الجامعة الأورومتوسطية بفاس
EUROMED UNIVERSITY OF FES
UNIVERSITÉ EUROMED DE FÈS

SDG7 Report

Clean and affordable energy

2023

7 ÉNERGIE PROPRE ET D'UN COÛT ABORDABLE

SDG7 report:Clean and affordable energy

Introduction

The theme of Clean and Affordable Energy constitutes one of the priority areas of the UEMF strategic plan. It is both a training and research theme, and a topic on the agenda in the development of the eco campus.

Training

Mechanical and Energy Engineering (EPS)

Main activities: Learning todefine the specifications, design, model, develop, optimize, implement and manage production systems for goods and services:

- in the fields of R&D services in industry, transport and energy for the "Mechanics and Industrial Engineering" course,
- in the areas of heat transfer, waste treatment and the development of process reactors for the "Energy Environment" course.

Electrical Engineering (EPS)

Main activities: Learn to design and implement electrical systems and acquire multidisciplinary skills in automation, signal processing, electronics and industrial computing.:

- The "Electric Energy" option trains engineers involved in the production, transport, distribution and transformation of electrical energy and renewable energies.
- The "Embedded Systems" option trains engineers capable of designing and implementing complex technological systems integrating components from different technologies (electronic components, computer and telecommunications hardware, software, networks, mechanical devices)

Civil Engineering sector (EPS)

Main activities :

Learn to :

- design and implement structures using various types of energy: electrical, mechanical, hydraulic, solar, wind, oil, etc.
- use sustainable construction standards to best integrate ecology during each stage of the construction, renovation or rehabilitation of a structure.
- identify the environmental impacts of projects throughout their life cycle.
- participate in the design and sizing of the envelope and equipment of high energy efficiency buildings.
- make the best choices and make the best decisions in a complex energy context

Sector: Master in Transport and Sustainable Mobility (EPS)

Modules taught in relation to energy

- Energy and climate change;
- Freight transportation systems
- Environmental and transport economics;
- Sustainable development ;
- Sustainable transport and mobility
- Environmentally friendly vehicle engineering;
- Operation of rail and guided transport;
- Choice of transport infrastructure and sustainability;
- Logistics infrastructure engineering;
- Supply Chain Management;

Master: DESIGN AND ENGINEERING OF GREEN BUILDINGS (CIBV)

Modules taught in relation to energy:

- Transfer phenomena;
- Fluid mechanics ;
- General and applied thermodynamics;
- Materials for energy efficiency in buildings;
- Standards and climate;
- Ventilation and lighting of the building;
- Air conditioning, heating and energy integration;
- Renewable energies for buildings;
- Eco-design of a building;
- Energy analysis and economic evaluation of the building;
- Green and smart buildings;
- Sustainable development and waste management;
- Preliminary project for an efficient building;

Specialized Master: Functional Materials and Additive Manufacturing (EPS)

Modules taught in relation to energy:

- Ceramic, polymer and metal materials
- Design adapted to additive manufacturing;
- Energy beam additive manufacturing;
- Industrial manufacturing processes;
- Mechanics and aging of materials;
- Additive manufacturing for the aeronautics and automotive industries;
- Additive manufacturing for the medical field;
- Biomaterials and their applications;

Specialized Master: Environmental Engineering and Water Management (EPS)

The sector aims to train executives with a transversal vision of environmental issues and water management in particular. The development of clean technologies (processes, methods or tools) in order to resolve environmental problems attributable to human activities is highlighted with a focus on the Euro-Mediterranean region.

To do this, the student acquires in this sector advanced knowledge in the field of the environment (scientific and technical methods, knowledge of ecosystems, techniques for analyzing and treating pollutants, water management and treatment, remote sensing tools and GIS, national and international policy, green economy, etc.) and energy efficiency

Architecture sector

Main energy activities:

Learn to :

- Promote urban planning and architectural choices that favor natural resources, integrate bioclimatic principles and guarantee good thermal insulation of the entire building envelope while respecting current legislation.
- Use materials that consume little energy for their manufacture, transport and implementation.
- Use construction techniques with low impact on the environment and energy consumption.
- Promote the use of renewable energies and/or low-polluting fuels.
- Opt for the choice of "intelligent" equipment (low-consumption lighting and household appliances, efficient and correctly sized heating, etc.).

