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An Empirical Analysis of Green Technology Innovation and Ecological Efficiency Based on a Greenhouse Evolutionary Ventilation Algorithm Fuzzy-Model

Xiumei Xu ¹, Yu Sun ^{1,*}, Sujatha Krishnamoorthy ² and Karthik Chandran ³

¹ Department of Management, Qingdao Agricultural University, Qingdao 266109, China; 200301103@qau.edu.cn

² College of Science and Technology, Wenzhou Kean University, Wenzhou 325060, China; krishnsu@wku.edu.cn

³ Department of Automation, Shanghai Jiao Tong University, Shanghai 200240, China; karthikchandran@sjtu.edu.cn

* Correspondence: 200301075@qau.edu.cn

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Abstract: The combination and convergence of energy-intensive industries developed by ecological factors based on energy clusters is discussed in this paper. Here, a few models for the prediction of greenhouse effects are used as a single type of modeling. In this model, the solar panel system is included as a measure of the greenhouse effect; Commitment Unit (CU) formulations are changed with flouted logic because solar integrations and other unknown variables are intermittent. In general, the greenhouse model with natural ventilation temperature prediction is incomplete, in which the resulting fluid logical CU problem can be solved with an evolutionary algorithm based on the definition and the theory of quantum calculation. This paper proposes a Fuzzy Model-Based Quantum Greenhouse Evolutionary Ventilation Algorithm (FM-BSQGEVA) which helps to minimize the CU problem. The QGEVA is updated to include a hierarchy-group-oriented scheme to tackle the non-linear nature of the issue and its multifaceted nature. The QGEVA is further developed to support a new binary differential operator and several genetic algorithm operators with a redefined rotational angle look-up. The chances that such operators are used on separate solutions are affected by stating the membership function based on their related fitness. The fitness function is calculated through a combination of the penalty function, objective function and the added fluid function. The models built can be used to regulate and control natural ventilation in greenhouse effects. This finding shows that an energy-intensive industrial cluster's environmental chain of the industry has improved eco-efficiency.

Keywords: green technology; ecological efficiency; fuzzy-model-based solar quantum greenhouse evolutionary ventilation algorithm

1. Green Technology Innovation and Ecological Efficiency

In the current scenario, eco-innovation is the conception of goods and processes that contribute to sustainable development, which are used to bring about direct and indirect ecological changes through the commercial application of knowledge [1]. This includes a variety of related ideas, from environmental technological advances to the generation of new ways to promote sustainable development which are socially acceptable [2]. Eco-innovation diffusion is the area of research that aims to explain how new 'carbon' ideas and technologies are spread [3].

The main aim of a greenhouse is to improve the environment, as shown in Figure 1; particularly in the winter, the crops grow based on the simulation of greenhouse temperatures, which can be a hypothesis for greenhouse control [4]. The term ‘green technology’ has become very popular; it has emerged in the past two decades to refer to environmentally responsive technology [5]. This technology has been built and used to analyze the damages to the atmosphere and natural resources [6]. Green systems are known as ‘environmental’ or ‘clean technology’, in which green technologies are primarily intended to mitigate global warming and reduce the greenhouse effect [7]; the key idea is to produce new technologies that do not harm natural resources and whose effect should be less harmful to people, animals and our planet’s environment [8].

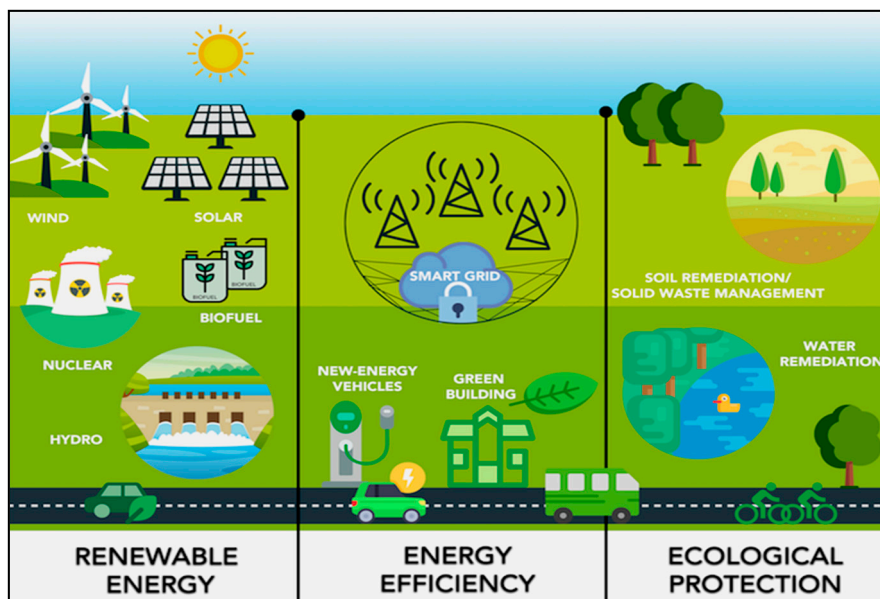


Figure 1. The architecture of green technology innovation and ecological efficiency.

