جامعة مولود معمري تيزي وزو

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Université Mouloud Mammeri de Tizi-Ouzou

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A Heuristic Optimization Approach for Wind Turbine Dimensions to Enhance Energy Capture and Reduce Costs

Authors : Mourad Naidji, Mohamed Ilyas Rahal, Alla Eddine Toubal Maamar, Aicha Aissa-Bokhtache, Maamar Latroch, Radu-Florin Porumb

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2025 International Conference on Artificial Intelligence, Embedded Systems, and Renewable Energy (AIESRE)

A Heuristic Optimization Approach for Wind Turbine Dimensions to Enhance Energy Capture and Reduce Costs

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***Abstract*—Emerging as a vital component in the worldwide shift towards environmentally friendly power generation is wind energy. Maximizing energy output and reducing cost depend on well-designed wind farms, particularly considering the growing demand for renewable energy. This work expands on several ideal wind turbine configurations suggested in previous work and chooses them as basis for more thorough investigation and enhancement. While most previous studies have concentrated mostly on lowering the cost per kilowatt of generated power, this work takes a more all-encompassing view aiming to improve general wind farm efficiency through strategic optimization of turbine tower heights and rotor diameters, so simultaneously lowering total costs. This kind of approach might produce more flexible and efficient wind farms. A Particle Swarm Optimization (*PSO*) method is used to find the best arrangement of rotor diameters and tower heights over the wind farm in order to reach these targets.**

Keywords—Wind turbine dimensions, Wind farm layout, PSO, Cost-effectiveness.

I. INTRODUCTION

Meeting the rising demand for clean, renewable energy worldwide depends on wind energy more and more [1], [2]. Widespread acceptance of this technology depends on designing wind farms that not only maximize energy output but also minimize costs.

Although most of the current research concentrates on maximizing turbine location alone, there is still great possibility in concurrently optimizing turbine dimensions, more especially, rotor diameters and tower heights. Aerodynamic efficiency, wake interactions, and structural costs all directly depend on these values.

[3] concentrated on reducing the Levelized Cost of Energy (LCOE) by accounting for all expenses across the entire lifecycle of a wind farm, including capital investment, operation, and maintenance. In contrast, [4] introduced an optimization approach for positioning fixed-hub height wind turbines using a Twin-Archive Guided Decomposition-based Multi-Objective Evolutionary Algorithm (TAG-DMOEA). This method simultaneously addresses multiple objectives such as turbine placement, energy efficiency, and overall cost.

Many researchers have aimed to improve and expand on the basic findings of Grady et al. [5] and Mosetti et al. [6] on optimizing wind turbine layouts within wind farms. Among the several contributions to this discipline, this paper has chosen for thorough reanalysis the configurations suggested by Grady et al. [5] and Mosetti et al. [6].

Although the overall power output recorded in previous studies is a benchmark, this work intends to reach similar power levels by carefully adjusting turbine rotor diameters and tower heights, so enhancing the wind farm efficiency. Aiming to investigate how changing these parameters in a wind farm might result in improved efficiency and cost-effectiveness as opposed to consistent designs. This paper provides pragmatic solutions for real-world wind farm development by using the Particle Swarm Optimization (*PSO*) algorithm to find ideal configurations that balance power output and investment costs.

This study builds upon and extends the approach introduced in [7], aiming to further enhance wind farm design performance. This optimization strategy not only helps to lower total installation costs but also clearly increases the general efficiency of the wind farm. In layouts where the upstream turbine rows are close together, the advantages of optimization are especially noticeable since the strategic changes help to more successfully reduce wake effects.

Given that a wind turbine's total cost consists mostly on its rotor blades and tower, their careful design and sizing are quite important for cost control. The following sections of this paper offer a thorough comparison of installation costs for several configurations.

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II. MATHEMATICAL MODELING OF THE WIND FARM

A. Wind Farm modelling

One of the key objectives of Wind Turbine (*WT*) location design is to reduce power loss caused by wake interferences among turbines. For an accurate estimation of these losses, a reliable wake model must be utilized. The Jensen model, originally introduced in [8], is among the most popular models in the literature. When wind hits a turbine, it decelerates and becomes turbulent and creates a wake, an area of decreased wind speed and heightened turbulence, directly downwind of the turbine.

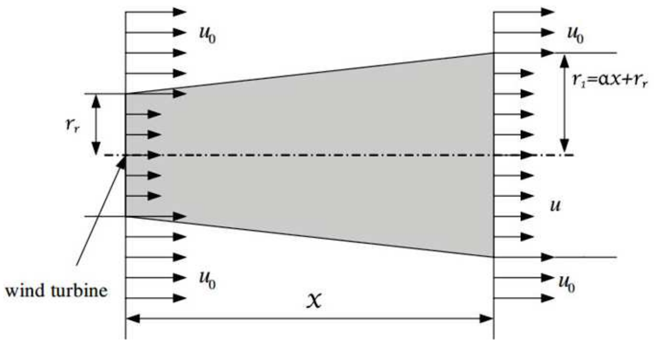

Fig. 1. Schematic diagram of the "Jensen" wake model.

The wake effect travels downstream and also moves sideways, impacting the functioning of downstream turbines. The "Jensen model", as shown in Fig. 1, assumes the wake to increase linearly with downstream distance from the WT and the wind speed profile within the wake to be flat across its cross-section. This is a simplification that makes it computationally inexpensive and therefore suitable for application to large-scale wind farm layout optimization problems. In this paper, the "Jensen model" is applied in the calculation of the wake velocity deficits, as a basis for the determination of the overall power production from the wind farm. Assuming that quantity of movement is preserved in the wake section, wind speed can be given as [7]:

$$v = v_0 \left[1 - \frac{2a}{\left(1+\alpha\frac{x}{R_r}\right)}\right] \tag{1}$$

$$a = \frac{1-\sqrt{1-C_T}}{2} \tag{2}$$

$$R_r = r\sqrt{\frac{1-a}{1-2a}} \tag{3}$$

$$\alpha = \frac{1/2}{\ln(\frac{H}{z_0})} \tag{4}$$

Here, v_0 represents the local wind speed that a turbine experiences when there's no intervention from any wakes. The variable x indicates how far downstream the turbine is located, while R_r refers to the rotor radius of the *WT* that's upstream, and R_w points to the expanded rotor radius of the wake at the downstream site. The tower height is symbolized as H, while α is the entrainment constant, that helps define how quickly the wake expands. The axial induction factor, a, shows how much the wind speed falls due to energy being extracted from the rotor. Additionally, C_T is the thrust coefficient, which measures the force the wind applies on the turbine rotor, and z_0 denotes the surface roughness of the ground in the wind farm area. When a *WT* is influenced by many upstream wakes, calculating the resulting wake velocity is not as straightforward as just adding them up. Instead, it is generally accepted that the total kinetic energy deficit at the downstream turbine is equal to the sum of the single energy deficits from each wake. Therefore, the effective wind speed that the i[th] turbine, situated downstream of N_T turbines, experiences is determined by adding up these energy losses accordingly as:

$$v_i = v_0\left[1 - \sqrt{\sum_{j=1}^{N_T}\left(1 - \frac{v_{ij}}{v_0}\right)^2}\right] \tag{5}$$

The output voltage of the panel is: The variable v_{ij} refers to the wind speed which the i[th] WT encounters, impacted by the wake shaped by the j[th] WT. In the linear wake model, we assume that this wake spreads out in a conical shape as it travels downstream. The area affected by this wake is defined by the wake influence radius, which indicates how far the wake's impact reaches. This radius is calculated using a specific formula that takes into account the distance between the WTs and the wake decay constant as:

$$R_w = R_r + \alpha x \tag{6}$$

Power output from a WT i, calculated in kW, can be given as follows: [15]

$$P_i = 0.5\, \rho\, \pi\, r^2\, v_i^3\, C_P/1000 \tag{7}$$

Where P_i is the total power output achieved considering wake effect in wind farm.