Lifelong training

The UEMF also has a rich offering of continuing training in the energy field.

https://ueuromed.org/formations-courtes

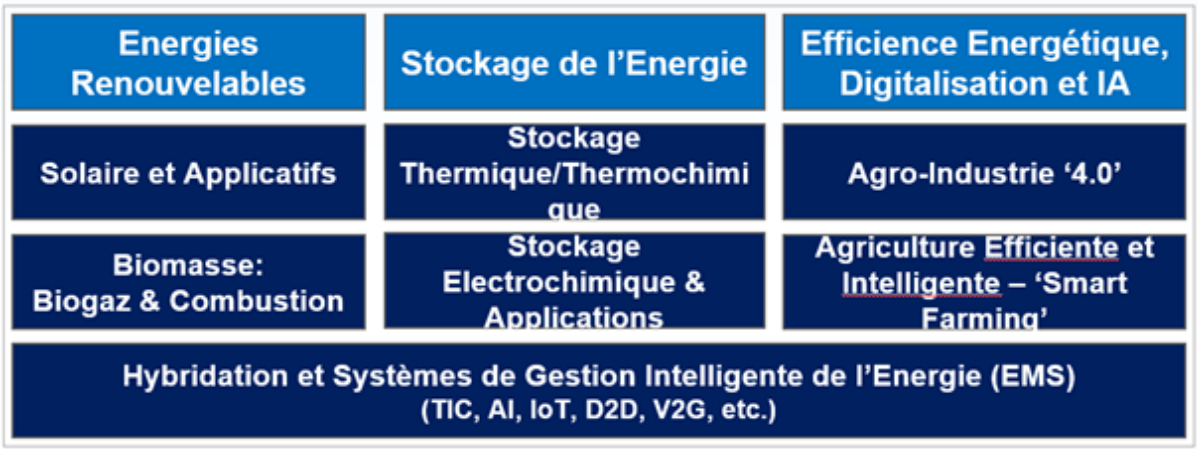
It also defines offers in response to the needs of local and regional partners.

Research

Innovation structures

Agro Energy TIC Valley

It is a mixed platform for testing, research and training in the fields of bioenergy and energy storage, created jointly by the EuroMed University of Fez and the Institute for Research in Solar Energy and New Energies. (IRESEN).



Publications and scientific partnerships

The UEMF contributes to international scientific production in the fields of energy: energy efficiency, renewable energies, intelligent energy management, thermal energy, etc.

https://ueuromed.org/innovation/scientific-production

Several doctoral theses are carried out on the theme of energy

https://ueuromed.org/formation-doctorale/formation-doctorale-sciences-de-lingenieur

The UEMF also carries out a large number of projects, some within a cooperation framework:

https://ueuromed.org/innovation/research-project

Technology platforms

UEMF has several high-level technological platforms in different fields: Additive Manufacturing (3D) and Prototyping, Process Engineering and Civil Engineering, Materials-Synthesis and Characterization, Biotechnology and Biomedical Engineering, Renewable Energy-Storage and Energy Efficiency, Engineering Digital and Artificial Intelligence.

Additive Manufacturing (3D) and Prototyping Platform

The Platform contains both extractive and additive technologies to design, manufacture and characterize a wide spectrum of materials and shapes: 1. Polymers, 2. Metals, 3. Composites, 4. Ceramics and 5. Concrete. It is the largest additive manufacturing platform (3D printing) in Morocco and probably on an African scale. It includes around fifty 3D printing machines, some of which are designed and manufactured at UEMF. A startup for the design and manufacturing of 3D printing machines has been created by the UEMF. Currently several research contracts are being carried out in partnership with the aeronautics and aerospace, automotive and biomedical sectors.

Plateforme de fabrication additive et de prototypage


SLS Polymères Haute-Température PEEK


SLM et SLS


FDM 5 filaments- Multicouleurs


FDM (20cmx30cmx30cm)

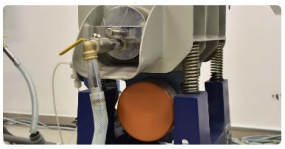

FDM (100cmx100cmx30cm)


FDM (45cmx45cmx65cm)


FDM (30cmx30cmx30cm et 20cmx20cmx20cm)