It is clear that our world is starting to suffocate with pollution, and the successful use of green technology will lead to a substantial pollution reduction factor [9]. For this reason, developed countries and some developing countries use these technologies to shield themselves from violent environmental impacts [10]. The range of operations related to green technology consist of easy tasks that anybody can do at home, and result in highly qualified systems [11].

Modeling a greenhouse system generally entails an efficient technique to establish the parameters of a greenhouse microclimate physical model [12], as they often lack minor factors of influence, depending on the real greenhouse situation, which can cause errors or extreme weather conditions [13]. As for the experimental model, several variables must be tracked to properly estimate the related parameters [13]. The test results of the simulation show that the environmental variables of solar greenhouses [14,15] are forecast according to existing models, which means that current greenhouse microclimate models cannot be directly used to avoid the greenhouse system [16]. Therefore, modeling natural ventilation solar greenhouses has greater research interest for agricultural production [17]. Mathematical modeling approaches have been introduced to improve the performance of the natural ventilation of solar greenhouse gases [18]. Based on the discussion, the contributions of this study are discussed as follows:

- This paper uses the two methods. First, we model the greenhouse temperature separately and discuss the root causes of the two model forecast errors; then, we integrate the fluid control theory to achieve a more precise and practical prediction of the greenhouse temperature model.
- The QGEVA is further developed to support a new binary differential operator and several genetic algorithm operators with a redefined rotational angle look-up. The chances that such operators

are used on separate solutions are affected by stating the membership function based on their related fitness.

- This model's error results are equated with two other error outcomes in the two models with a single modeling approach.

The paper is organized as follows: Section 2 discusses the related background survey, the problem formulation and the objective constraints are discussed in Section 3, the result analysis and numerical simulations are explained in Section 4, and Section 5 follows with a conclusion.

2. Related Work and Background Study

Ye and Guo et al. introduced a lithium-ion battery with an accurate charge status (SoC) calculation which is extremely important for SoC algorithm lithium-ion batteries in electric vehicles based on an active particle filter (APF) [19]. Firstly, lithium-ion batteries are modeled on a one-stage hysteresis-based network, and the particle swarm optimization process decides their parameters. The battery has been proposed and implemented with an improved active particulate filter. Finally, the proposed SoC estimator is tested by two standard lithium-ion batteries, LiFePO₄ and NMC lithium-ion.

Mumtaz et al. introduced the Fuzzy Model-Based Solar Quantum Greenhouse EVV framework facilitating the evolutionary quantum algorithm. The domestic load and conventional loading stations running unstable, instant nonlinear dynamics should be captured online to run renewable energies which efficiently harvest maximum power. A variable speed wind turbine-permanent synchronous generator (VSWT-PMSG) was discussed in this paper [20]. A Chebyshev-wavelet-embedded neuro-fuzzy indirect adaptive MPPT control model was proposed. In Matlab/Simulink, a robust simulation testbed was built for a network-associated hybrid power system. Based on the simulation performance, a test-bed for a net-associated hybrid power system compares to the traditional and intelligent control methods based on the suggested robustness indirect adaptive controls.

The idea of an adaptive lights compressor must be built to improve traffic flow congestion, which is a key issue and needs to be addressed. The author presented the strategy of an adaptive traffic light controller utilizing the fuzzy logic control Sugeno Method (ATLC-FLCSM) [21]; this fluid logic control is utilized to evaluate the green time at a crossroads. This paper aimed to develop a three-input adaptive traffic light system; namely, the number of queues, time of waiting and the vehicle's flow. The configuration of the intersection was used in a simulation to measure the number of lines, the wait and the number of vehicles. The simulation results demonstrated that traffic lights perform better with a fixed time control via a fluid-source control.

The layout of the urban transport network was demonstrated by object charts and state charts. Here, the drawbacks in demonstrating the traffic information flow had a behavioral perspective. The state-space model was utilized to measure vehicles' half-value waiting time. The paper used a mixture of general type-2 fuzzy logic sets and the modified backtracked search algorithm (MBSA) [22] methods to control the scheduling of the traffic signal and the phase series to guarantee dynamic traffic with the average queue length and least waiting times. The new heuristic MBSA algorithm optimized the input and output parameters at the same time, making a comparison with those of optimal and traditional type-1 fuzzy logical controllers.

