



REMO PROJECT
JULY 2020 - DEC. 2023



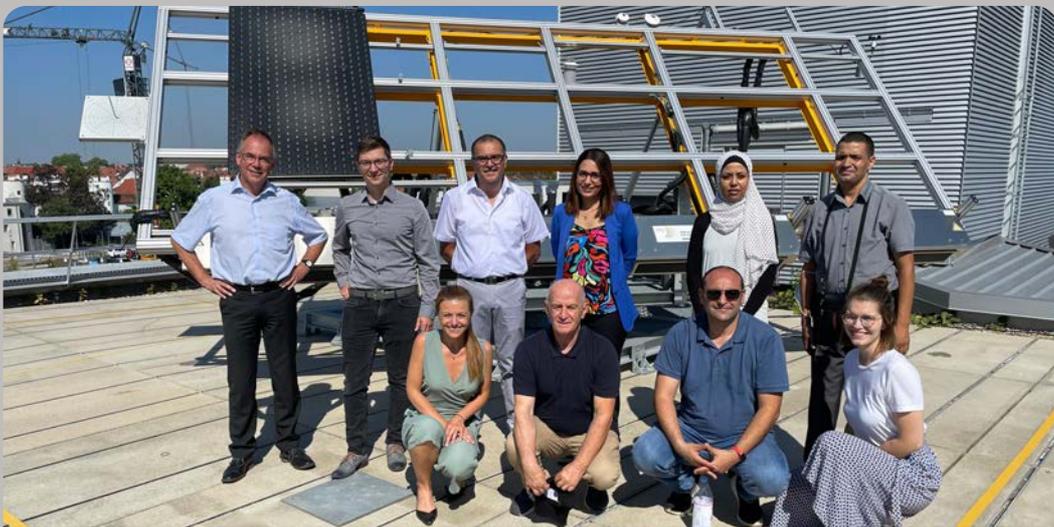
TOWARDS A SUSTAINABLE E-MOBILITY
14 NOV. 2023

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- 02** PARTNERS
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OVERVIEW & GOALS

01



OVERVIEW



REMO project is part of the DAAD program: “University-Business-Partnerships between Higher Education Institutions and Business Partners in Germany and in Developing Countries”. The project involves both industrial and academic partners from Germany (Technische Hochschule Ingolstadt - THI), Tunisia (Research Lab of Smart Grids and Nanotechnology - LaRINa, ENSTAB, University of Carthage) and Morocco (Al Akhawayn University in Ifrane - AUI).

REMO (ID 57545562) is funded by the German Academic Exchange Service (DAAD), Federal Ministry for Economic Cooperation and Development (BMZ), Germany.



Deutscher Akademischer Austauschdienst
German Academic Exchange Service



Federal Ministry
for Economic Cooperation
and Development

OVERVIEW & GOALS



THREE MAIN GOALS

The main objective of REMO is to study renewable energy technologies (RET) and electrical-mobility (e-mobility) in order to present a sustainable and low-emission transport solution. Since this objective meets the climate targets of Tunisia and Morocco, the project will be mainly focusing on studying e-mobility as one possible solution for an alternative transport mode in both countries.

WP1

Undergraduate Program

- ✓ 1.1: Identification of Educational Requirements and Framework Conditions
- ✓ 1.2: Development of Programme Structure and Tailor-Made Courses
- ✓ 1.3: Integration of Practice-Oriented Course Contents and
- ✓ 1.4: Rollout of Undergraduate Study Programme at Partner Universities

WP2

International Master Program

- ✓ 2.1: Analysis of Target Group
- ✓ 2.2: Development of Curriculum for international Master's Program
- ✓ 2.3: Integration of Practice-Oriented Course Contents and Laboratory Planning
- ✓ 2.4: Framework Definition for Multinational Degree
- ✓ 2.5: Foster Master's Students' and Lecturers' Mobility