B. Cost Estimation Formulation

Originally presented by Mosetti et al., the cost model emphasizes just one variable: the farm's overall wind turbine count. Formulated as:

$$Cost_{base} = N\left(\frac{2}{3} + \frac{1}{3}e^{-0.00174N^2}\right) \tag{8}$$

The cost connected with a wind farm including N turbines. This statement offers a basic cost estimate free of consideration for turbine design variances. In a standard wind turbine, the tower and blades respectively account for roughly 17.7% and 21.9% of the turbine's cost [9]. Furthermore, the turbine itself accounts for about 75% of the total cost of a wind farm. Especially, each 1% change in rotor radius within a ±10% deviation from a reference rotor radius of 20 meters results in an expected 3% variation in blade cost. Tower cost scales, then, in line with tower height [10]. A refined cost model has been developed to accommodate design variances, more especially, changes in rotor diameters and tower heights. By including the weighted contributions of rotor and tower costs relative to the total installation cost, this revised model modulates the baseline cost [13], [14]. The adjusted cost equation shows as:

$$Cost = Cost_{base}\left[1 + \frac{1}{N}\sum_{i=1}^{v_1} 0.0039825 y_i N v_i + \frac{1}{N}\sum_{j=1}^{v_2} 0.0016425 y_j N v_j\right] \tag{9}$$

where:

- $Cost_{base}$ is the base cost calculated using the original formula;

- y_i denotes the percentage change in rotor radius for the i[th] turbine variant relative to the reference radius R_{base} = 20 m;
- y_j represents the percentage change in tower height for the j[th] turbine variant compared to the reference height H_{base}=60 m;
- v_1 and v_2 correspond to the number of rotor radius and tower height variants, respectively;
- Nv_i and Nv_j denote the number of turbines of each respective variant.

III. PSO Formulation and Application

This section discusses the *PSO* principle and its application in the wind farm.

A. Particle Swarm Optimization (PSO) Description

PSO is an evolutionary computation method inspired by the collective behavior of social organisms. This technique relies on how individual agents make decisions based on two key sources of information. The first is personal experience, each agent evaluates the choices it has previously made, identifying which option has yielded the most favorable outcome and how beneficial it was. The second source of information comes from the experiences of neighboring agents. That is, each agent observes and learns from the performance of others, recognizing which choices have led to optimal results within the swarm and how effective those solutions have been.

Fig. 2 shows how a particle in the enhanced *PSO* algorithm updates its position. The new velocity (black arrow) is computed by merging three components: inertia (gray), memory of the particle's own best position (blue), and cooperation with the global best position found by the intelligence swarm (red). The particle travels from its actual position (black x) to a new position (black dot), directed by the present updated velocity. This mechanism can help balance survey and convergence in the optimization course [11], [12].

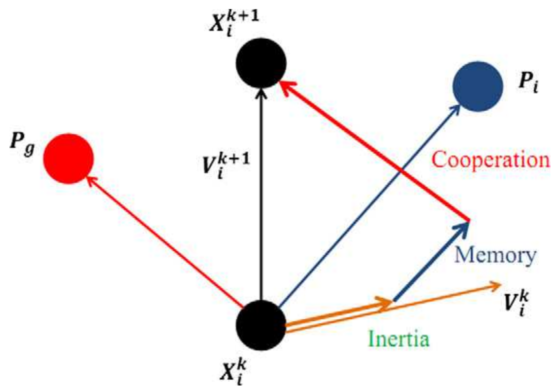

Fig. 2. Description of PSO parametrs' updates (position and velocity) in a 2D space.

The particles are controlled according to the following equations:

$$v_i^{t+1} = w^t.v_i^t + c_1.r_1\left(P_i^t - x_i^t\right) + c_2.r_2\left(P_g^t - x_i^t\right) \quad (10)$$

$$x_i^{t+1} = x_i^t + v_i^{t+1} \quad (11)$$

Here, i ranges from 1 to N, where N denotes the total number of individuals in the population. The parameter w represents the inertia weight, which is determined by the following expression:

$$w^t = w_{\max} - \left(\frac{w_{\max} - w_{\min}}{t_{\max}}\right)t \quad (12)$$

The general pseudocode structure of the *PSO* algorithm is presented below:

Algorithm 1 Pseudocode structure of the *PSO*

1. Initialize a swarm of particles with random positions and velocities in the search space.
2. For each particle:
   a. Evaluate its fitness using the objective function.
   b. Set the particle's best known position (***P_{best}***) to its current position.
3. Identify the global best position (***G_{best}***) among all particles.
4. Repeat until the stopping criterion is satisfied:
   a. For each particle:
      i. Update its velocity using the ***PSO*** velocity update rule.
      ii. Adjust its position based on the updated velocity.
      iii. Recalculate the fitness at the new position.
      iv. If the new position yields better fitness than ***P_{best}***, updates ***P_{best}***.
   b. Update ***G_{best}*** if any particle's ***P_{best}*** outperforms the current ***G_{best}***.

B. PSO Application to Windfarm

For practical implementation, it is neither feasible nor efficient to assign a unique combination of rotor diameter and tower height to every individual turbine in the wind farm. In this study, the evaluated layouts consist of 30 and 26 turbines respectively, arranged within a 2 km × 2 km wind farm area divided into multiple 200 m × 200 m grid cells. Rather than defining a distinct size for each turbine, three discrete values for rotor diameter and tower height are randomly selected within specified parameter ranges. These values are then systematically and evenly distributed across all turbines in the farm. The rotor diameter is varied between 34 m and 44 m, while the tower height spans from 54 m to 62 m, as input to the PSO algorithm. To simplify computations, the parameter values selected by the algorithm are rounded before evaluating the objective function. The power output from each turbine, accounting for wake effects, is computed using Equations (1) through (6). The wind farm's efficiency is defined as:

$$\eta = \frac{\sum_{i=1}^{N} P_i}{\sum_{i=1}^{N} P_{i,\max}} \quad (13)$$

Under this framework, $P_{i,\max}$ represents, assuming no reduction from wake-induced flow deficits, the theoretical peak power output of turbine i. Table I presents the reanalyzed variables derived from past studies.

TABLE I. REANALYZED VARIABLES DERIVED FROM PAST STUDIES [5, 6]

Parameter	***Case* 1 [5]**	***Case* 2 [6]**
Number of turbines (*N*)	30	26
Total power (kW/year)	14 310	12 352
Efficiency	0.92015	0.91645

IV. RESULTS AND DISCUSSION

This section resumes the achieved results in two cases with comparaisons. Case 1: The current analysis vs. Grady et al. [5], and Case 2: The current analysis vs. Mosetti et al. [6].

A. *Case 1: The current analysis vs. Grady et al.* [5]

Under conditions of constant wind direction and uniform wind speed, the *PSO* optimization applied to a 30- turbine wind farm generates particular layout results as described in [5]. Fig. 2 and Fig. 3 show the configuration aspects including the selected tower heights and rotor diameters. Observing the wind direction, shown by the arrow in these figures, is essential since it helps one to understand the turbine configuration.