The implementation of a framework for managing urban traffic efficiently does protect drivers, but also spares time, money and the atmosphere. Easy time management is an important tool in the Intelligent Transportation System (ITS) [23]. This paper described the development of a complex and reliable system of traffic management based on fugitive logic. Since the traditional controls used as sensors have certain limitations, the vision sensors (i.e., the camera) can overcome these limitations. Image and vision processing plays an important role in traffic density control and estimation on roads. The outcome of detailed simulations with the proposed solution shows that the system increases the average movement time and reduces the average wait time compared to conventional sensor controllers.

Based upon the above research, the share of energy generated by different thermal power plant types is projected to decrease with a growing share of energy from renewable energy sources. At the

same time, the electric energy supply fluctuates dramatically and the supply-demand equilibrium of power cannot be met utilizing existing electricity systems that are currently in use. Such situations are typically reemitted by neural networks or stochastic programming fuzzy logic.

3. Fuzzy-Model-Based Solar Quantum Greenhouse Evolutionary Ventilation Algorithm

Most physical models of greenhouses are based on the thermal equilibrium in greenhouses, while the others are focused on the theory of system recognition, namely experimental modeling. In general, greenhouse modeling uses one method; nevertheless, the physical model's greenhouse micro-climate parameters are difficult to determine. According to the current greenhouse situation, the physical model often lacks those variables which may result in errors or extreme weather.

To describe the temperature difference within this system, the greenhouse temperature model is considered. The experimental greenhouse structure diagram is shown in Figure 2, in which the study adopts two approaches for the simulation of the greenhouse temperature, based on the current situation of the greenhouse. For the calculation of greenhouse temperature, the mathematical equations are based on the material and energy balance. The mathematical model, therefore, applies to all greenhouse types. The model divides the greenhouse system into 5 measures: heating pipes, indoor air, soil layer, greenhouse wastewater and crops. The exchange of energy and material with the external world involves heat exchanged for long waves, ventilation, heat exchange, solar thermal radiation, convective oil exchange and artificial heating for the transpiration of crops.

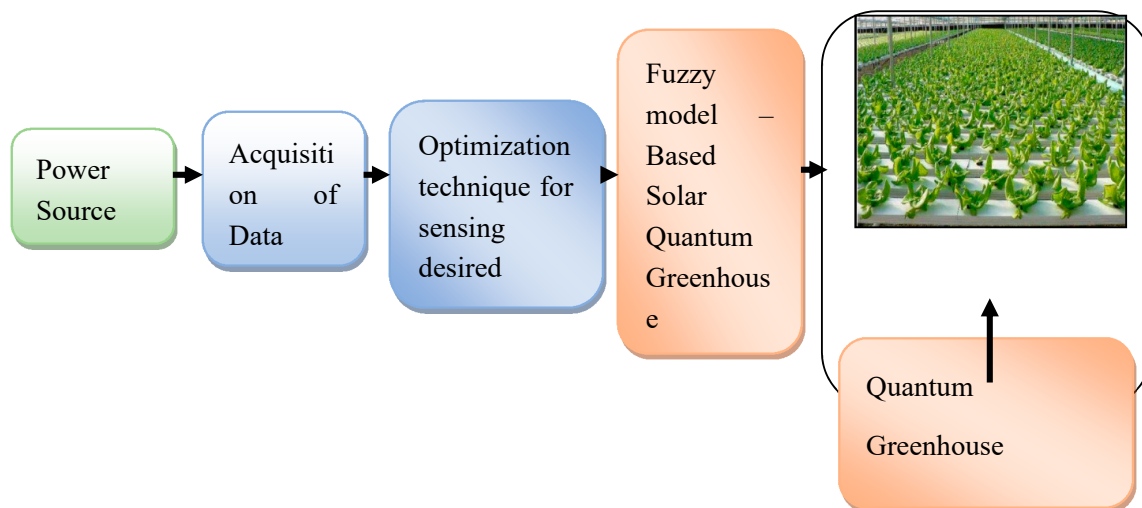


Figure 2. Block diagram of green technology innovation and ecological efficiency.

As per the source of thermal equilibrium, the climatic condition and structure of the greenhouse is drawn as a dynamic expression as follows in Equation (1):

$$\nabla E = \sigma \varphi D_w \frac{dS_j}{ds} \quad (1)$$

σ = the volume of the sensible greenhouse. ∇E = the heat sensible greenhouse increment of air. φ = air density of greenhouse. $D_w D_w$ = heat capacity of the greenhouse. $\frac{dS_j}{ds} \frac{dS_j}{ds}$ = the rate of temperature change in the greenhouse.

The solar ventilation energy of the greenhouse is transmitted in the covering film transmittance light; thus, the ventilation energy exchange of the greenhouse is expressed in the following Equation (2):

$$E_{ventilation} = \sigma \varphi D_w \frac{dS_j}{ds} (s_i - s_0) \quad (2)$$

$s_i s_i$ = the inside temperature of the greenhouse. $s_0 s_0$ = the outside temperature of the greenhouse. A greenhouse is mainly aimed at improving the climate, particularly in the wintertime, when crops grow.