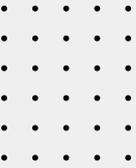
WP3

E-Mobility Research Projects

- ✓ 3.1: Knowledge Transfer in Applied Research Structures
- ✓ 3.2: Analysis of Existing Energy Supply Frameworks & Data Acquisition
- ✓ Task 3.3: Development of Technical Concept and System Simulation
- ✓ 3.4: Economic Assessment & Implementation Concept
- ✓ 3.5: Foster Researchers' Mobility and Exchange with Industry Partners

PARTNERS

02



LaRiNa
Research in Smart
grids



THI
Applied Reserch
University



AUI
liberal arts-based
University



IBC Solar
Solar energy solutions
provider



Asantys Systems
Solar energy provider



SPECIAL WORLD INVEST
Solar energy provider



SHAMS Technology
Solar energy solutions
provider



SuperViz
AI for 4.0 industry



GE Lighting
Manufacturing of
lighting solutions

PARTNERS

7 MOA SIGNED

02



08 Oct. 2021



16 Feb. 2022



16 Feb. 2022



16 March 2022



08 Dec. 2022



06 Feb. 2023



06 Feb. 2023



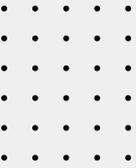
TEAMS



Technische Hochschule
Ingolstadt

Institute of
new Energy Systems

03



Wilfried Zörner

Project lead

Professor
THI, Germany
wilfried.zoerner@thi.de



**Carina
Mwatunga**

Project Coordinator

International Project Manager
THI, Germany
carina.mwatunga@thi.de



Kedar Mehta

Research Associate

Research Associate
THI, Germany
kedar.mehta@thi.de



Caroline Kaiser

Research Assistant

Student
THI, Germany
kak0366@thi.de



Mariem Trojette

Researcher

Assistant Professor of
Industrial Engineering,
LaRiNa, ENSTAB, Tunisia
mariem.trojette@ensta.u-
carthage.tn



Samir Jomaa

Researcher

Assistant Professor
Expert in Environmental/Civil
Engineering
ENSTAB, Tunisia
samir.jomaa@ensta.u-carthage.tn



Faten Kardous

WP2 Coordinator

Assistant Professor of Smart
Sensors and Nanotechnologies
LaRiNa, ENSTAB, Tunisia
Faten.kardous@ensta.u-
carthage.tn



Ikbal Msadaa

WP3 Coordinator

Assistant Professor in Computer
Science and Networks
LaRiNa, ENSTAB, Tunisia
Ikbal.msadaa@ensta.u-
carthage.tn



Ines Mehouchi

PostDoc

Electrical Engineering
LaRiNa, ENSTAB, Tunisia
ines27mehouchi@gmail.com



**Mohamed Ali
Krouma**

Adm. & Financial
Coordinator

General Secretary
ISTIC, University of Carthage, Tunisia
mohamedali.krouma@ensta.u-
carthage.tn



Dimeth Nouicer

Ph.D. candidate

LaRiNa, ENSTAB, ENSIT,
Tunisia
dimeth.nouicer@ensit.u-
tunis.tn



Lazher Mejdi

Ph.D. candidate

LaRiNa, ENSTAB, ENSIT,
Tunisia
mejdi.lazher@ensit.u-tunis.tn



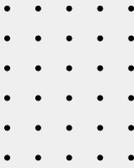
Khaled Grayaa

Country Coordinator

Professor of Communication Systems
and Advanced Electronic
Director of LaRiNa, ENSTAB, University
of Carthage, Tunisia
Khaled.grayaa@ensta.u-carthage.tn