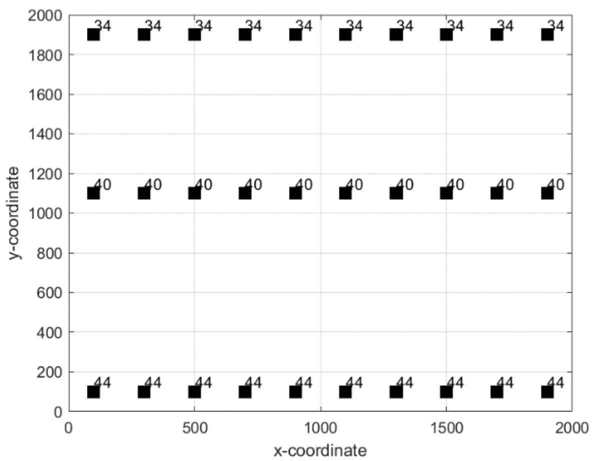

Fig. 3. Layout indicating Optimized Rotor Diameters for Case 1.

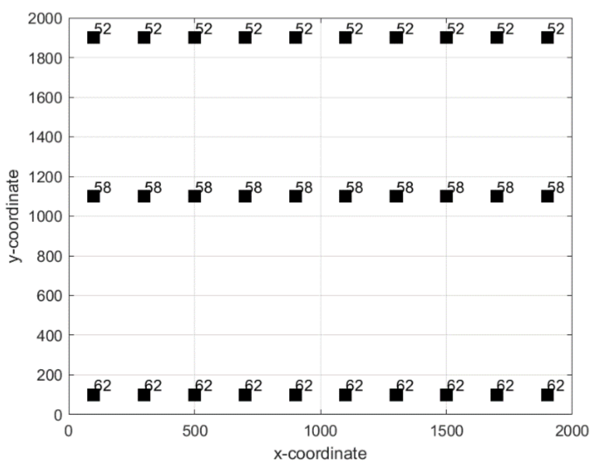

Fig. 4. Layout indicating Optimized Tower Heights for Case 1.

B. *Case 2: The current analysis vs. Mosetti et al.* [6]

Under conditions of constant wind direction and uniform wind speed, the *PSO* optimization applied to a 26- turbine wind farm generates particular layout results as described in [6]. Fig. 4 and 5 show the ideal arrangement including the chosen tower heights and rotor diameters for the turbines, so illustrating the particular design criteria followed in the study by [6].

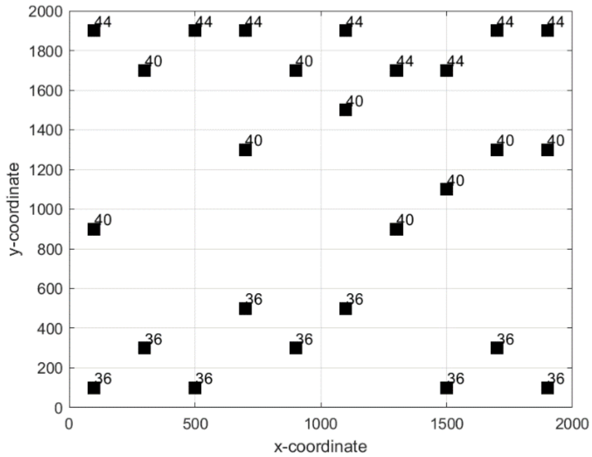

Fig. 5. Layout indicating Optimized Rotor Diameters for Case 2.

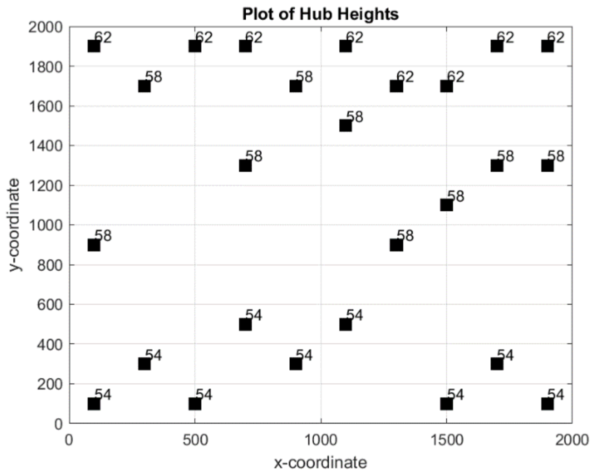

Fig. 6. Layout indicating Optimized Tower Heights for Case 2.

The suggested wind farm design places turbines in a way that maximizes energy capture and reduces wake-generated losses. For instance, in case 1 the front row (upwind) consists of the biggest turbines, with 44 m rotor diameters and 62 m tower heights, placed to maximize quality, undisturbed wind flow. Because of the wake effects from the front row, the middle row includes medium-sized turbines with 40' m rotor diameters and 58' m tower heights operating under partially disturbed wind conditions. With 34 m rotor diameters and 52 m tower heights, finally the smallest turbines in the back row (downwind) are suitably scaled to offset reduced wind speeds and enhanced turbulence. By means of a balanced trade-off between aerodynamic efficiency and wake reduction, this progressive decrease in turbine size and height along the wind direction guarantees of overall performance and energy yield of the wind farm.

The relative results shown in Table II clearly show that changing the rotor diameters and tower heights over the wind farm greatly improves its general efficiency. Unlike previous studies, such as those in [5] and [6], which assumed a uniform rotor radius of 20 m and a fixed tower height of 60 m. The present approach uses a diversified configuration using PSO. Assuming the same number of turbines, this results in an increase in total power and efficiency. It's important to underline that although some turbines in the optimal layout use bigger rotor diameters and higher tower heights to maximize more wind energy, especially in the front rows, others use smaller dimensions.

By preventing needless oversizing over the whole farm, this balanced variation not only improves aerodynamic performance but also helps in managing capital investment costs. Moreover, it should be mentioned that the produced configurations are not original solutions. Stochastic character of heuristic optimization methods means that several combinations of rotor diameters and tower heights could produce rather good efficiencies. Thus, repeated runs of the optimization process can generate various but efficient design solutions that provide flexibility in adjusting to site-specific constraints and financial constraints [16].

TABLE II. EFFICIENCY COMPARISON [3, 4].

Parameter	**Case 1**		**Case 2**	
	[5]	Proposed	[6]	Proposed
No. of Turbines (N)	30	30	26	26
Total Power	14 310	14 708	12 352	12 712
Efficiency	0.9201	0.9315	0.9164	0.9295

Using the enhanced formulation in Eq. (9), the cost per kilowatt of generated power is computed and summarized in Table III. This table compares, for the suggested designs against their respective reference cases, both power output and cost metrics (Grady and Mosetti). The best configurations in both cases produce more total power: 12712 kW/year in Case 2 against Mosetti's 12352 kW/year, and 14708 kW/year in Case 1 against Grady's 14310 kW/year. Crucially, these increases are accompanied by a decrease in normalized total cost (from 1.5436×10^{-3} for Case 1 and from 1.6197×10^{-3} for Case 2). This shows that different turbine sizes let for better cost-to-power ratios. With unambiguous economic and operational advantages, the results confirm the value of including dimensional optimization into wind farm design.

TABLE III. COST COMPARISON [3, 4].

Parameter	*Case* 1		*Case* 2	
	[5]	Proposed	[6]	Proposed
No. of Turbines (N)	30	30	26	26
Total Power	14 310	14 708	12 352	12 712
Total cost	1.5436×10^{-3}	1.5048×10^{-3}	1.6197×10^{-3}	1.5464×10^{-3}

The results confirm that measured increases in both cost-effectiveness and efficiency follow from optimal rotor diameters and tower heights. Clearly better than standard turbine designs, this method provides a useful compromise between maximizing energy capture and minimizing wake losses.