The heat convective energy exchange between the external environment and the greenhouse environment is calculated in the following Equation (3):

$$E_{convec} = \sigma \varphi D_w (s_i - s_0) \int \frac{E_{ventilation}}{VE} \quad (3)$$

The simplified long wave radiation energy is denoted by the launch rate of greenhouse surface material decided by the coefficient's emissivity based on the test variable, as shown in Figure 3. Based on principles and concepts of quantum computation ϑ_β , linear superimposition γ , a novel quantum α bit chromosome depiction is adopted based on the weights and variables as Wx_b with (x,y) input, and it is represented in the following Equations (4) and (5):

$$\vartheta_\beta = \gamma(0) + \alpha \quad (4)$$

$$\vartheta_\beta = \begin{bmatrix} \gamma_1 & \gamma_2 & \dots & \gamma_\sigma \\ \alpha_1 & \alpha_2 & \dots & \alpha_\sigma \end{bmatrix} \quad (5)$$

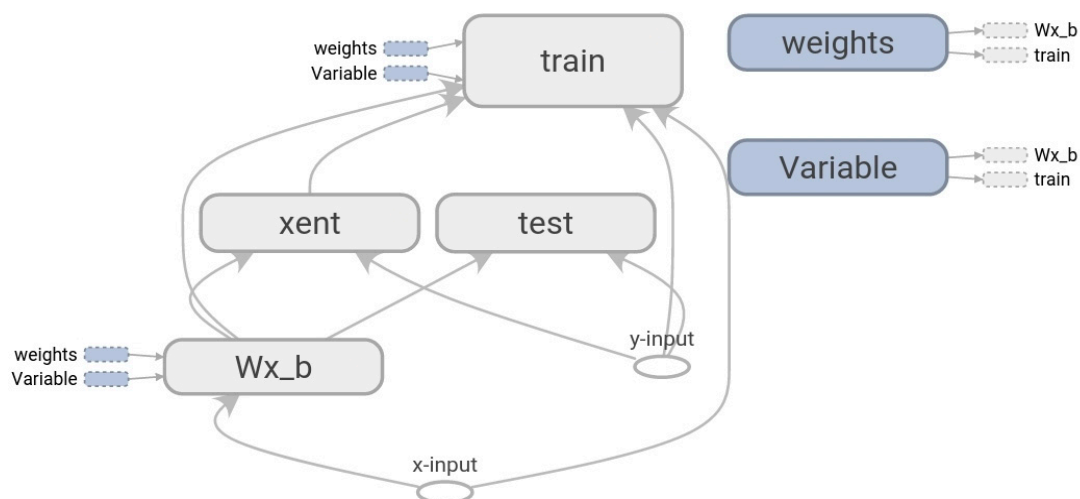


Figure 3. Data flow based on weights and variables.

The goal of the thermal CU issue is to reduce the total cost of production while meeting many device and operational constraints. The minimal information objective function is represented in the following Equation (6):

$$\text{Minimum CU} = T_j G_{j,s} \sum_{j=1}^M \sum_{s=1}^S [D(G_{j,s}) + F T_j (1 - G_{j,s})] \quad (6)$$

$G_{j,s} G_{j,s}$ = the quadratic fuel cost. $F T_j T_j$ = the output thermal power energy. $1 - G_{j,s} G_{j,s}$ = the status of the binary number.

The total energy output from the solar thermal generator and battery supply is expected to meet the hour of load demand. Therefore, the balance power equation for the hour can be evaluated in the following Equation (7):

$$G_{t,s} E_s \sum_{j=1}^M G_{j,s} + G_{t,s} = E_s \quad (7)$$

$G_{t,s} G_{t,s}$ = the output of solar power. $E_s E_s$ = the forecasted demand load.

The output power of the solar system is represented in the following Equation (8):

$$G_{gw}G_{gw}(T(s)) - Ga_sG_{ts}a_s + G_{ts} = 0 \quad (8)$$

$T(s)$ = the solar radiation per hour. $G_{gw}G_{gw}$ = the function conversion of solar energy radiation. $Ga_s a_s$ = total output batteries.

The solar output batteries for standard environment radiation are defined in the following Equation (9):

$$G_{gw}G_{gw}(T(s)) = \left\{ \begin{array}{l} \frac{T(s)^2}{Q_D} \quad 0 < T(s) < a_s \\ \frac{T(s)^2}{Q_{DGa_s}} \quad T(s) > a_s \end{array} \right\} \left\{ \begin{array}{l} \frac{T(s)^2}{Q_D} \quad 0 < T(s) < a_s \\ \frac{T(s)^2}{Q_{DGa_s}} \quad T(s) > a_s \end{array} \right\} \quad (9)$$

$T(s)T(s)$ = the solar radiation energy. $Q_D Q_D$ = the standard environment.

