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Impact Analysis of Team Leader on Green Behaviors Based on Affective Events Theory in Cyber Physical Social Energy System

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ABSTRACT With the formation of the concept of Cyber Physical Social Energy System, social and human factors become more prominent and stay at an important position. The interaction between the energy system and the social system will have a huge impact on the development of the energy system. As one of the hot topics in the CPSES area, the influence of the transformational leadership on the team green behaviors has attracted extensive attention of the academics. By influencing the enterprise behaviors through the leadership behaviors, it can promote the development of the Power Energy Internet Platform Technology and accelerate the application of the technology. Based on the Affective Events Theory, this article discusses the influencing mechanism and key factors of the transformational leadership on the team green behaviors. A total of 3 821 employees and their supervisors from 457 work teams in 19 energy enterprises in the Pearl River Delta region were tracked. This article finds that the transformational leadership positively affects the team green behavior. The connectedness to nature plays a positive mediating role between the transformational leadership and the team green behavior. The work features has a negative regulating effect on the relationship between the transformational leadership and the connectedness to nature, while the team task performance has a positive regulating effect. This article expands the application scope of the AET theory, discusses details of the influence mechanism between the transformational leadership and the team green behaviors, and provides a direction for further theoretical exploration.

INDEX TERMS Cyber physical social energy system, green behavior, connectedness to nature, work features, task performance.

I. INTRODUCTION

Currently, the energy system is transforming towards the digital direction. The electric power reform process is accelerating constantly, and the concept of the power Energy Internet Platform is forming. These changes attract attention from the management department and the academic circle. With the support of technologies such as the big data, the cloud computing, the Energy Internet Platform, the mobile Internet, and the artificial intelligence, the stability and security of the power grid can be improved, and resources can be reasonably allocated. Therefore, the sustainable economic development can be promoted. Enterprise, a main participant of economic world, plays a fundamental role in the construction of the

power Energy Internet Platform. As a decision-maker of an enterprise, the leader need to react to the external environment, evaluate the energy supply system [1], suggest energy demands [2], establish an energy supply system supporting the production of the enterprise, and create the enterprise value [3]. The chief executive officer and senior managers lead internal employees, develop enterprise strategies, and focus on introducing artificial intelligence and other innovative technologies to ensure that manufacture is in order [4]. Through responses to the internal and the external signals quickly, leaders manage enterprise behavior for enterprise development. Therefore, the leader in a company is highly pertinent to the effective establishment of the Energy Internet Platform. However, most of the current researchers focus on the technology, and ignore the people who operate the company. The CEO and managers guaranteed the technology

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can be adopted appropriately for a company during the whole manufacture process. From the perspective of research and development, the technology research and development cannot be conducted efficiently without effective leadership. From the perspective of operation, the lack of leader ability leads to the unsuccessful system control [5]. Therefore, the influence of team leadership on the green behavior is one of the most important and burning issues in the energy system of the networked physical society.

The Affective Events Theory (AET) is one of the main theory in the Affective Action Mechanism of Leader area [6]. The AET theory pay attention on the emotional response of individual at work. The cause of the emotional response, and its structure and consequence are key points that the AET theory cares about. In a team, the leader has the formal authority endorsed by the organization. The leader controls the internal resource allocation of the team, and has a significant influence on team members, including feelings and behaviors [17]. The emotion of the leader is an important antecedent variable that affects the attitude and behavior of team members, then causes the emotional response of team members, or employees. According to the AET theory, the emotional mechanism of employees in the workplace plays a role through the chain of the ''event-emotion-attitude behavior''. The attitude or behavior of the leader or the leader is a significant emotional event during the work. In the relationship between employer and employee, the emotion of the leader affects not only the emotion of the employee [18], but also the performance of the employee [19]. This emotional impact may occur in the form of direct drive mode and indirect drive mode. The first kind of mode is the direct driven, also known as affect-driven behaviors. The leader generates unique teamwork environment. The work events generated can stimulate the team to form specific emotions. The second kind of mode is the indirect drivers, also known as judgment-driven behaviors. Under this mode, the leader does not generate teamwork environment first, but affects the work attitude of team members. Team members compares the consistency among work features, self-worth, self-pursuit, and expectation, then form their evaluation of work [20]. After that, the attitude drives behavior and affects work performance. This is the result of the action mechanism and orientation of workers' emotional response.

Many studies connect the key points of the AET theory with other theories to construct new theoretical models. For example, the AET theory is associated with the leadership theory to develop a theoretical model of the emotional events and emotional reactions experienced by leader to influence the leadership behaviors and attitudes [17]. Based on the AET theory, researchers constructed a three-level model of the relationship between the leader's behavior and the employee's attitude behavior. The model emphasized that the emotion and behavior of leader are often an important source of employee emotional response. Peng [6] verified the AET theory, at the same time, considered organizational culture and other regulatory variables at the organizational level and proposed a multi-level model of the relationship between the emotional response and the organizational commitment. They believed that teams, groups, and organizations differ in task complexity, reward and punishment mechanism, group relationship conflict and other characteristics. These characteristics mediate between emotional response and organizational commitment.