V. CONCLUSION

Selecting tower heights and rotor diameters in staggered configuration assists to increase the overall efficiency of a wind farm and can even offer cost benefits, particularly in situations where wind speed and direction remain quite stable. Under this research, a uniform thrust coefficient is considered for all the turbines with varying rotor diameters, an assumption that can be made feasible through effective rotor design. In line with previous research, wind speed at the tower height of each turbine is used as the local wind speed that impacts that turbine's power output. Once an optimal turbine setting, by genetic algorithms or other optimizing techniques, is established, then the rotor diameters and tower heights can be reevaluated for additional adjustments. However, the actual benefits of varying tower heights and rotor diameters in conditions closer to real-world situations, where wind direction and speed vary, is an area of crucial future study.

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Ministry of Higher Education and Scientific Research
University of Mouloud Mammeri, Tizi-Ouzou
Faculty of Electrical Engineering and Computer Science

International Conference on Artificial Intelligence,
Embedded Systems, and Renewable Energy

15-17 December 2025

AIESRE 2025
PROGRAM

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Program Layout

1ST DAY - 15 DECEMBER	
	Registration (8:00- 8:30)
	Opening Ceremony (8:30 – 9:00)
	Keynote 1 (9:00 – 9:45) **PROF. TEDJANI MESBAHI** **Smart Battery and Hybrid Energy Storage Systems for Electric Vehicles and Drones: Advanced Energy Management Strategies and Applications**
	Coffee break (9:45 – 10:15)
	Keynote 2 (10:15 – 11:00) **DR. HACIB BEN AISSA** **Energy Transition and Industry Decarbonisation: Emerging Pathways and Technologies**
	Oral Session 1 (11:00 – 12:00) **Track 1** **Track 5** **Track 6**
	Lunch (12:00 – 13:00)
	Keynote 3 (13:00 – 13:45) **MR. DANIEL COOK** **Energy Management and Storage with Bio-Based Phase Change Materials**
	Oral Session 2 (13:45 – 14:45) **Track 1** **Track 5** **Track 6**
	Poster Session & Coffee break (14:45 – 15:30)
	Online Session (15:30 – 17:30) **Track 1** **Track 5** **Track 6**

2ND DAY- 16 DECEMBER	
	Keynote 1 (9:00 – 9:45) **PROF. HAMID LAGA** **Efficient Deep Learning for 3D/4D Shape Analysis: From Medical Applications to Generative AI**
	Coffee break (9:45 – 10:15)
	Keynote 2 (10:15 – 11:00) **PROF. FREDE BLAABJERG** **Challenges of Renewable Energy Integration in Clean Energy Systems**
	Oral Session 1 (11:00 – 12:00) **Track 1** **Track 2** **Track 3&4**
	Lunch (12:00 – 13:00)

2ND DAY- 16 DECEMBER	**Keynote 3 (13:00 – 13:45)** **DR. KAMAL HADIDI** **Innovating Chemical Manufacturing: Low-Temperature Solutions for Energy Efficiency and Emissions Reduction**
	Oral Session 2 (13:45 – 14:45) **Track 1** **Track 2** **Track 3&4**
	Poster Session & Coffee break (14:45 – 15:30)
	Online Session (15:30 – 17:30) **Track 1** **Track 2** **Track 3&4**
3RD DAY- 17 DECEMBER	
	Panel Discussion 1 (8:30 – 9:30) **Policy, Regulation and Standards in Renewable Energy** **Energy Transition and Decarbonization Strategies**
	Coffee Break (9:30 – 10:00)
	Panel Discussion 2 (10:00 – 11:00) **Energy Education and Training for the Future Workforce** **Stakeholder Collaboration and Economic Benefits of Renewable Energy**
	Award & Closing Ceremony (11:00 – 12:00)
	Historic Tizi Ouzou and Surroundings **(Starting at 12:00)** **Guided Tour (Lunch Included)**

Presentation – Duration & Format

Keynote:	Each presentation is 30 minutes, followed by 10 minutes of Q&A
Oral Presentation:	Each presentation is 10 minutes, followed by 5 minutes of Q&A
Note:	Accepted file formats for all presentations are PDF and PPT

Zoom Information

Room#	Zoom
Mammeri Room01	https://uva-live.zoom.us/j/62109557560?pwd=16u7zKQ2Vnvp7tHKrvbZ3bvTgett1O.1 Meeting ID: 621 0955 7560 Passcode: 497195
Mammeri Room02	https://zoom.us/j/95191075939?pwd=dZj4V18csPyDXZoNhdEjWOLztURIpX.1 Meeting ID: 951 9107 5939 Passcode: 054356
Mammeri Room03	https://us02web.zoom.us/j/84885459983?pwd=c2FqbWdGSkdwRVRZWmcyYURFSllxQT09 Meeting ID: 848 8545 9983 Passcode: 063890

Track Room Assignments

Track#	Title	Room
Track 1	Harnessing Renewable Energy: Advances and Innovations	Mammeri Room01
Track 2	Innovations in Embedded Systems for Renewable Energy Management	Mammeri Room02
Track 3	Green Computing (ML/AI) for Renewable Energy Integration	Mammeri Room03
Track 4	Advancing Hybrid Energy Systems for Sustainable Infrastructure	Mammeri Room03
Track 5	Energy Management and Storage	Mammeri Room02
Track 6	Innovations in Precision Agriculture and Sustainable Water Management	Mammeri Room03
Panel Discussion	Renewable Energy Policy and Regulation, Education and Training, and Stakeholder Collaboration	Mammeri Room01

Session Schedule

Day 1: Monday – December 15, 2025 / Oral Session 1

Session Code:	**Track 1**
Session Title:	**Renewable Energy Innovation, Control, and Optimization**
Session Time:	*11:00 – 12:00*
Session Room:	**Mammeri_Room01**
Session Chairs:	**MEZIANE HAMEL & SAID AISSOU**

ID	Starts at	Title & Authors
67	**11:00**	**Sustainable Power Generation via Olive Solid Waste Gasification in the Tizi Ouzou Region.** Abdenour Elias and Abderrezak Kennas
71	**11:15**	**Analysis of Long-Term Performance Degradation in Photovoltaic Modules** Amar Hadj Arab, Bilal Taghezouit, Fatah Mehareb, Smail Semaoui, Kamel Abdeladim, Ismail Bendaas, Abdelhak Razagui, Kada Bouchouicha, Saliha Boulahchiche and Fella Tobbal
77	**11:30**	**Sensorless Voltage-Oriented Control of Modular Multilevel Converters for Wind Power Systems** Mustapha Asnoun, Adel Rahoui, Koussaila Mesbah, Boussad Boukais, Noumidia Amoura and Seddik Bacha
130	**11:45**	**Improved Funnel Control Strategy with PI Regulation for Wind Energy Systems for Maximum Power Point Tracking** Zaina Ait Chekdhidh, Aghiles Ardjal and Maamar Bettayeb

Day 1: Monday – December 15, 2025 / Oral Session 1

Session Code:	**Track 5**
Session Title:	**Advanced Control, Optimization, and Sustainable Technologies for Renewable Energy Systems**
Session Time:	**11:00 – 12:00**
Session Room:	**Mammeri_Room02**
Session Chairs:	**AREZKI FEKIK & MOHAMED LAMINE HAMIDA**