The time of waiting and the number of vehicles are the common traffic control signal indicators. The time of waiting is used as the indicator of results; the optimization goal is therefore specified in the following Equation (10):

$$\text{Min } V(m) = \sum_{j=1}^N V_j(m) \quad (10)$$

$V(m)$ = the queue length variable. $\sum_{j=1}^N V_j(m)$ = the state space dynamic evolution.

Fuzzification is the final step to achieve the last production of a crisp value. Several methods are available to de-fuzzify the logical fuzzy framework, as expressed in the following Equation (11):

$$X_i X_i(M) = \frac{\sum_{m=k}^s G_{gw}(T(s))}{T(s)} \quad (11)$$

Here, in the above equation, m denotes the fuzzy rules. There are contradictions in the considering model of the power system; any extremely critical formulation is updated by m -fuzzy logic to provide a coherent model. For this reason, the distance between the formulations is expressed in the following Equation (12):

$$D(x_1, x_2, x_1, x_2) = \frac{1}{m_2} \sum_{s=1}^{m_2} G_{gw}(T(s)) \quad (12)$$

x_1, x_2, x_1, x_2 determines the distance between a coherent model set. M = the critical fuzzy logic system.

From the above Equation (12) the coherent model is subdivided into constraints of non-crispy formats and expressed in the following Equation (13):

$$Q_{ji} Q_{ji} = \frac{D(x_1, x_2)_{ji}^*}{\sum_{j=1}^m D(x_1, x_2)_{ji}^*} \quad (13)$$

$D(x_1, x_2)_{ji}^* D(x_1, x_2)_{ji}^*$ expresses the evaluation index format of the fuzzy system. The above Equation (13) determines the crispy constraint formats in the coherent model system.

Thus, the following crispy subsection is described with the fuzzy formulation $V_{ji} V_{ji}$ associated functions, and it is expressed in the following Equation (14):

$$V_{ji} V_{ji} = \frac{1}{xyw} \sum_{j=1}^n G_{gw}(T(s)) D(x_1, x_2)_{ji}^* \quad (14)$$

$\frac{1}{xyw} \frac{1}{xyw}$ = the Boltzmann constant which satisfies the condition $0 < V_{ji} V_{ji} < 1$; $\sum_{j=1}^n G_{gw}(T(s)) D(x_1, x_2)_{ji}^*$ = the evaluation index of the j th condition.

From the above Equation (14), the initial weight of the fuzzy entropy model is calculated and expressed in the following Equation (15):

$$V_c V_c = \frac{1 - D(x_1, x_2)_{ji}^*}{\sum_{j=1}^n 1 - D(x_1, x_2)_{ji}^*} \quad (15)$$

$1 - D(x_1, x_2)_{ji}^* 1 - D(x_1, x_2)_{ji}^* =$ the factor relationship of the fuzzy model.

From Figure 4, the factor relationship function e is used to forecast load based on rail and hail demand, as transformed into the fuzzy logic measurement and the matrix format, as obtained in the following Equation (16):

$$E = e (D(x_1, x_2)_{ji}^*)_{n \times m} D(x_1, x_2)_{ji}^*)_{n \times m} / F T_j G_{j,s} T_j (1 - G_{j,s}) \quad (16)$$

$D(x_1, x_2)_{ji}^*)_{n \times m} D(x_1, x_2)_{ji}^*)_{n \times m} =$ matrix format measurement. Thus, the standardization fuel cost matrix is minimized and the total thermal power production energy is met, balanced from the above equations. Therefore, a prediction model for the thermal activity of a solar greenhouse is developed in this paper and managed using external surroundings with a flowing control system. Based on the mathematical model and neural network analysis, the fuzzy controls referred to in the process are calculated as follows:

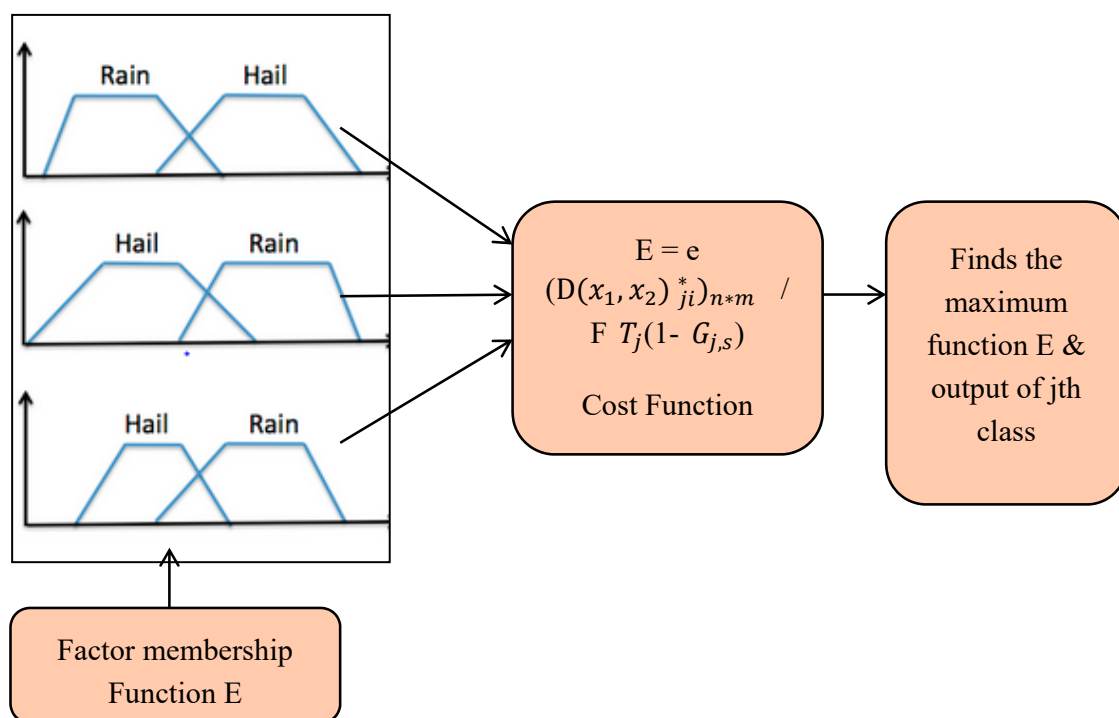


Figure 4. Block diagram of green technology innovation and ecological efficiency.

4. Results & Discussions

The Fuzzy-Model-Based Solar Quantum Greenhouse Evolutionary Ventilation Algorithm model was applied to measure the effect of conventional technology which has no environmental or resource value, with the intent of thoroughly analyzing the effects of environmental pollution and overall energy use on green technology innovation. A fitness function was stated by merging the overall flowing membership function and penalty function for contraventions of a specific individual.

The implementation of an unreliable combination optimization problem based on uncertainty by utilizing a fuzzy, Quantum Greenhouse Evolutionary Ventilation approach comprised of several high-performance operators to explore a wider search environment is shown in the above Figure 5. The scheme used the operators with a minimum likelihood to minimize the disorder within high-performing individuals while reversing the process for low-performance people. It is not always applicable to individuals with those operators listed. As an alternative, a flourishing rule is introduced, to reveal the fact that not all individuals are equally fit. The solutions are represented and

rearranged in several categories; these features provide more space for the study and exploitation of the algorithm output, which is evaluated in various power systems.

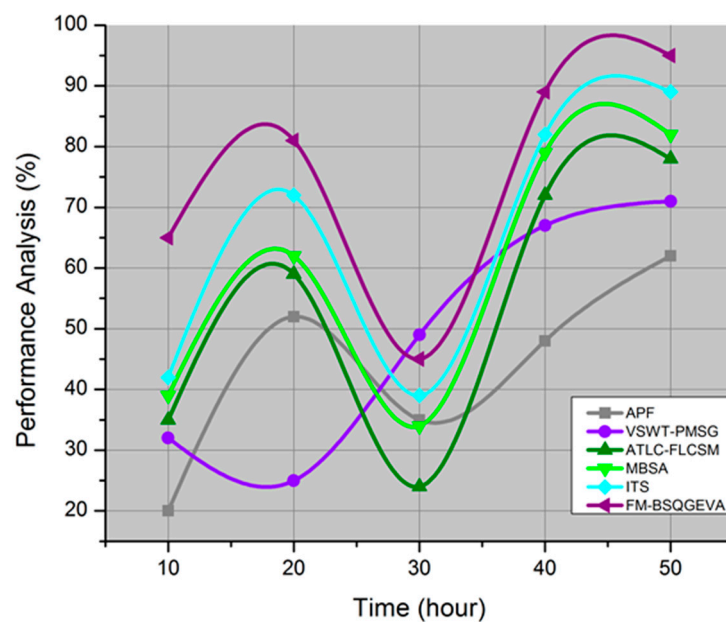


Figure 5. Performance Analysis.

In general, regional green growth is very unbalanced, and further explains that the connection between high-end production technology and economic development level is high, as shown in the above Figure 6. First, because there are environmental policies, national filtration policies and high talent density, the eastern coastal areas are economically and geographically durable. Hence, it creates favorable conditions for progress in green technology in high-end manufacturing industries in the world. However, in the Midwest and northeast areas, the scientific and technological foundations in the long term are relatively weak. Lack of investment in research & development (R&D) resources, intellectual burn-out, high emissions and power-intensive industries dependent on endowment advantages have hindered developments in high-end high-tech manufacturing innovation to different degrees.