Post-fabrication et finition

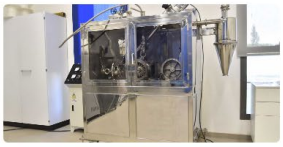

Post-fabrication et finition


Finition par vibration

Plateforme de fabrication extractive et de prototypage


Laboratoire de mise en œuvre


Extrudeuse et mélangeur batch


Broyeur cryogénique


Broyeur à couteaux


Presse hydraulique


Simulateur CMS


Centre d'usinage 3 axes


Tour manuel


Electrospinning

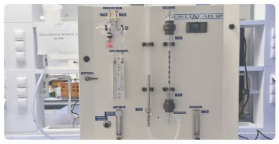
https://ueuromed.org/plateformes-technnologique/plateforme-fabrication-additive-3d-et-prototypage

Process Engineering and Civil Engineering Platform

The "Process Engineering and Civil Engineering" platform includes several design equipment for both materials and processes as well as their characterization:

Material transfer -Heat exchanger-Temperature measurement Heat transfer-Compression machine-reactors, ...

Laboratoire procédés et thermique


Transfert de matière


Mesure de température

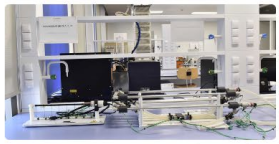

Transfert de chaleur par ébullition

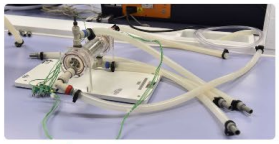

Convection forcée


Transfert de chaleur


Tour de refroidissement


Échangeur de chaleur


Conduction dans une tige (gauche) et Échangeur tubulaire


Échangeur à calandre

Laboratoire de Mécanique des Fluides

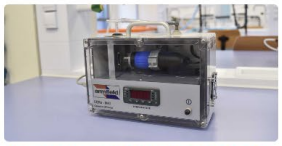

Diffusion dans les liquides et dans les gaz


Mesure du débit avec le tube de Venturi

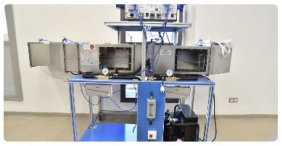

Banc d'hydrologie


Etude des pertes de charge régulières et singulières


Sécheur supercritique


Mesure du coefficient de diffusion des gaz


Banc d'étude de la régulation des procédés


Unité de conditionnement d'air


Banc de soufflerie pour l'étude en aérodynamique


Canal à pente variable – Ecoulement à surface libre


Impact d'un jet sur un obstacle-Théorème d'Euler

Laboratoire de Génie Civil


Bain thermostatique avec groupe réfrigéré


Scie à béton


Maniabilimètre à béton


Table à secousses


Essai de rétention d'eau


Consistomètre VEBE

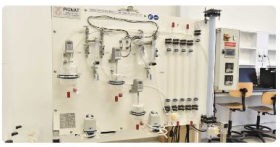

Mesure de la perméabilité à l'air

Laboratoire de Génie Civil / Résistance des matériaux


Machine de compression 3000 kN

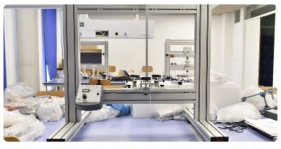

Plasticimètre à béton


Carotteuse électrique


Banc d'étude des réacteurs continus (à piston, tubulaire, agité, en cascade)


Banc d'étude de la flexion


Banc d'étude de la torsion


Banc d'étude de la flexion combinée (Système hyperstatique)

https://ueuromed.org/plateformes-technnologique/plateforme-genie-des-procedes-et-genie-civil

Materials, Synthesis and Characterization Platform

This platform includes several laboratories for chemical synthesis, for the implementation of materials and for their physical and physico-chemical characterization. Several research projects are being carried out with academic and industrial partners in the field of active molecules, bio-sourced molecules, composites, nanomaterials, biomaterials and ceramics.

Microscopie et Spectroscopie

Vidéogranulométrie

Microscopie électronique à balayage

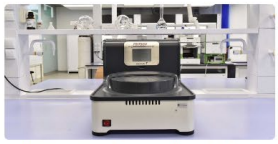

Microscopie optique et électronique

Imagerie morphologique (taille et forme des particules)


FTIR-ATR


UV

Synthèse


Hottes et sorbonnes de synthèses chimiques


Mise en œuvre des céramiques


Synthèse micro-onde


Synthèse micro-onde


Lyophilisateur


Centrifugeuse


Spin coater


Broyeur Planétaire à Billes


Sécheur supercritique

Etuve


Etuve


Four à moufle

Caractérisation physico-chimique

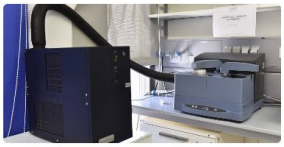

BET (Porosité)