ID	Starts at	Title & Authors
33	**11:00**	**Solar Inverter Performance Prediction Using Double Exponential Curve Fitting** Lyazid Kaci, Amar Hadj Arab and Rachid Zirmi
44	**11:15**	**Robust Generalized Predictive Speed with Direct Torque Control for Multiphase Wind Generators under Parametric Uncertainty** Kamel Ouari, Amel Kasri, Youcef Belkhier and Zoubir Boudries
58	**11:30**	**Energy-Efficient and Sustainable Approaches to AS/RS Design and Control: A Comprehensive Review** Omar Bahmid, Sihem Kouloughil and Bendiouis Amaria
97	**11:45**	**Equivalent Consumption Minimization Strategy for Energy Management in Unmanned Aerial Vehicle** Haroune Aouzellag and Sabrina Nacef

Day 1: Monday – December 15, 2025 / Oral Session 1

Session Code:	**Track 6**
Session Title:	**AI-Driven Automation and Robotics for Precision Agriculture**
Session Time:	**11:00 – 12:00**
Session Room:	**Mammeri_Room03**
Session Chairs:	**KHALED BOUNAR & DRISS NEHARI**

ID	Starts at	Title & Authors
92	**11:00**	**Using a UAV Crop Monitoring System for Early Tomato Disease Detection and Decision Support** Dimosthenis Minas, Theodosios Chronopoulos and Michalis Xenos
105	**11:15**	**Sensor-Driven Real-Time Obstacle Detection for Agricultural Drone Spraying Systems** Ahmed Lallal, Sabrina Mokrani, Tassadit Sadoun and Mehammed Daoui
112	**11:30**	**Fruit Anomaly Detection and Manipulation Using a Vision-Guided Autonomous Aerial Manipulator** Bidjad Souier, Choukri Bensalah, Rida Mokhtari, Amal Choukchou Braham and Mohamed Abderrahim

Day 1: Monday – December 15, 2025 / Oral Session 2

Session Code:	**Track 1**
Session Title:	**Innovations in Renewable Energy Conversion, Optimization, and Integration**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room01**
Session Chairs:	**FATMA LOUNNAS & KAHINA LAGHA**

ID	Starts at	Title & Authors
27	**13:45**	**Performance and Emission Analysis of LPG-Hydrogen Dual Fuel Engines** Hassina Ghodbane, Fouad Khaldi and Bahloul Derradji
55	**14:00**	**Comparative Study of the Different Structures of Multi-Level Inverters for the Connection of PV Systems to the Power Grid** Amina Benabda and Amina Azizi
83	**14:15**	**Hippopotamus Optimization Algorithm-Based Robust Tilt-FOID Control Design for Linear Time-Invariant Systems in Renewable Energy Applications** Elouahab Bouguenna, Samir Ladaci, and Akila Djoudi Gherbi
107	**14:30**	**Coupled Magneto-Mechanical Modeling of a Marine Wave Energy Recovery System** Bachir Ouartal, Meziane Hamel, Mustapha Zaouia, Ratiba Fellag, Riad Moualek and Ahmed Nait Ouslimane

Day 1: Monday – December 15, 2025 / Oral Session 2

Session Code:	**Track 5**
Session Title:	**Advanced Forecasting, Control, and Energy Harvesting**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room02**
Session Chairs:	**MOURAD LAGHROUCHE & FATEH KRIM**

ID	Starts at	Title & Authors
138	13:45	**Design and Development of a Piezoelectric Shoe Using Lead-Free Composite Materials for Mechanical Energy Harvesting** Zakia Chelli, Massine Gana, Hakim Achour, Abdel Madjid Djidda, Yacine Baghdadi, Malika Saidi, Mourad Laghrouche and Ahcène Chaouchi
140	14:00	**Energy Management of a Smart District Using the Neural Predictions and Predictive Control Model (MPC)** Zoulikha Ouchefoun, Mourad Hasni and Lakhdar Guenfaf
173	14:15	**Enhanced Battery Health Forecasting with Dynamic Thresholds Using Multi Input LSTM Networks** Rafik Saddaoui, Karim Oudiai, Mhenna Nachef, Hamid Hamiche, Rachid Zirmi and Mourad Laghrouche
185	14:30	**Predictive Control of DFIG in a Hybrid PV/DFIG/Batt System Supplying a Water Pumping System** Tarek Boudjerda, Sofia Lalouni Belaid and Salah Tamalouzt

Day 1: Monday – December 15, 2025 / Oral Session 2

Session Code:	**Track 6**
Session Title:	**Intelligent Sensing and Prediction for Agricultural Systems**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room03**
Session Chairs:	**NABIL KHERBACHE & SALAH HADDAD**

ID	Starts at	Title & Authors
134	13:45	**Prediction of a Tunnel Greenhouse Relative Humidity Using Artificial Neural Network** Salah Bezari, Asma Adda and Sidi Mohamed El Amine Bekkouche
161	14:00	**Review of Smart Systems in Aquaculture and Aquaponics** Elarbi Kacemi, Khelifa Benahmed and Tariq Benahmed
178	14:15	**Comparative Analysis of YOLOv8, YOLOv11, and Faster R-CNN for Multi-Crop Plant Disease Detection** Rim Gasmi, Marwa Chander and Mohamed Amine Badache

Day 1: Monday – December 15, 2025 / Poster Session

Session Code:	**Track 1, 5 & 6**
Session Title:	**Smart Energy, Machine Learning, and Power Materials Reliability**
Session Time:	**14:45 – 15:30**
Session Room:	**Mammeri_Hall**
Session Chairs:	**MUSTAPHA MOUDOUD & SAID DJENNOUNE**

ID	Starts at	Title & Authors
72	**14:45**	**Smart Energy Control in PV-Battery Systems Using Three-Level Boost Converters with DC-Link Voltage Regulation via Genetic Algorithm** Ahmed Bahri, Nabil Mezhoud, Bilel Ayachi, Abdelkrim Thameur, Farouk Boukhenoufa and Abderrahmane Bellaouar
85	**14:45**	**Bio-Inspired Method for Optimal Energy Management and Efficiency Improvement of Microgrids** Nabil Mezhoud, Ahmed Bahri, Farouk Boukhenoufa, Bilel Ayachi, Lakhdar Bouras and Ilham Ahmed Hazila
131	**14:45**	**Thermal Aging Effects on the Electrical, Mechanical and Physicochemical Properties of LDPE Power Cables Insulation** Ferhat Slimani, Abdallah Hedir, Mustapha Moudoud, Omar Lamrous, Soraya Nait Larbi and Sébastien Rondot
142	**14:45**	**Comparative Numerical Study of Multilayer Walls with and without Phase Change Materials for Enhanced Thermal Performance** Asma Bouterfif and Farid Mechighel
146	**14:45**	**Design and Implementation of a Modular Cold Storage System** Bouchra Lahlou, Latefa Ghomri and Mohammed Sari
151	**14:45**	**Performance Assessment of ANN and MLR Models for Predicting NF/RO Desalination System** Asma Adda, Salah Bezari and Salah Hanini
163	**14:45**	**Heart Beat IoT: Real-Time Cardiac Monitoring** Saliha Rabehi, Malika Saidi, Hayat Hammouche, Nadia Serkhane, Hakim Achour, Ahcéne Chaouchi, Mourad Laghrouche, Nouara Lamrani, Mohamed Rguiti, Christian Courtois, Yannick Lorgouilloux and Mohamed Aymen Ben Achour
177	**14:45**	**Effect of Critical Current Density Dependence on the Internal Magnetic Field Penetration in an HTC Superconducting Bulk** Asma Azzouza, Hicham Allag and Jean-Paul Yonnet
183	**14:45**	**Machine Learning for Predictive Maintenance of Electrical Machines: A Review** Taher Amraoui, Samir Merad and Ahmed Amrane
184	**14:45**	**Hydrothermal Degradation Impacts on the Properties Of PVC Cables Insulation** Hassene Ait Ouazzou, Ferhat Slimani and Mustapha Moudoud
191	**14:45**	**Ultraviolet Aging Effects on the Dielectric Properties of PVC/Al_2O_3 Nanocomposites Cables Insulation** Sabrina Amraoui, Abdallah Hedir, Ferhat Slimani, Mustapha Moudoud, Omar Lamrous and Ali Durmus

