-of-the-art
- ✓ Development of a **general and basic understanding** of the structure-morphology-property nexus
- ✓ Development of **quantitative and predictive multiscale models** for all quantities in zT
- ✓ Design and fabrication of **stable printed thermoelectric generators modules** with a power density $> 1 \mu\text{W}/\text{cm}^2$ at $\Delta T = 10^\circ\text{C}$
- ✓ Inclusive **library of hybrid and organic printable thermoelectric materials** as reference for future R&D activities

HORATES Consortium

The HORATES consortium is composed by **11 Beneficiaries** and **5 associate partners** from **7 different European countries** and **1 non-European country**. This consortium brings together expertise from both academic and non-academic nodes to ensure to the **15 recruited ESRs** a real multisectoral exposure.



 PI Martijn Kemerink	 ESR 1 Aditya Dash from India	 PIs Mariano Campoy-Quiles Sebastián Reparaz	 ESR 6 Jiali Guo from China	 PI Michael Sommer	 ESR 11 Diego Ropero-Hinojosa from Spain
 PI Jana Zaumseil	 ESR 2 Angus Hawkey from UK	 PI Riccardo Rurali	 ESR 7 Paolo Sebastiano Floris from Italy	 PI Martin Brinkmann	 ESR 12 Shubhradip Guchait from India
 PI Mario Caironi	 ESR 3 Nathan James Pataki from USA	 PI Simone Fabiano	 ESR 8 Qifan Li from China	 PIs Wolfgang Kowalsky Christian Melzer	 ESR 13 Irene Brunetti from Italy
 PI Christian Müller	 ESR 4 Mariavittoria Graighero from Italy	 PI Igor Zozoulenko	 ESR 9 Najmeh Zahabi from Iran	 PI Besira M Mihiretie	 ESR 14 Zijun Zeng from China
 PI Christian Müller	 ESR 5 Joost Kimpel from The Netherlands	 PI Jan Anton Koster	 ESR 10 Federico Ferrari from Italy	 PIs Ana Moya Lara Claudia Delgado Paul Lacharmoise	 ESR 15 Matías Nicolás Joglar from Argentina

Work programme

The research programme of the HORATES network is articulated into **4 highly interconnected scientific work packages (WPs)**, devoted to R&D and field-testing:

- **WP1 Materials Synthesis** will aim to the design and synthesis of new organic thermoelectric materials, hybrid composites and stable dopants.
- **WP2 Processing and Characterization** will aim to develop optimal processing methods of materials.
- **WP3 Theory and Modeling** will aim to provide modeling to predict and interpret properties at the molecular, material, and device levels.
- **WP4 Upscaling and Devices** will use the materials and processes from WP1 and 2 to design and fabricate efficient and stable organic thermoelectric generators by scalable printing techniques.

Three additional WPs are devoted to Network Training, Management, Dissemination, Exploitation & Outreach, respectively.

Network meetings

Kick-off meeting via web conference, 16 March 2021

1st Progress Meeting in Göteborg (Sweden), 25-26 October 2021

2nd Progress Meeting & Mid-Term Project Meeting with the Project Officer in Barcelona (Spain), 25-29 April 2022

ESRs attending Prof. Martijn Kemerink's seminar about *Introduction to charge transport theory*



Related training and dissemination activities

nanoGe's Fall Meeting – #ThermoElect21: New concepts in organic/hybrid thermoelectrics, 18-21 October 2021

SOPHOT2021 – Severo Ochoa Workshop on Phononics and Thermal Transport, 18-19 October 2021

Training workshops & schools

The HORATES Network offers a wide range of individual and Network-Wide training opportunities to its ESRs, including 5 international schools on more specific scientific topics and 5 workshops on complementary and transferrable skills.

Workshops and international schools held thus far:

International School 1:
Basics of Thermoelectrics: Theory, Synthesis and Processing,

Workshop 1: Team Building Workshop

Göteborg (Sweden), 25-26 October 2021

International School 2:
Thermoelectric Characterization

Workshop 2: Academic Writing and Presentation, with focus on OTE

Barcelona (Spain), 25-29 April 2022

More workshops and schools to come:

International School 4:
Advanced Topics in OTE

Workshop 4: From the initial idea to market entry

International School 5:
Printed Electronics and Opportunities for OTE

Workshop 5: Career Development, incl. Postdoc Funding