TEAMS

03



جامعة الأخوين
AL AKHAWAYN
UNIVERSITY



**Ahmed
Khallaayoun**
Country Coordinator

Associate Professor of Engineering
AUI, Morocco
a.khallaayoun@aui.ma



**Khalid
Loudiyi**

Former coordinator

Associate Professor of Physics
AUI, Morocco
k.loudiyi@aui.ma



**Rhannai El
Makhtar**

Administrative and
financial Manager

Financial manager
AUI, Morocco
e.rhannai@aui.ma



**Mhammed
Chraibi**

Lecturer

Computer Science Lecturer
AUI, Morocco
m.chraibi@aui.ma



Rachid Lghoul

Lecturer

Lecturer of Physics
AUI, Morocco
r.lghoul@aui.ma



Ameur Arechkik

Post Doc Researcher

Post Doc Researcher
AUI, Morocco
a.arechkik@aui.ma



**Hamza El
Hafdaoui**

Researcher

Adjunct Professor &
Researcher
AUI, Morocco
h.elhafdaoui@aui.ma

FORMER TEAM MEMBERS



**Philine
Ginsberg**

Project Coordinator

International Project Manager
THI, Germany
Philine.ginsberg@mail.de



Technische Hochschule
Ingolstadt

Institute of
new Energy Systems



**Mathias
Ehrenwirth**

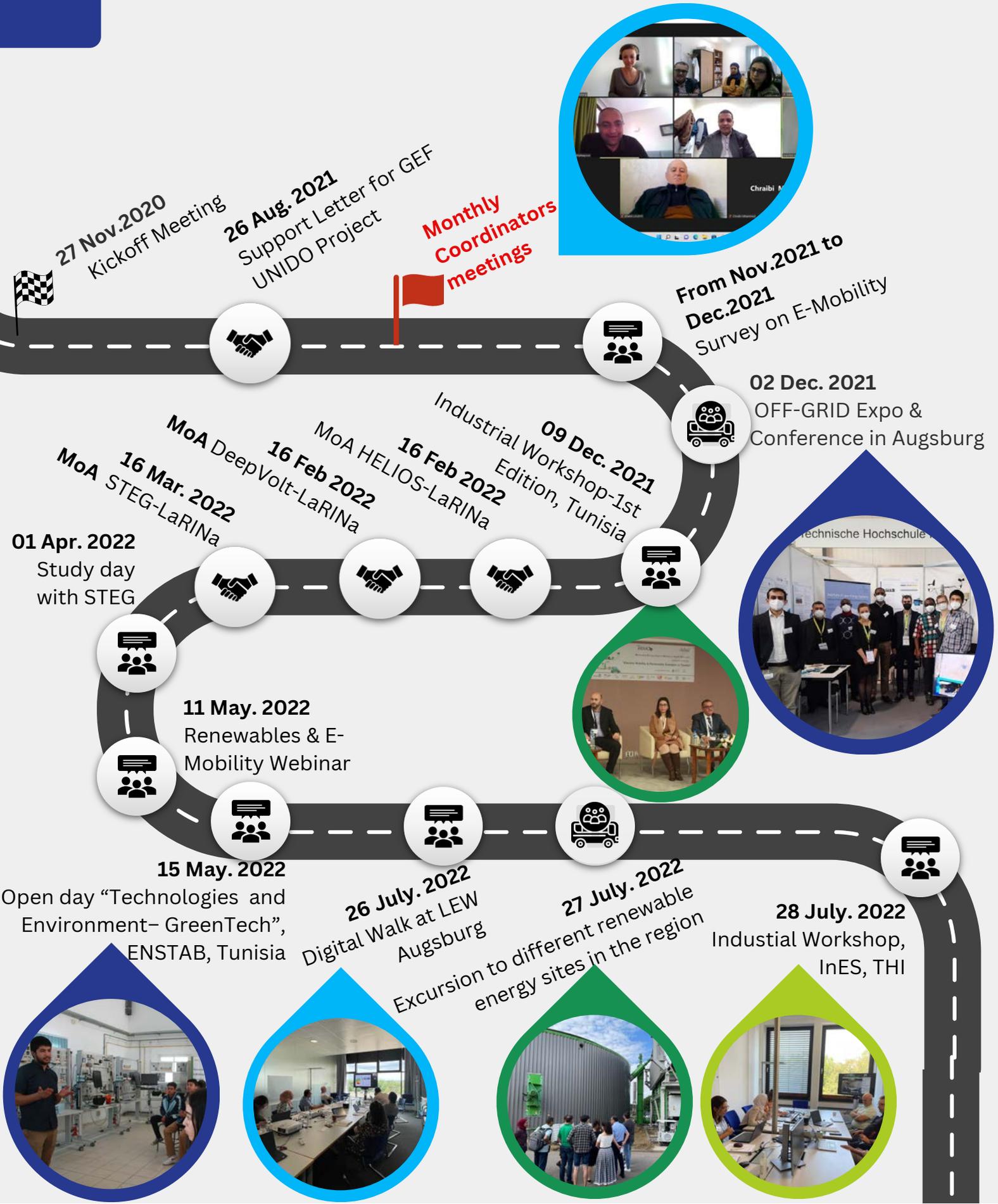
Research Associate

Research Associate
THI, Germany
linkedin.com/in/mathias-ehrenwirth

TIMELINE & MAIN EVENTS

04

CONFERENCES & INDUSTRIAL WORKSHOPS



TIMELINE & MAIN EVENTS

04

CONFERENCES & INDUSTRIAL WORKSHOPS

29 July. 2022

Excursion to Audi production site, Ingolstadt, Germany



12-15 Sept. 2022

Conference on Improving Graduate Employability through capacity building partnerships in Kigali, Rwanda