Day 1: Monday – December 15, 2025 / Online Session

Session Code:	**Track 1**
Session Title:	**Advanced Renewable Energy Systems: Design, Monitoring, and Control**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room01**
Session Chairs:	**AGHILAS ARDJAL & YACINE TRIKI**

ID	Starts at	Title & Authors
136	**15:30**	**Study and Development of Methodology for Dimensioning Photovoltaic Systems (PVS)** Leonardo Kunen, André Tavares, Breno Carvalho and Franciele Ronchi
153	**15:45**	**Daily Energy Production Patterns in Medium-Scale Hydroelectric Operations: a Longitudinal Descriptive Study** Elmer Arellanos-Tafur and Marcelo Damas-Niño
156	**16:00**	**Design and Implementation of a Low-Cost Automatic Weather Station Based on the Internet of Things** Sefia Attia, Abdelkader Mechernene and Mourad Loucif
158	**16:15**	**From Grid Following to Grid Forming in PV Grid Tied Single Phase Inverter** Mourad Zebboudj, Syphax Ihammouchen, Toufik Rekioua, Djamila Rekioua, Ali Chebabhi and Mohammed Said Ouahabi
167	**16:30**	**Overshoot-Free Speed Control in PMSG Wind Turbines Using a Smooth Sliding Mode Controller** Wassila Hattab, Abdelhamid Benakcha, Seddik Tabet, Amira Slimani, Ahmed Marouane Ghodbane
84	**16:45**	**Modeling High-Performance $Cs_{0.05}(FA_{0.77}MA_{0.23})_{0.95}Pb(I_{0.77}Br_{0.23})_3$ Perovskite Solar Cells via SCAPS-1D Simulation** Belkacem Hanafi, Abderrahim Yousfi, Rabah Boubaaya, Okba Saidani, Mokhtar Djendel, Sara Bendib, Rafik Zouache
179	**17:00**	***Numerical Investigation of CsSnCI3 Perovskite Solar Cells Utilizing WS2 and CuSbS2 Transport Layers for Enhanced Efficiency beyond 24%*** Ahmed Benameur, Abderrahim Yousfi, Okba Saidani
186	**17:30**	**Seasonal Variability and Performance Optimization of Wind Power Generation: A Comprehensive Study of ENGIE Operations** Elmer Arellanos-Tafur and Marcelo Damas-Niño

Day 1: Monday – December 15, 2025 / Online Session

Session Code:	**Track 5**
Session Title:	**Metaheuristic Optimization and Control Strategies for Hybrid Systems**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room02**
Session Chairs:	**TEDJANI MESBAHI & SMAIL SEMAOUI**

ID	Starts at	Title & Authors
28	**15:30**	**PSO Algorithm for Optimal of Fuzzy Logic Controller for A DC-DC Buck Converter** Ahmed Bennaoui, Aissa Ameur, Ameur Bennaoui and Salah Benzian
64	**15:45**	**Two-Level Hierarchical Control of a PV-Battery Hybrid Energy System Using Differential Flatness-Based Strategy and MShOA-Tuned FOPID Controller** Hadjer Chabana, Ilyes Tegani, Hamza Afghoul and Soumia Merah
73	**16:00**	**Comparative Optimal Dispatch Control Strategies for a Hybrid Renewable Energy System** Mourad Zebboudj, Djamila Rekioua and Toufik Rekioua
115	**16:15**	**Energy Management of a PEMFC/Battery Electric Vehicle Using a State Machine Strategy** Khoudir Kakouche, Toufik Rekioua, Djamila Rekioua, Amira Slimani, Zahra Mokrani and Mohammed Amine Soumeur
149	**16:30**	**Optimization of Energy Management in a PV–Wind–Battery Microgrid Using PSO in MATLAB** Meziane Kaci, Hassane Ezziane, Slim Rouabah, Zakaria Layate, Hakim Ait Said and Hamou Nouri
154	**16:45**	**Statistical Assessment of Commercial Electric Service Quality: A Case Study of ENEL Distribution Company in Peru** Marcelo Damas-Niño and Elmer Arellanos-Tafur
162	**17:00**	**Optimal Distribution Network Reconfiguration for Minimizing Energy Losses and Enhancing Reliability Using Metaheuristics** Anes Bouhanik, Samir Bouslimani, Ahmed Salhi, Djemai Naimi, Younes Zahraoui and Saad Mekhilef

Day 1: Monday – December 15, 2025 / Online Session

Session Code:	**Track 6**
Session Title:	**Machine Intelligence and Sensing Technologies for Precision Agriculture and Water Management**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room03**
Session Chairs:	**MOHAMMED RACHEDINE & ADAM BELLOUM**

ID	Starts at	Title & Authors
30	**15:30**	**Hybrid WCA-HS Based Control for Autonomous Quadrotor Navigation in Precision Agriculture** Nesrine Tenniche, Boubekeur Mendil, Farid Ghilas and Lamine Brikh
40	**15:45**	**Advancing Infiltration Modeling with Deep Learning: A Superior Alternative to Empirical Approaches in the Mitidja Plain** Amina Mazighi, Mohamed Meddi and Hind Meddi
91	**16:00**	**Advancing Agricultural Robotics: AI Control Strategies for Delta Robots** Issam Kessira, Ali Chabane, Nawel Ghazi, Khaled Benfriha and Samir Meradi
98	**16:15**	**Early-Season Water Use Patterns in Wheat and Barley under Semi-Arid Conditions: A Lysimetric Approach** Omar Bouziane, Mohamed Meddi and Amina Mazighi
147	**16:30**	**IoT-Based Climatic Environment Monitoring System Design for a Cattle Breeding Buildings** Sihem Souiki, Mourad Hadjila, Reda Yagoub, Abdelillah Boudjella and Oussama Ahed Messaoud
157	**16:45**	**Integrated Geophysical Approach for Groundwater Prospecting** Doria Kutrubes and Khaled Bounar

Day 2: Tuesday – December 16, 2025 / Oral Session 1

Session Code:	**Track 1**
Session Title:	**Advanced Photovoltaic Materials and Solar Forecasting**
Session Time:	**11:00 – 12:00**
Session Room:	**Mammeri_Room01**
Session Chairs:	**NACEREDDINE BENAMROUCHE & MOHAMMED KAOUANE**

ID	Starts at	Title & Authors
22	11:00	**Comparative Analysis of Pure ZnO, Ag-Mn Codoped ZnO, and Mn:ZnO/Ag/Mn:ZnO Multilayer Transparent Conductive Oxides for Photovoltaic Applications** Fouaz Lekoui, Khaoula Settara, Rachid Amrani, Elyes Garoudja, Walid Filali, Slimane Oussalah, Driss Dergham and Salim Hassani
41	11:15	**Characterization of EVA/phase change material blend embedded with zinc oxide (ZnO) nanomaterial as nanocomposite for photovoltaic module encapsulation process** Kamel Agroui, Lyes Maifi, Ouided Hioual, Aicha Ayadi and Abdelhamid Chari
70	11:30	**Surpassing 16% Efficiency in Cd-Free CZTS Solar Cells via Si Back-Contact Engineering and IR Harvesting** Lynda Metref, Essaid Mansouri, Mahfoud Abderrezek and Samira Sali
171	11:45	**A Hybrid Electrical and Environmental LSTM Approach for Short-Term Solar Power Forecasting in Algeria** Rafik Saddaoui, Samir Aoughlis, Karim Oudiai, Nachef Mhenna, Hamiche Hamid and Mourad Laghrouche