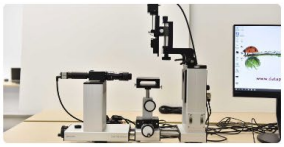

GCMS (Chromatographie en phase gazeuse et spectro de masse)


HPLC (Chromatographie en phase liquide)


Pycnomètre : Mesure de densité


Conductivité thermique

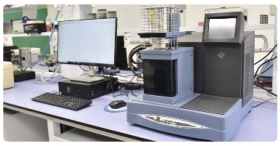

M-DSC (Modulated Scanning Chalorimetry)


Angle de contact


Osmométrie (Densité)

Caractérisation Mécanique et Thermo-mécanique


Dureté Vickers et Dureté Rockwell


TMA : Thermal Mechanical Analyzer


Dynamic Mechanical Analyzer


Rhéomètrie dynamique et continue


Linkam : Rhéo-optique

Caractérisation Optique


Laboratoire d'optique Laboratoire d'optique géométrique et physique


Dispersion et pouvoir de résolution du prisme et d'un spectroscope à réseau


Interféromètre de Michelson


Banc de focométrie

https://ueuromed.org/plateformes-technnologique/plateforme-materiaux-synthese-et-caracterisation

Biotechnology and Biomedical Engineering Platform

The biotechnology and biomedical engineering platform is equipped with several instruments and laboratories for training and research in the fields of medicines, agri-food, diagnostic tests, genomics and microbiology.

Laboratoire de synthèse en biomédical et biotechnologie


Spectroscopie UV


Spectroscopie Infrarouge à transformée de Fourrier UV

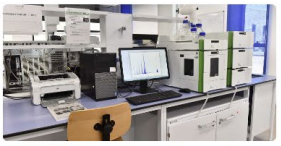

Synthèse micro-onde

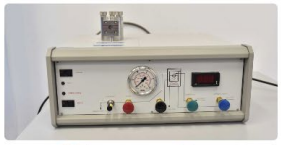

Lyophilisateur


Centrifugeuse


Système de purification d'eau


GCMS (Chromatographie en phase gazeuse et spectro de masse)


HPLC (Chromatographie en phase liquide)


Sécheur supercritique


BET (Porosité)

https://ueuromed.org/plateformes-technnologique/plateforme-de-biotechnologie-et-de-genie-biomedical

Renewable Energy, Storage and Energy Efficiency Platform

The "Renewable Energy, Storage and Energy Efficiency" Platform includes several design, manufacturing and characterization equipment for devices meeting sustainable development criteria in energy matters. In addition to this intramural infrastructure, the university also has open-air laboratories including a house equipped with several types of sensors for research on energy efficiency.

Lab 01


Chauffe-eau solaire


Turbine à vapeur


Banc de test des membranes d'osmose directe


Panneau photovoltaïque test


Unité de conditionnement d'air

Caractérisation thermodynamique et thermique

Réfrigération par compression / détente


Réfrigération par absorption


Chaleur spécifique des gaz et de la détente de Joule-Thomson


Étude de l'équation d'état thermique et du point critique


Étude de l'équation d'état thermique ttet du point critique


Étude de l'équation d'état thermique et du point critique


Osmomètre

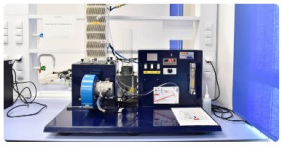

Transfert de matière


Mesure de température


Transfert de chaleur par ébullition

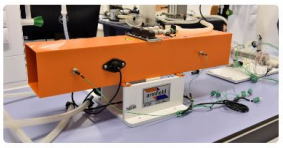

Convection forcée

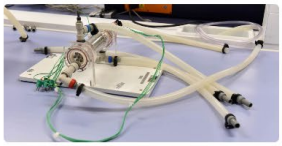

Transfert de chaleur


Tour de refroidissement


Échangeur de chaleur


Conduction dans une tige (gauche) et Échangeur tubulaire (Accessoires de


Échangeur air-liquide

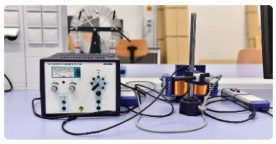

Échangeur à calandre


Expansion thermique des solides


Détermination du coefficient adiabatique des gaz

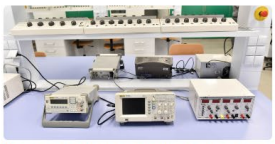
Laboratoire de mesures électriques


Machine électrostatique de Wimshurst (à induction électrostatique)