17-19 Oct. 2022

Onsite visit to LaRINA-ENSTAB from Technopolis group representative



21 Oct. 2022

Participation in the 1st edition of the International Exhibition of the Energy Transition #SITE - 2022.



07 Nov. 2022

REMO Conference AUI, Morocco



11 Nov. 2022

workshop organized by MIME in collaboration with ANME, STEG and GIZ.



08 Dec. 2022

Industrial Workshop 2nd Edition, Tunis Tunisia



08 Dec. 2022

MoA Hawkar-LaRINA



09 Nov. 2022

Visit to Mohamed VI University & Green Energy Park, Morocco



30 May. 2023

Kickoff Meeting of GEF project "Scaling up the adoption of e-mobility in Tunisia"



June. 2023

E-Mobility National Hackathon Tunis, Tunisia



25 Jan. 2023

Participation to the DAAD "University-Business Partnership Progress" conference



06 Feb. 2023

MoA LaRINA - IEDDC & LaRINA - Horizop energy



19 Oct. 2023

Excursion to Khabta Metline Wind park Tunisia



14 Nov. 2023
Industrial Workshop Tunis, Tunisia



TIMELINE & MAIN EVENTS

04

CONFERENCES & INDUSTRIAL WORKSHOPS



REMO Online Kickoff Meeting, 27 Nov. 2020



REMO Industrial Workshop organized by LaRINA
09 Dec. 2021, Tunis, Tunisia



REMO project meeting & industrial workshop
July 2022, INES, THI, Germany



DAAD "Improving graduate employability through capacity building partnerships", 12 - 15 Sept. 2022, Kigali, Rwanda