Day 2: Tuesday – December 16, 2025 / Oral Session 1

Session Code:	**Track 2**
Session Title:	**Edge AI and Intelligent Monitoring for Energy Systems**
Session Time:	**11:00 – 12:00**
Session Room:	**Mammeri_Room02**
Session Chairs:	**NADHIR DJEFFAL & RACHID ZIRMI**

ID	Starts at	Title & Authors
26	11:00	**Recent Advances in the Application of TinyML and Edge Devices in Solar Photovoltaic Systems: Bridging the Gap Between Laboratory Research and Industry** Adel Mellit and Marco Zennaro
49	11:15	**An Embedded AI Model for Defect Detection in Photovoltaic Modules Using a Jetson Nano-Powered Unmanned Aerial Vehicle** Nouamane Kellil, Adel Mellit, Toufik Benkherouf and Maamar Bettayeb
125	11:30	**Unbalance fault detection in an IoT-Connected Motor Network Using Artificial Neural Networks** Massine Gana, Zakia Chelli, Rafik Saddaoui, Hakim Achour and Mourad Laghrouche

Day 2: Tuesday – December 16, 2025 / Oral Session 1

Session Code:	**Track 3&4**
Session Title:	**Data-Driven Modeling and Optimization in Power Systems**
Session Time:	**11:00 – 12:00**
Session Room:	**Mammeri_Room03**
Session Chairs:	**ADAM BELLOUM & FERHAT SLIMANI**

ID	Starts at	Title & Authors
36	**11:00**	**Advanced Polynomial and Gaussian Regression Frameworks for Predictive Modeling of Tangential Discharge Phenomena in High-Voltage Insulation Systems** Nabila Saim
80	**11:15**	**Data-Driven Based Sparse Identification of Nonlinear Dynamics for Stability Analysis of Mixed Grid-Following and Grid-Forming Inverters** Houssam Deboucha, Bessam Deboucha, Elyazid Amirouche, Said Aissou, Ali Berboucha, Kaci Ghedamsi and Saad Mekhilef
121	**11:30**	**Formal Concept Analysis for Knowledge Extraction and Optimal Configuration Selection in Photovoltaic Installations** Zina Ait Yakoub, Ali Bechouche and Djaffar Ould Abdeslam
170	**11:45**	**Study of a Hybrid PV/Fuel Cell System Dedicated to an Electric Vehicle Charging Station** Mohamed Lamine Hamida, Damya Iamrache, Sarah Maouche, Hakim Denoun, Arezki Fekik, Dyhia Kais and Zoulikha Tebri

Day 2: Tuesday – December 16, 2025 / Oral Session 2

Session Code:	**Track 1**
Session Title:	**Intelligent Control and Fault Diagnosis in Photovoltaic Systems**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room01**
Session Chairs:	**KARIM KEMIH & MOUNIR AMIR**

ID	Starts at	Title & Authors
59	**13:45**	**A Novel Linguistic Hedge-Based Fuzzy Logic Controller for Enhanced MPPT in PV Systems** Chellali Benachaiba
61	**14:00**	**Tuning of a Neutrosophic Fuzzy Controller for DC Motor Using the Novel Qudwa Metaheuristic** Chellali Benachaiba
87	**14:15**	**Experimental Study of Solar Water Pump Control by Arduino** Amina Azizi and Amina Benabda
93	**14:30**	**Open-Circuit Fault Diagnosis of a Three-Level Boost Converter for Photovoltaic Applications** Abdeldjabar Benrabah, Mouaad Belguedri, Mohamed-Amine Yahiaoui, Fayçal Benyamina and Mohamed Benbouzid

Day 2: Tuesday – December 16, 2025 / Oral Session 2

Session Code:	**Track 2**
Session Title:	**Control and Security in Modern Renewable Energy Systems**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room02**
Session Chairs:	**ADEL MELLIT & MASSINE GANA**

ID	Starts at	Title & Authors
53	**13:45**	**Security of Grid-Connected Photovoltaic Plants A Mini-Review and Future Directions** Nassiha Boutana, Rokia Chekirou, Adel Mellit and Maamar Bettayeb
141	**14:00**	**Direct Power Control Technique for Wind Power Generation System based on a Double Stator Induction Generator (DSIG)** Fatma Lounnas
190	**14:15**	**Development and Design of an Intelligent Energy Router** Rachid ZIRMI, Belkacem Zouak, Nadhir Djeffal, Abderrahmane Alem, Massinissa Kloul and Hakim Achour

Day 2: Tuesday – December 16, 2025 / Oral Session 2

Session Code:	**Track 3&4**
Session Title:	**Intelligent Control and Optimization in Renewable Energy Systems**
Session Time:	**13:45 – 14:45**
Session Room:	**Mammeri_Room03**
Session Chairs:	**GHANIA BELKACEM & BILAL ATTALLAH**

ID	Starts at	Title & Authors
123	**13:45**	**Improving the Performance of a Wind Turbine PID Controller Using GWO Optimization and Fuzzy Logic** Houari Habiba and Noureddine Zerhouni
128	**14:00**	**Stabilizing Photovoltaic Output Using a Controlled Ćuk Converter Topology** Mohamed Kaouane, Nidhal Cherrat and Akkila Boukhelifa
188	**14:15**	**Anomaly Detection in Datacenter Energy Consumption Using an Autoencoder** Karima Oukfif
194	**14:30**	**Optimizing Batteries Charging Time Inside an Autonomous Photovoltaic System Installed on a House's Roof** Salah Tamalouzt, Kamel Djermouni, Ali Berboucha, Kaci Ghedamsi and Djamal Aouzellag

Day 2: Tuesday – December 16, 2025 / Poster Session

Session Code:	**Track 1, 2, 3 & 4**
Session Title:	**Smart Sensing, and Intelligent Control in Energy and IoT Systems**
Session Time:	**14:45 – 15:30**
Session Room:	**Mammeri_Hall**
Session Chairs:	**MUSTAPHA MOUDOUD & SAID DJENNOUNE**