Champ magnétique de bobine - Loi de Biot et Savart


Mesure de la constante diélectrique des matériaux


Induction magnétique – Hystérésis ferromagnétique


Equipements de métrologie électrique

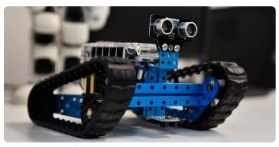

Circuits électriques (RL-RC-RLC)

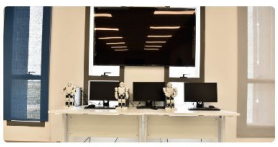
https://ueuromed.org/plateformes-technnologique/plateforme-energies-renouvelables-stockage-et-efficacite-energetique

Digital Engineering and Artificial Intelligence Platform

UEMF has created the first Engineering School completely dedicated to Digital Engineering and Artificial Intelligence (EIDIA) in the Euro-Mediterranean-Africa Area. This School is equipped with several cutting-edge infrastructures with the largest digital platform in Morocco: 3D System Platform from Dassault Systèmes, Huawei, Microsoft, IBM and others. EIDIA research teams work on big data, deep learning, virtual reality, robotics and cobotics (human-machine interaction) for applications in various fields: Cybersecurity, medical, profiling, mobile, connected car, etc.


Programmation robot


Intelligence-Robot


Coordination multi-Robots


Salle de programmation


Postes de programmation


Poste électrique et électronique


Labo génie électrique


Montage électrique-électronique

https://ueuromed.org/plateformes-technnologique/plateforme-dingenierie-digitale-et-dintelligence-artificielle

Research topics

Renewable energies and energy efficiency:

- Technological and operational development of solar thermal, photovoltaic, wind and hydroelectric production technologies. This work will cover both possible technical developments in current energy production and storage technologies as well as the development of new materials aimed at increasing energy efficiency in the production, storage and distribution of renewable energies.
- Conduct and control of the different phases of studies (implantation, operation, maintenance of installations and electrical equipment);
- Improvement of processes and devices related to energy engineering;
- Integration of renewable energies into industrial processes;
- Mastery of different calculation methods for energy and thermal systems;
- Development of identification and prognosis methods for wind generators (Project to be developed with the EDF Energies Nouvelles group);
- Cleaning, alignment and maintenance systems for solar parks to preserve high transformation efficiency (Project to be developed with the EDF Energies Nouvelles group).
- Materials, Nanomaterials and Additive Manufacturing
- Bioactive substances and phosphorus dendrimers: medical applications;
- Improved bioceramics for bone regeneration: manufacturing, testing and validation for medical implantation;
- Fatigue resistance of Inconel 718 from additive manufacturing (Project to be developed with the CEROC, SANDWIK, AEROCENTRE groups);
- New classes of nano-composite and bio-composite polymers (Project to be developed with the PSA group for the design of materials with minimal ecological impact and mechanical characteristics suitable for the construction of automobile shells);
- Nanodevices based on 2D materials.

Vehicles and land mobility / Aeronautics and aerospace:

- Development of lightweight and innovative meta-materials for optimal acoustic insulation of electric vehicles (Project to be developed with the PSA group for the creation of acoustic insulation plates suitable for very light vehicles);
- Innovative solutions for electric machines for the advanced electrification of passenger transport (Project to be developed with the PSA group for the study of multi-phase electric motors for traction);
- I.MOVE: Innovative MObility serVicEs for non-car owners: Prospective scenario based on participatory design (Project to be developed with the PSA group for the shaping and optimal management of carpooling networks);
- Development of tools for real-time processing of vehicle fleet control in an open environment and data security management;
- Dynamic modeling and identification of non-linear structural joints between carbon fiber plates and hulls (Project in the definition phase with European partners).

Environmental genius :

- Development of innovative technologies for water depollution, filtration and desalination;
- Development of innovative technologies for air pollution control and sequestration of CO2 and VOCs (Volatile Organic Components);
- Valorization of certain natural plant resources, in particular the argan tree.