REMO Conference
AUI, Ifran, Morocco, 07 Nov. 2022



REMO Industrial Workshop organized by LaRINA
08 Dec. 2022, Tunis, Tunisia

REMO KEY EVENTS

EXCURSIONS

04



27 July 2022, REMO Team
Excursion to Biogas Riedelshof (Denkendorf), Germany



27 July 2022, REMO Team
Excursion to Erbe Energy Solar park (Gelbelsee), Germany



09 Nov. 2022, REMO Team and students from AUI
Visit to Green Energy Park, Benguerir, Morocco



29 July 2022, REMO Team
Excursion to Audi - Fascination of production Ingolstadt, Germany



19 Oct. 2023, LaRiNa REMO Team
Excursion to Khabta Metline Wind Park, Tunisia

MAIN OUTCOMES

05

WP1

A New B.Sc. in Renewable Energy Systems Engineering
BSRESE
at AUI

Program Description

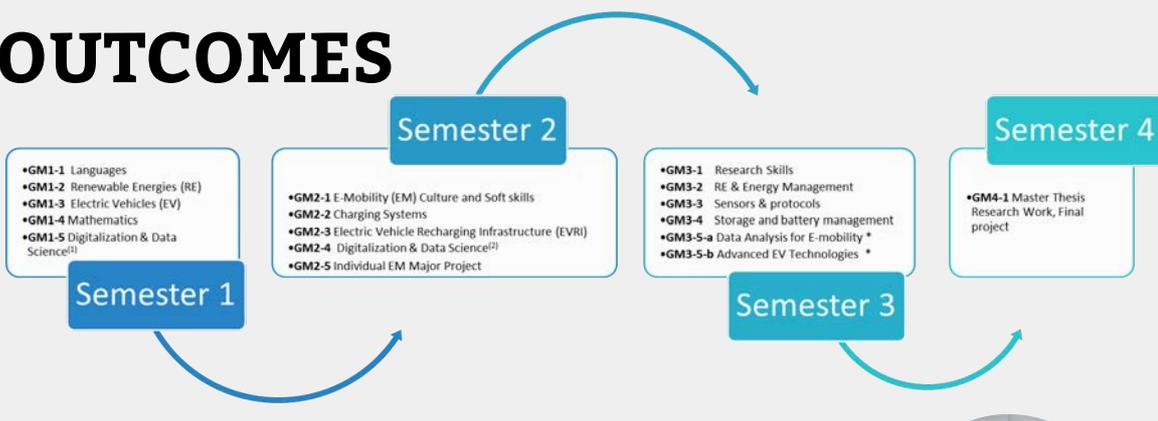
The proposed Bachelor in Renewable Energy Systems Engineering (RESE) builds on a general engineering core to train students in technical issues involved in renewable energy production, storage, conversion, and distribution.

Key Courses

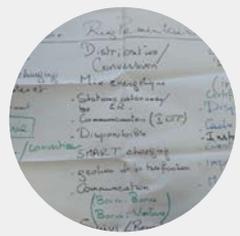
- RES 3311: Introduction to physics of Energy
- RES 3321: Conventional Energy Technologies
- RES 4301: Energy Storage and conversion
- RES 4323: Introduction to Renewable Energy Technologies
- RES 4325: Energy Distribution Systems (as Engineering Elective)

MAIN OUTCOMES

WP2



Curricula development of a Master's program with active involvement of industry partners and universities



Strategy



Enquête sur la mobilité électrique en Tunisie
Industrial & Academic Surveys



REMO Industrial Workshop. 09 Dec. 2021
Session1: REMO Training and capacity building: Master, Engineering & Professional Trainings



Meetings with international cooperations departments



One to one meetings



Conducting interviews with coordinators of prospective study programs for future master's students and engaging with relevant stakeholders.



MAIN OUTCOMES

WP3

05



Research topics related to RET and E-MObility identified and addressed



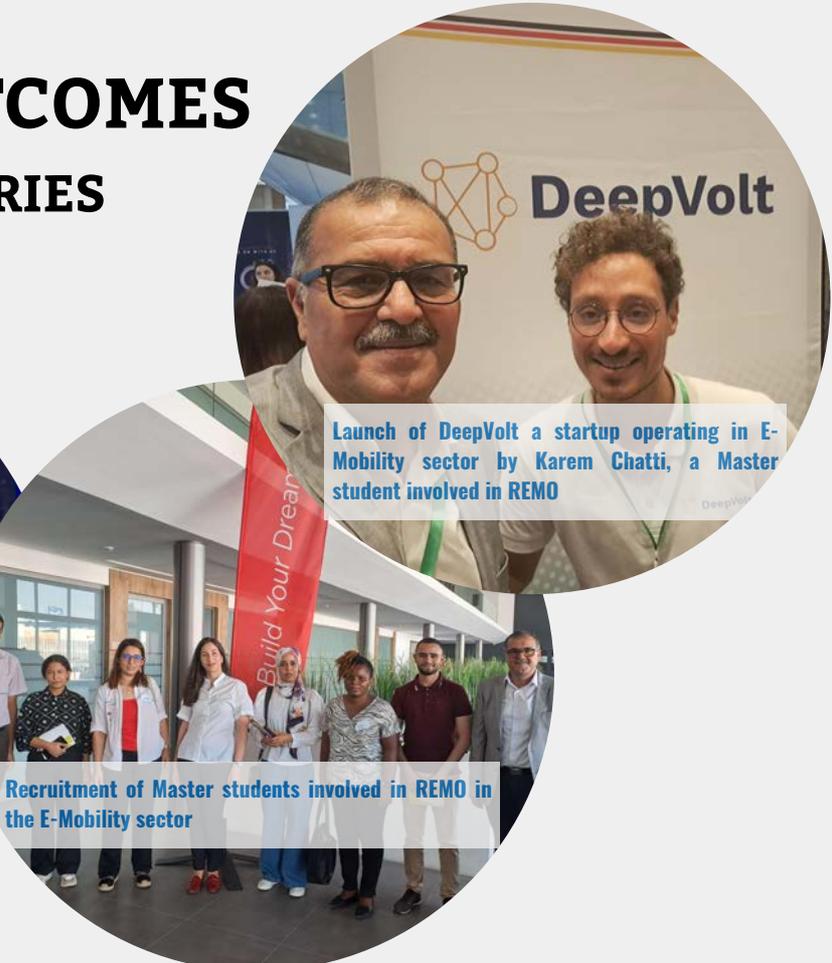
Tight collaboration with industrial partners