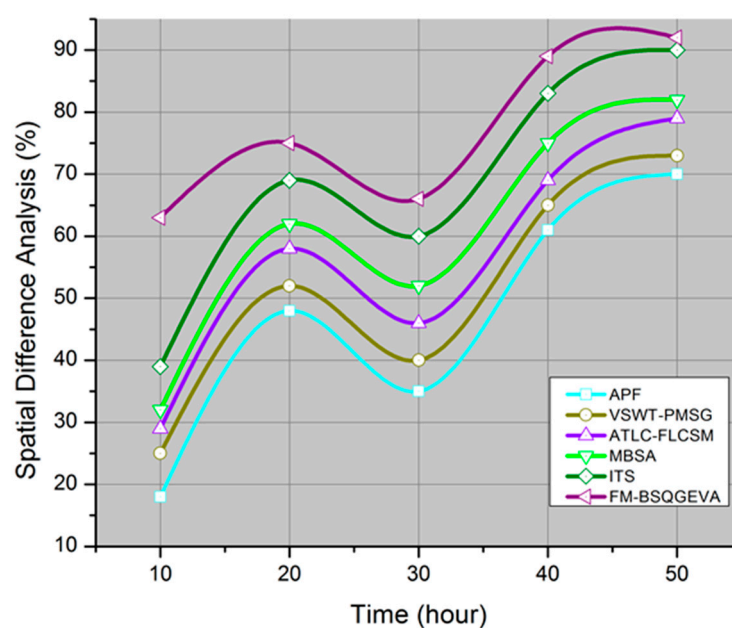


Figure 6. Spatial difference analysis.

The output of innovation in green technologies in the eastern region fluctuates more easily without major changes, as seen in Figure 7. In addition, investment in and financing of R & D staff have increasingly become justified, helping to improve the productivity of the world's traditional innovation in high-end manufacturing technologies with less time. With the increased environmental problems, the nation is taking environmental protection very seriously and has formulated several green regulatory guidelines and preferential policies on environmental protection with less difference analysis. As a result, green technology innovation effectiveness in the world has improved greatly to surpass conventional technologies innovation output in 2019 with less time computation. This has encouraged high-end manufacturing companies to develop green-technology technologies.

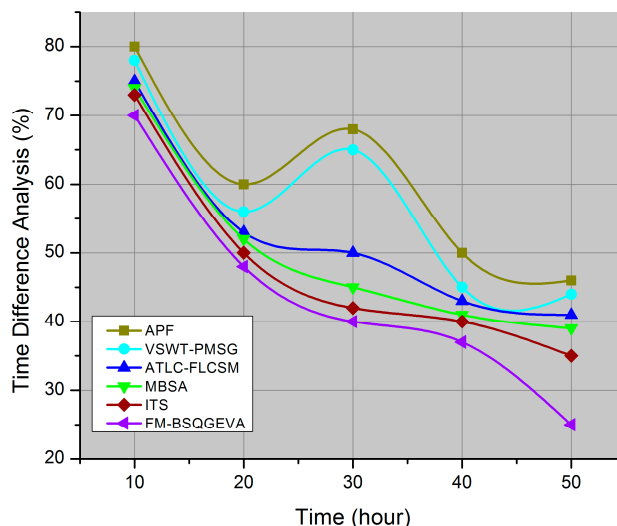


Figure 7. Time difference analysis.

New technologies will simplify the production process, change the probability of production, increase the manufacturing efficiency of companies, create a technology market access barrier and boost market competitiveness, as shown in the below Figure 8. While total R&D investment in the world grows rapidly, it can be triggered by environmental factors both internal and external. In addition to forcing companies to concentrate on technological development to counter competition, the increasing rate of technological refreshment and monopoly competitive gains from key technologies makes them focus on the secrecy and productivity of their research and development activities. Full productivity and the interest of customers as the carriers of contractual ties are fundamental objectives of the business. Because various stakeholders have different interests, knowledge and risk priorities, disputes and power-play often emerge during corporate decision-making.

Wind speed, or wind flow speed, is a fundamental amount of air moving from high to low pressure, usually due to temperature changes. Note that, due to the rotation of the Earth and it not being perpendicular, as one would expect, the wind direction generally is almost parallel with isobars. Wind speed affects the weather forecast, air and maritime operations, building projects, growth and rate of metabolism of many species of plants, and countless other consequences. Figure 9 shows that time varies with the feedback of the novel model; these days, the rate of wind has changed a lot and this is the major cause of mistakes in the mathematical model.