Eco-campus and energy

The UEMF project was designed with the Negawatt approach:

The constructions at UEMF are new and less than 7 years old. The UEMF reconfirms its firm commitment to guarantee that all renovations, restorations or new constructions comply with the highest standards of energy efficiency and sustainable development:

- the UEMF campus is an Eco-Campus which respects the best international standards in terms of sustainable development. It was certified by COP 22 and recently obtained the French-speaking responsible innovation label

- the buildings of the UEMF Eco-campus are built according to the "High Environmental Quality" approach limiting any harmful environmental impact through precise choices: low-energy local materials, materials ensuring good thermal and sound insulation, architecture open ensuring maximum natural light and luminosity, clean and renewable energy sources: installation of photovoltaic panels on large areas of building roofs for the production of electrical energy with real-time measurement of the energy recovered, installation and thermal solar panels for the production of hot water, ongoing installation of pipes and basins for rainwater recovery, recirculation of gray water (in progress), construction/rehabilitation of positive energy buildings, installation on the entire Eco-campus of sorting bins for waste, creation of sports, leisure and relaxation spaces, use of a circular economy (minimizing waste by optimizing the value generated by resources), installation on the UEMF Eco-campus with charging stations for electric cars. These terminals are the only ones in the Fez-Meknes region and the only ones on a university campus in Morocco. Advertising panels have been placed in several places in the city of Fez inviting motorists to come and recharge the batteries of their electric cars free of charge on the UEMF Ecocampus, total accessibility and in all University buildings to people at reduced mobility (PRM), installation on all floors, in front of all doors, on staircases and in elevators of Braille signage for the blind and visually impaired, installation on all floors and in all buildings of sanitary facilities (toilets) for PMRs.

UEMF energy efficiency policy 2023-2026

The UEMF displays its desire to contribute effectively to Morocco's 2030 objectives and has the ambition to move towards carbon-neurality. In this regard, this policy implemented aims to:

- Develop energy management processes;
- Establish rules for optimal energy management.

The UEMF has implemented concrete actions to inform and raise awareness among members of the university community in order to limit environmental impact and global warming.

https://www.ueuromed.org/sites/default/files/upload/files/politique-defficacite-energitique-de-luemf-2023-2026.pdf

MONITORING SYSTEM FOR PHOTOVOLTAIC POWER PLANTS

A monitoring system (SmartLogger) has been integrated into each photovoltaic plant. This central unit plays the dual role of warning the operator of any major failure (or other abnormal situation) as well as collecting the electrical power produced in "real time". The data collected every 5 minutes is accessible through a web service, which allows remote monitoring of the state of the plant at any time. From the web console, it is possible to obtain the performance values of the PV plants established from the data collected:

- the daily cumulative power that was injected into the electricity network;
- the cumulative power that has been injected into the electrical network since initial commissioning;
- the instantaneous power produced by the plant(s), updated every 5 minutes;
- the income calculated on the basis of the electricity tariff;
- CO2 reduction through the use of photovoltaics.

https://www.jetenergy.ma/en/projects/ombri%C3%A8re-solaire/ombriere-uemf

AVERAGE PRODUCTION EVALUATION (2020-2021-2022)

- 2 photovoltaic power plants with power injection into the building.
- 1,246m²of solar panels installedes.
- Total peak power of 197.8 kWp.
- Theoretical production of 300 MWh/year by the two plants.
- 248 MWh produced in 2019 / 441 MWh since November 2017.
- Real yield of 83% of theoretical yield.
- Average annual saving of 200,000 DH/year on the energy bill.
- Return on investment (not discounted) over twelve years, based on maintaining current performance.

Responsible innovation label

The Responsible Innovation Label was awarded to the UEMF during its first 2020/2021 edition. A jury specializing in responsible innovation selected the first 3 projects which are being deployed in the member universities of the Agence Universitaire de la Francophonie (AUF), including that of the UEMF entitled "**Sustainable UEMF program**".

The Responsible Innovation Label is intended for higher education and research establishments. Its objective is twofold:map and promote responsible innovations from French-speaking university establishments around the world,but alsodeploy the responsible innovation network to promote synergies between universities,civil society and the socio-economic sectorworking for the development of a responsible society.

40 ha Eco-Campus certified by COP22 (in 2016)

Responsible Campus of the Year

The Euromed University of Fez was named winner of the "RESPONSIBLE CAMPUS OF THE YEAR" Prize, during the ceremony organized in Paris, on Tuesday October 4, 2022, under the effective presidency of the Minister of Higher Education and French Government Research.