Research works published & disseminated

11 Students & 3 lecturers exchanged

Technical Concepts and System Simulation related to RET and EM developed

MAIN OUTCOMES SUCCESS STORIES



MAIN OUTCOMES

05

9 journal &
6 conference
papers



2 PhD &



11 master
theses



588.686 €



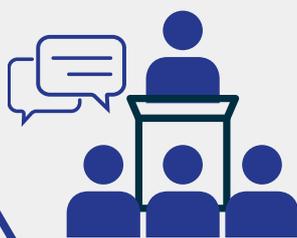
3,5 years

7 new MoA
signed with
industry



9 exchanged
Students

5 industrial
Workshops
& 1 Conference



REMO in numbers

MOBILITY

06



KAREM CHATTI
Ingeiner ENSTAB
July-December 2021

AI-empowered E-Mobility based on Renewable Energy



LAZHER MEJDI
PhD LaRiNa
July-December 2021

Impact Analysis of RL based EV charging control on the electric grid



DIMETH NOUICER
PhD LaRiNa
March-August 2022

E-Mobility As A service - The EV Fleet Management Use case



FEDY ABDELLAOUI
Ingeiner ENSTAB
March-August 2022

Study of the impact of Fleet Electrification using AnyLogic Simulator



EYA SAOUDI
Ingeiner ENSTAB
June-October 2023

Renewable based energy management using AI algorithms in the context of agriculture



FATEN OTHMANI
Ingeiner ENSTAB
June-October 2023

Energy management system for EV charging using AI



AMIN BEN ASSI
PhD LaRiNa
June-October 2023

Smart Grid and Dynamic Energy Management using AI



REDA EL MAKROUM
Masters AUI
July-November 2022

Home Energy Management System Based on Genetic Algorithm for Load Scheduling: A Case Study Based on Real Life Consumption Data



AHMED BAZZI
Masters AUI
June-November 2023

optimization model for on-site sizing of renewable energies for electric buses



Philine Ginsberg, Lazher Mejdi & Karem Chatti
THI, Germany, July 2021



Dimeth Nouicer & Fedi Abdellaoui
THI, Germany, March 2022



L. Mejdi, C. Kaiser, Dr. S. Jomaa, & K. Chatti
Visit to IBC Solar, Germany, Nov. 2021



Students and lecturers stay through the DAAD funded Renewable Energy-based E-Mobility in Higher Education (REMO) project.