The greenhouse effect is the fact that radiation from the atmosphere of the planet warms the planet's surface above its temperature without this atmosphere. A radiantly active gas means greenhouse gasses radiate energy in all directions in the atmosphere of the earth, as shown in the above Table 1. Some of this radiation is directed at the air, which heats it. The rate (i.e., the frequency) of the greenhouse effect of downward radiation would depend on the temperature of the atmosphere and the number of greenhouse gasses in the environment. The natural greenhouse effects of Earth are important to life promotion, which is a precursor of life from the ocean moving onto the surface. Human activities,

however, have exacerbated the greenhouse effect, caused by global warming and effects, mainly through the burning of fossil fuels and simple deforestation.

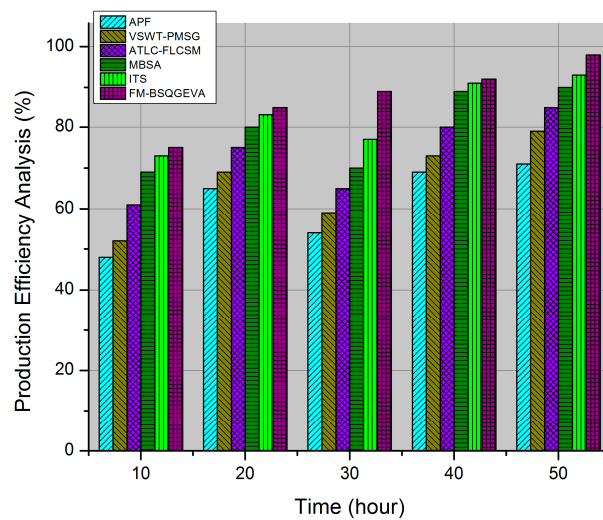


Figure 8. Production efficiency analysis.

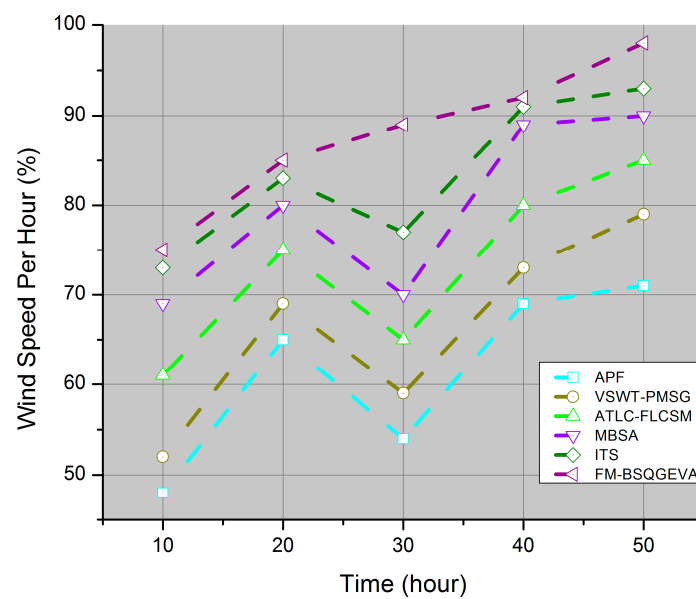


Figure 9. Wind speed per hour.

Table 1. Statement of green house.

Time (hour)	APF	VSWT-PMSG	ATLC-FLCSM	MBSA	ITS	FM-BSQGEVA
10	73.7	72.9	78.3	77.6	77.2	85.5
20	66.8	77.5	75.2	82.1	84.3	89.4
30	59.6	69.4	76.5	65.8	71.6	78.9
40	73.3	75.3	75.1	81.9	83.9	91.2
50	76.5	79.3	82.6	86.3	89.7	93.0

5. Conclusions and Future Work

This paper provides a furious thermal energy UC strategy for the quantum-inspired creation algorithm, which involves the solar system. The goal of this work was to implement the Fuzzy-Model-Based Solar Quantum Greenhouse Evolutionary Ventilation Algorithm of several high-performance operators for a higher search space by diversifying resolutions used for inaccurate combinatory optimization problems. This study depicted a fluid logical thermal CU plan with a solar energy system that facilitates the quantum-inspired evolutionary algorithm. The formulations were modified with fluidized logic to integrate the uncertainties of solar radiation and demand load, and spinning reserve. The conventional QGEVA method was modified by applying multiple operators for the diversification of solutions, for example differential operator, crossover and transformation. In this study, a temperature prediction model was developed with a fluoridated controller to study the thermal behavior of a solar greenhouse controlled by outside environments. The model was established in Matlab/Simulink; the simulation outcomes showed that the new model's accuracy is higher than that of the classic models. The regulations can, therefore, be adapted to the characteristics of the greenhouses, to ensure the versatility of the model and a wide range of operations. The fuzzy rules for controlling the system were based on a mathematical model, and on the neural network models of an analysis of error causes. In short, the temperature prediction model with the use of fuzzy control to minimize errors can direct and facilitate practical applications for the control and regulation of the solar greens.

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