ID	Starts at	Title & Authors
38	**14:45**	**Determination of the Minimum Capacitance for Self-Excitation of a SEIG, Taking Into Account the Speed Ramp Up** Madjid Si Brahim, Rabah Rouas, Rahma Kachenoura and Salah Haddad
57	**14:45**	**Comparative Analysis of MPPT Algorithms for Photovoltaic Systems Under Partial Shading: A MATLAB/Simscape-Based Study** Ahmed Chebri, Fatima Zohra Boukahil, Assala Mouffouk and Boubekeur Azoui
90	**14:45**	**Transformer Fault Diagnosis Using HHO-Enhanced XGBoost and Liquid Dielectric Signal Analysis** Tarek Bouguettaya, Abderrahim Reffas, Mohammed Adaika, Hicham Talhaoui, Oualid Aissa and Sherif S. M. Ghoneim
110	**14:45**	**Graph-Based Semi-Supervised Learning for Fault Clustering in Grid-connected PV Systems** Nassim Sabri
114	**14:45**	**Detection of Silicone Oil Concentration Using a Two-Dimensional Photonic Crystal Sensor** Sarra Bendib, Saidani Okba, Abderrahim Yousfi and Nadhir Djeffal
120	**14:45**	**AI-Enabled Wearable IoT Device for Facial Recognition in Student Transportation Systems** Dhai Eddine Salhi, Majdi Rawashdeh, Mohamed Tahar Bennai, Awny Alnusair and Ali Karime
135	**14:45**	**Dynamic Performance Evaluation of a Dual-Star Induction Machine Fed by an Indirect Matrix Converter** Sifoura Mezhoud, Celia Mehanaoui and Ahmed Azib
159	**14:45**	**A Low-Cost and Eco-Friendly Humidity Sensor Based on Keratin Thin Film** Hayat Hammouche, Rachida Douani, Ahcène Chaouchi, Saliha Rabhi, Nouara Lamrani and Mourad Laghrouche
172	**14:45**	**Wearable Low-Energy RFID-Integrated Vibration Tag for Silent, Long-Term Sleep Apnea Monitoring and Posture Sensing** Rafik Saddaoui, Samir Aoughlis, Karim Oudiai, Mhenna Nachef, Hamid Hamiche and Mourad Laghrouche
175	**14:45**	**Low Power Energy and Real-Time Localization of Prisoners Inside Correctional Facilities Using Inertial Sensors and Particle Filtering: A Dead Reckoning Approach** Samir Aoughlis, Rafik Saddaoui, Karim Oudiai, Hamid Hamiche, Brahim Achour and Mourad Laghrouche

Day 2: Tuesday – December 16, 2025 / Online Session

Session Code:	**Track 1**
Session Title:	**Innovations and Optimization in Wind, Solar, and Hybrid Renewable Systems**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room01**
Session Chairs:	**MEZIANE HAMEL & KOUSSAILA MESBAH**

ID	Starts at	Title & Authors
68	**15:30**	**A Heuristic Optimization Approach for Wind Turbine Dimensions to Enhance Energy Capture and Reduce Costs** Mourad Naidji, Mohamed Ilyas Rahal, Alla Eddine Toubal Maamar, Aicha Aissa-Bokhtache, Maamar Latroch and Radu-Florin Porumb
75	**15:45**	**Advancements in Solar Energy Systems: Innovations in Photovoltaic (PV) and Floating PV Technologies for Decentralized Energy Production** Mourad Naidji
103	**16:00**	**Current Sensor Fault Diagnosis of Wind Power System Based on DFIG** Chaima Gherari, Farid Berrezzek, Hicham Zaimen and Khaled Khelil
106	**16:15**	**Cold plasma-Based Methane Dry Reforming for Hydrogen Production** Abir Azara and Khadidja Khodja
122	**16:30**	**Recent Advancements in Energy Management for Hybrid Renewable Energy Systems** Fayçal Hassaini, Said Aissou, Ali Berboucha, Elyazid Amirouche, Yanis Hamoudi, Houssam Deboucha and Abdelhakim Belkaid
152	**16:45**	**Renewable Energy Deployment Efficiency: Analyzing Algeria's Achievement Gap and Optimization Strategies** Elmer Arellanos-Tafur and Marcelo Damas-Niño
126	**17:00**	***Ultra Wideband Hybrid-Shaped Dielectric Resonator Antenna Using (RE-$BaTiO_3$) for Modern Wireless Communication Applications*** Chelghoum Rachid, Brahimi Abdelhalim, Bourouba Nacerdine, Juan Pablo Martínez Jiménez, Bouzit Nacerdine, Zerrougui Raouf, Yousfi Abderrahim, Saidani Okba

Day 2: Tuesday – December 16, 2025 / Online Session

Session Code:	**Track 2**
Session Title:	**Advanced Control and Modeling for Wind and PV Energy Systems**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room02**
Session Chairs:	**RATIBA FELLAG & NIDAL CHERRAT**

ID	Starts at	Title & Authors
43	**15:30**	**Real-Time Sensorless Control for PMSG Wind Generators Using Step-by-Step Sliding Mode Observer on STM32** Sofiane Benabit, Hocine Khati, Arezki Fekik and Malek Ghanes
52	**15:45**	**Two Step Ahead Finite Set Predictive Torque Control Using Improved Sliding Mode Control for Three Phase Induction Motor** Sofiane Brahami, Kaci Ghedamsi, Yanis Hamoudi and Abdelyazid Achour
78	**16:00**	**A Prototype Design of Smart DC Power Device for Solar System Application** Khadar Saad, Larbi Brahimi, Mohamed Elbar, Meriem Ghezal, Aya Mebarki and Sif Eddine Souadia
117	**16:15**	**Co-Simulation and Modeling of WT-AFPMSG Based on Ansys Software and MATLAB/Simulink for Wind Energy Application** Lina Bouhafs, Salah Tamalouzt, Mustafa Ergin Şahin and Ahcene Bouzida
118	**16:30**	**Enhanced Fault-Tolerant Harmonic Compensation in Grid-Connected PV Systems: A Comparative Study of Analog Filters for Cascaded Multilevel Inverter Control** Sabrina Nacef, Haroune Aouzellag, Bessam Amrouche, Rabah Babouri and Kaci Ghedamsi
119	**16:45**	**Enhanced Direct Current Control in Grid-Following Inverters Using Open-Loop Synchronization and PR Regulator for Renewable Energy Integration** Lakhder Ayhar, Ahmed Safa, Abdelmadjid Gouichiche and Fayssal Elyamani Benmohamed
129	**17:00**	**A Space Vector Modulation Scheme for Five-Phase to Three-Phase Indirect Matrix Converter for a Wind Power Application** Celia Mehanaoui, Sifoura Mezhoud, Ahmed Azib and Nabil Taib

Day 2: Tuesday – December 16, 2025 / Online Session

Session Code:	**Track 3 & 4**
Session Title:	**Advanced AI, Forecasting, and Control Strategies in Modern Energy Systems**
Session Time:	**15:30 – 17:30**
Session Room:	**Mammeri_Room03**
Session Chairs:	**KARIMA OUKFIF & MEHAMMED DAOUI**

ID	Starts at	Title & Authors
31	**15:30**	**Fault Diagnosis of Induction Motors Using Convolutional Neural Networks** Benyamine Arroul, Farid Tafinine and Farid Ghilas
101	**15:45**	**Autonomous Photovoltaic/Thermal Solar Solution for Resilient Isolated Habitats** Djamila Rekioua, Nabil Mezzai, Toufik Rekioua, Zahra Mokrani, Khoudir Kakouche, Adel Oubelaid and Chokri Ben Salah
109	**16:00**	**Intelligent Hysteresis Current Control Based on Support Vector Machine for SAPF Integrated PV System Under Nonstationary Harmonics** Mustapha Meraouah, Faiza Kaddari, Said Hassaine, Youcef Mihoub and Sandrine Moreau
145	**16:15**	**Forecasting Electrical Outages in Adrar, Algeria: Towards a Smart Energy Management System** Samia Bentaieb, Driss Nehari, Ammar Neçaibia and Messaoud Hamouda
155	**16:30**	**A Multidisciplinary Systems Engineering Approach to Hybrid Energy Systems Development** Khaled Bounar and Salah Badjou
168	**16:45**	**A LADRC-Based Robust Speed Controller for PMSMs in Electric Vehicles With External Disturbance Rejection** Amira Slimani, Amor Bourek, Abdelkarim Ammar, Khoudir Kakouche, Wassila Hattab and Samira Heroual
182	**17:00**	**Emerging AI Methodologies in the Renewable Energy Ecosystem: Successes, Challenges, and Future Research Directions (v2)** Temitope Bobola and Temitayo Fagbola