Carina Mwatunga, Faten Othmani, & Amine Ben Assi
THI, Germany, June 2023

PUBLICATIONS

07



JOURNALS

- **[J1]** D. Nouicer, I. C. Msadaa and K. Grayaa, "A Novel Routing Solution for EV Fleets: A Real-World Case Study Leveraging Double DQNs and Graph-Structured Data to Solve the EVRPTW Problem," in IEEE Access, doi: 10.1109/ACCESS.2023.3327324.
- **[J2]** El Hafdaoui H, Jelti F, Khallaayoun A, Jamil A, Ouazzani K (2023) Energy and environmental evaluation of alternative fuel vehicles in Maghreb countries. Innovation and Green Development, 3(1), Article 100092
- **[J3]** I. Mehouchi, M. Trojette, K. Grayaa, "Optimal location of electric vehicle charging stations using new meta-heuristic algorithm: A case study in Tunisia", Accepted for publication in Journal of Cleaner Production. Nov. 2023.
- **[J4]** H. E. Hafdaoui and A. Khallaayoun, "Mathematical Modeling of Social Assessment for Alternative Fuel Vehicles," in IEEE Access, vol. 11, pp. 59108-59132, 2023, doi: 10.1109/ACCESS.2023.3284844.
- **[J5]** El Hafdaoui, H., & Khallaayoun, A. (2023e). Internet of energy (IoE) adoption for a secure semi-decentralized renewable energy distribution. Sustainable Energy Technologies and Assessments, 57, Article 103307
- **[J6]** El Hafdaoui, H.; Jelti, F.; Khallaayoun, A.; Ouazzani, K. Energy and Environmental National Assessment of Alternative Fuel Buses in Morocco. World Electr. Veh. J. 2023, 14, 105. <https://doi.org/10.3390/wevj14040105>
- **[J7]** El Makroum, R.; Khallaayoun, A.; Lghoul, R.; Mehta, K.; Zörner, W. Home Energy Management System Based on Genetic Algorithm for Load Scheduling: A Case Study Based on Real Life Consumption Data. Energies 2023, 16, 2698. <https://doi.org/10.3390/en16062698>
- **[J8]** El Hafdaoui, H.; El Alaoui, H.; Mahidat, S.; El Harmouzi, Z.; Khallaayoun, A. Impact of Hot Arid Climate on Optimal Placement of Electric Vehicle Charging Stations. Energies 2023, 16, 753. <https://doi.org/10.3390/en16020753>
- **[J9]** L. Mejdi, F. Kardous, and K. Grayaa. Impact Analysis and Optimization of EV Charging Loads on the LV Grid: A Case Study of Workplace Parking in Tunisia. Energies. 2022; 15(19):7127. <https://doi.org/10.3390/en15197127>



PUBLICATIONS

07

2 Ph.D &
11 MSc theses



9 journal
papers

6 conf.
papers



CONFERENCES

- **[C1]** A. Mabrouki, H. E. Hafdaoui and A. Khallaayoun, "A Forecast of Pumped Fuel Prices in Morocco Using ARIMAModel," 2023 3rd International Conference on Innovative Research in Applied Science, Engineering and Technology (IRASET), Mohammedia, Morocco, 2023, pp. 1-5, doi: 10.1109/IRASET57153.2023.10152952.
- **[C2]** D. Nouicer, F. Abdellaoui, I. Chammakhi Msadaa, K. Mehta, K. Grayaa, and W. Zörner, "Transition from ICE to EV Fleets: A Tunisian Public Utility Use Case", In Proceedings of Young Energy Researchers Conference held in the context of the World Sustainable Energy Days 2023 (28 Feb. - 3 March 2023), Wels/Austria.
- **[C3]** L. Mejdi, F. Kardous and K. Grayaa, "Experimental Validation of PV Power Prediction with ML Models for Improved Grid Integration", in 2023 20th International Multi-Conference on Systems, Signals & Devices (SSD), Mahdia, Tunisia, 2023.
- **[C4]** D. Nouicer, I. Chammakhi Msadaa, and K. Grayaa, "Ontology for the Context of E-Mobility: Charging Station Recommendation based on the EV Trip";. In Proceedings of The Seventeenth International Conference on Internet and Web Applications and Services (ICIW2022). Porto, Portugal, June 2022. https://www.thinkmind.org/articles/iciw_2022_1_10_20009.pdf
- **[C5]** I. Mehouchi, M. Trojette and K. Grayaa, "Optimal Placement of Electric Vehicle Charging Infrastructure: Study Case of an Urban Area of Tunisia"; 2022 8th International Conference on Control, Decision and Information Technologies (CoDIT), Istanbul, Turkey, 2022, pp. 189-194, doi:10.1109/CoDIT55151.2022.9803893.