The "Responsible Establishment of the Year" category rewards UEMF's commitment to the SDGs and its lasting impact to become an organization responsible for the challenges of the transition.

http://ueuromed.org/actualites/annonces-diverses/luemf-laureate-du-prix-campus-responsable-de-lannee

Activities

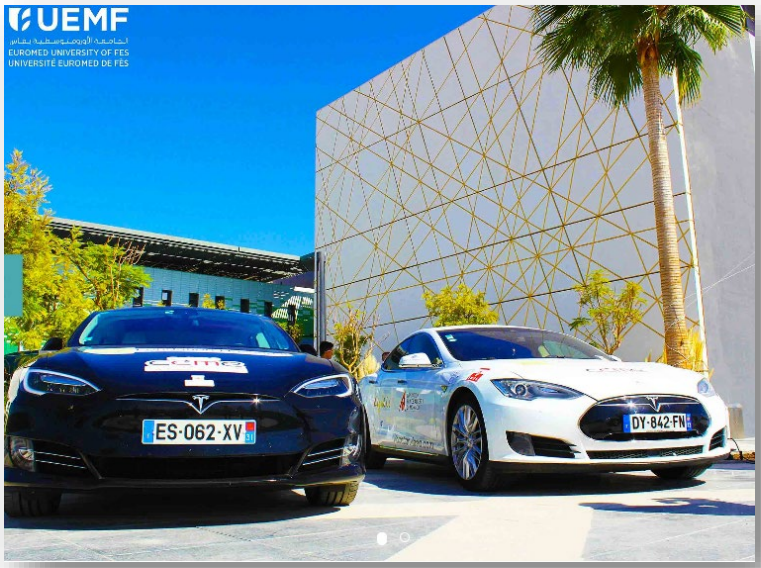
The UEMF promotes Electric Mobility! (06 May 2022)

The UEMF has entered into a new partnership with the Moroccan start-up "POGO", which consists of the development of soft and electric mobility within the UEMF eco-campus.

For a first incubation phase, "POGO" deployed a fleet of 12 electric scooters for internal travel needs within the campus, in addition to 10 electric motorcycles for external travel.

POGO will benefit from the services offered by the UEMF incubator, namely technical assistance, individualized monitoring, access to technological platforms and access to the UEMF partner network.

The sustainable and intelligent COP 25 torch, "Light Us", "made in UEMF", has arrived



Sustainable development - The Euromed University of Fez welcomed the MIPAI-Mediterranean Institute of Intelligence and Public Affairs association to its eco-campus during its stopover in the city of Fez.

Arriving aboard Tesla brand electric cars, the "Light Us" caravan was warmly welcomed by the community of Euromed University in Fez. Upon their arrival, the crew members were

received by the Vice-President of the University, the faculty and administration as well as the students, all proud and happy to receive the convoy. For his part, the President of the Association (MIPAI), Ayoub Makhloufi, expressed his enthusiasm for this noble cause of raising awareness of the issue of sustainable development, supported both by his association and by the Euromed University of Fez.

The photovoltaic torch which will mark the symbolic transition from COP 24 (Katowice in Poland) to COP 25 (in Santiago, Chile) was manufactured in the additive manufacturing and 3D printing laboratories of the University with the help of the Professor Sébastien Vaudreuil, teacher-researcher at UEMF. Today, this torch which combines artificial intelligence and sustainability has become a strong and meaningful universal symbol. Proudly displaying the colors of the Moroccan flag upon the arrival of the "Light Us" crew in the territory, it undoubtedly recalls the desire of its creators Zacharia Saha and Ayoub Makhloufi, young Franco-Moroccans, to underline the importance of the objectives sustainable development to save the planet.

As a reminder, the "Light Us" project is labeled COP22 and supported, among others, by the Prince Albert II of Monaco Foundation, the Union for the Mediterranean (UfM), the Council of the Moroccan Community Abroad (CCME) , MEDEF, CGPME, CGEM and IRESEN. The MIPAI team will be welcomed at COP25 in the presence of Polish, Chilean and Moroccan authorities.

https://ueuromed.org/en/news/visits/sustainable-and-intelligent-torch-cop-25-light-us-made-uemf-has-arrived-safely