Dimeth Nouicer at the International Conference on Internet and Web Applications and Services (ICIW2022). Porto, Portugal, June 2022



Master Thesis Defense of Fedi Abdellaoui, 27 Oct. 2022 at ENSTAB, Borj Cedria, Tunisia



PUBLICATIONS

07

2 Ph.D &
11 MSc theses



9 journal
papers

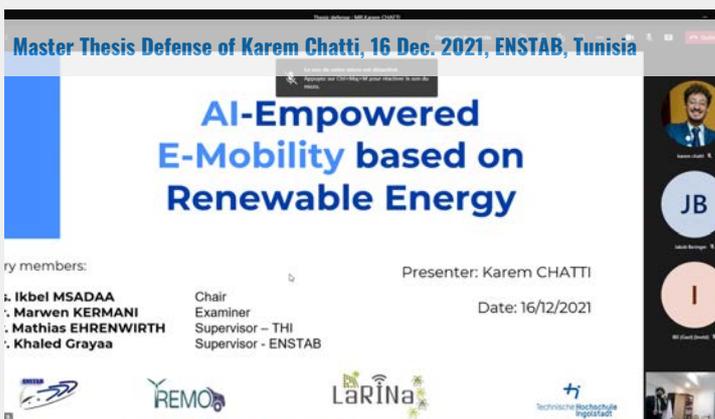


6 conf.
papers



PH.D THESES

- D. Nouicer (2021-present). E-Mobility As A service - The EV Fleet Management Use case. LaRiNa, ENSTAB, University of Carthage and ENSIT, University of Tunis, Tunisia.
- L. Mejdi (2021-present). Smart Charging and Impact of RET & EVs on the grid. LaRiNa, ENSTAB, University of Carthage and ENSIT, University of Tunis, Tunisia.



PUBLICATIONS

07



MASTER THESES

- **[M1]** A. Bazzi (2023) "Optimization Model for On-Site Renewable Energy Generation for Electric Buses".AUI Morocco
- **[M2]** A. Belghiti (2023)."Mathematical Modeling for Environmental and Energy Assessment of Alternative Fuel Vehicles". AUI Morocco.
- **[M3]** E. Saoudi (2023) "Renewable based energy management using AI algorithms in the context of agriculture". LaRINa, ENSTAB, University of Carthage Tunisia and INES, THI, Germany.
- **[M4]** D. Nasreddine (2023). "E-mobility: The Inhibitors of the Increased Adoption of Electric Vehicles in the Kingdom of Morocco". AUI Morocco
- **[M5]** F. Othmani (2023). "Energy management system for Ev charging using AI". LaRINa, ENSTAB, University of Carthage Tunisia and INES, THI, Germany.
- **[M6]** S. Jaafari (2023). "Vehicular Wireless Power Transfer: Optimization of Circular Magnetic Coils with Ferrite". AUI Morocco
- **[M7]** F. Abdellaoui (2022). "Study of the impact of Fleet Electrification using AnyLogic Simulator". LaRINa, ENSTAB, University of Carthage Tunisia and INES, THI, Germany.
- **[M8]** E. Aloui (2022). High voltage BYD EV batteries: Impact on the smart charging station and on the electric grid. LaRINa, ENSTAB, University of Carthage and Helios Energy, Tunisia.
- **[M9]** H. Boughdiri (2022). Electric Scooter Battery Management System Design. LaRINa, ENSTAB, University of Carthage, Tunisia and ENMOSOL GmbH, Dresden, Germany
- **[M10]** J. Soussi (2022). Battery Management systems for electric & plug in hybrid vehicles - BYD case. LaRINa, ENSTAB, University of Carthage and Helios Energy, Tunisia.
- **[M11]** K. Chatti (2021). AI-empowered E-Mobility based on Renewable Energy. LaRINa, ENSTAB, University of Carthage Tunisia and INES, THI, Germany.



CONTACT INFORMATION



+216 79 326 767



KHALED.GRAYAA@ENSTA.U-CARTHAGE.TN



WWW.ENSTAB.RNU.TN/LARINA/



LARINA RESEARCH LABORATORY



BP 122 HAMMAM-CHOTT, 1164.TUNISIA