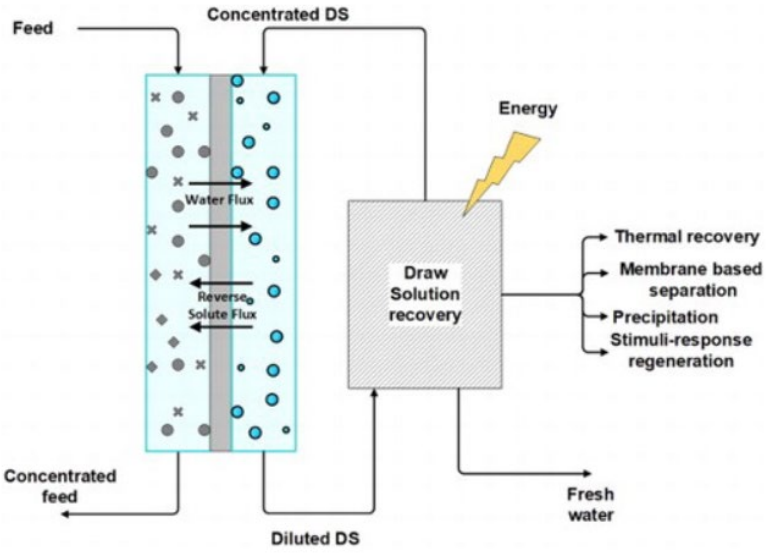
Water desalination by forward osmosis: drawing solutes and recovery methods – review

Imane Chaoui

Teacher. Souad Abderafi

Teacher. Sébastien Vaudreuil

Professor Tijani Bounahmidi

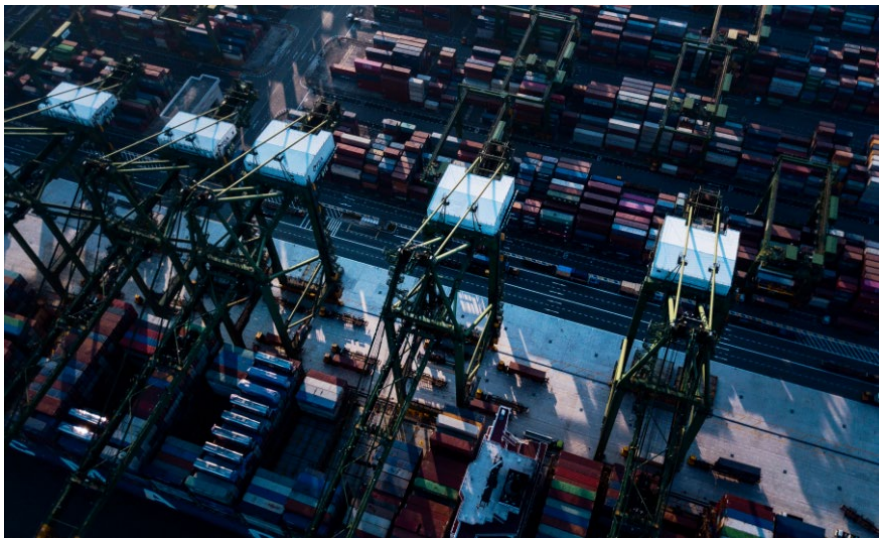


Water production has become a serious concern nowadays due to many environmental and social factors. Conventional desalination processes are considered energy-intensive, as energy consumption represents 50 to 60% of the cost of water production.

In this article, a state-of-the-art update of newly developed suction solutes such as deep eutectic solvents, ionic liquids, smart materials, and conventional FO suction solutes has been carried out. Finally, the challenges, opportunities and future prospects of FO technology were discussed.

Forward osmosis water desalination: suction solutes and recovery methods – review: Environmental Technology Reviews: Vol 8, No 1 (tandfonline.com)

Pr. Othmane Benmoussa explains how to respond effectively to ecosystem disturbances in his article on Média 24, November 11, 2022



The Covid-19 pandemic, galloping international inflation, environmental and political crises and the war in Ukraine, so many disasters that have caused unprecedented disruption and unpredictability in supply chains. A delicate situation which has called into question the planning process of businesses around the world.

The ADDAPT framework for "Anticipate, "Detect", "Diagnose", "Activate resources for", "Protect Against" and "Track Risks" intervenes in particular in the case of ecosystem disturbances, precisely those relating to supply.

Pr. Othmane Benmoussa responded to this relevant issue by identifying the main actions to be undertaken through his article on Média 24

https://ueuromed.org/actualites/articles/pr-othmane-benmoussa-exple-comment-reagir-efficacement-aux-perturbations

www.medias24.com/chronique/se-preparer-aux-ruptures-dalimentation-leadership-et-capacites-organizationnelles/