Compared with the general discussion on the mechanism of the AET theory, the energy internet platform, which attracts more and more attention, requires scholars to pay attention to the influence of leadership attitude and behavior on team green behaviors. It is an important branch of research that the leadership type stimulates the green behavior of the team and its formation mechanism. The green behavior means the employee behavior that protect the environment or promote the environmental performance of the organization for the purpose of spontaneity and organization. It includes the initiative green behavior and the task-based green behavior. The initiative green behavior means the employees act pro-environment behavior which is beyond the organization requirement. The task-based green behavior is the green behavior that employees try to complete the main green tasks or recycle resources and protect the environment [18], [19]. The leadership style is considered as an important factor that influence the green behavior of a team [2]–[4]. Through the social interaction within the team, the demonstration effect of the leader can have a significant positive impact on the shaping of team behavior. There are common leadership types such as the transformational leadership, the transactional leadership, and the responsible leadership. Among these leadership, the transformational leadership stimulate the high-level needs of employees by making employees realize the significance of the tasks they undertake, establishing an atmosphere of mutual trust, urging employees to sacrifice their interests for the benefit of the organization, and chasing results beyond the original expectations [23]. The environmental transformational leadership, also known as the green transformational leadership, is one of the new leadership styles recently proposed and studied by scholars [24]. The green transformational leadership fits the diversified needs of the internal and the external environment of an organization and influences employee behaviors through organizational culture [12]. It is a potential important leadership behavior for managers to inspire team green behaviors in an enterprise organization. However, the motivation mechanism of the transformational leadership for the team green behavior has not been sufficiently discussed. Second, the role of the connectedness to nature in this mechanism needs to be clarified.

Based on the AET theory, this article will clarify the internal mechanism and boundary conditions of the transformational leadership in inspiring the green behaviors in team. This article intends to discuss the mechanism and motivation mechanism of how the transformational leadership affect the green behavior and the connectedness to nature. Then, understand the theory of green behavior management by

considering the two fundamental factors of work features and task performance. Specifically, the transformational leadership should positively influence the green behaviors of the team, and the connectedness to nature should play a positive intermediary role between the transformational leadership and the green behaviors of the team. Furthermore, the work features have a negative regulating effect on the relationship between the transformational leadership and the connectedness to nature. While the team task performance has a positive regulating effect. First, the leader makes employees realize the importance and significance of their work through vision, stimulate their high-level needs, and ask them to transcend the personal gains and losses to achieve organizational goals. Events appear in this environment can stimulate the team members to have positive emotional experience close to the natural environment and interact with each other. Thus, the connectedness to nature is strengthened. This effect can further promote the team to have more green behaviors expected by the organization in their work. Therefore, it is unnecessary for the leader to initiative a green team environment. On the other hand, in the long run, the green behavior will not only reduce pollution but also improve the use efficiency of resources, obtain higher benefits, and create incentives for employees. This emotion drives both the emotion and the judgment, and the team welcomes the positive emotional experience of its natural connection, which further affects the performance. Therefore, corporate with the AET theory, we believe that the above process of emotional events should be stronger when the team has a better performance. This study will conduct normative theoretical construction and empirical test on these inferences.

This article has three contributions. Firstly, it discusses the relationship between the transformational leadership and the team green behaviors, and the mediating role of the connectedness to nature in it. It clarifies the logic of the mechanism playing a role under the application background of the energy internet platform. In addition, the work features and the task performance are innovatively introduced in the discussion. It clarifies the work features and the task performance in the overall mechanism of influence that scholars paid less attention before. Secondly, it describes the role of the work features in the green behavior mechanism of the transformational leadership and finds that the work features have a negative regulating effect on the relationship between the transformational leadership and the connectedness to nature. Thirdly, it describes the role of the task performance in the green behavior mechanism of the transformational leadership. It finds out that contrary to the work features, the task performance plays a positive regulating role in the mechanism. Fourthly, the moderating effect of the team task performance on the relationship of the connectedness to nature and the team green behavior is discussed comprehensively.

The rest of the paper is organized as follows. The second section introduces the literature review of the green behavior and puts forward hypotheses and models. The third section introduces the research design and the empirical results. The

TABLE 1. Definition for fig.1.

Initial	Definition
TL	Transformational Leadership
C	Charisma
IC	Individualized Consideration
IM	Inspirational Motivation
CTN	Connectedness to Nature
EC	Emotional Contagion
EA	Environmental Atmosphere
GB	Green Behavior
TE	Team Environment
ES	Emotion Stimulation
ED	Emotion Drive
WF	Work Features
R	Responsibility
S	Significance
E	Effort
TP	Task Performance
PM	Perception Match
RM	Reward Motivation

fourth section discusses the methods used to develop the system based on localization.

II. THE PROPOSED APPROACH
In the study of the organization and the management areas, scholars used the mediating and regulating variables to discuss the potential mediating mechanism and the situational limitation of the relationship among differ variables. The mechanism of the influence of the team leader on the green behaviors conforms to the two-stage mediated model description. The model and technology roadmap presented in this article is showed in table 1 and figure 1.

A. FRAMEWORK
As shown in Figure 1, the transformational leadership influences the green behavior of the team through two stages. In the first stage, the transformational leadership positively affects the connectedness to nature. At this stage, the work features as a moderator will weaken this influence. In the second stage, the connectedness to nature positively affects the green behavior of the team. In this process, the task performance as a moderator variable will enhance this impact. The relevant derivation and discussion are indicated below.

B. DEDUCTION
Hypothesis 1: The transformational leadership has a positive effect on the formation of the team green behaviors.

Definition 1-1: The transformational leadership has four dimensions: the charisma, the intellectual stimulation, the individual consideration, and the inspiration motivation. Through the above four dimensions, the transformational leadership has its impact to set up the development vision for the organization and lead the organization members to work [28].

Definition 1-2: This article defines the team green behavior as a task-oriented green behavior. Furthermore, the concept of
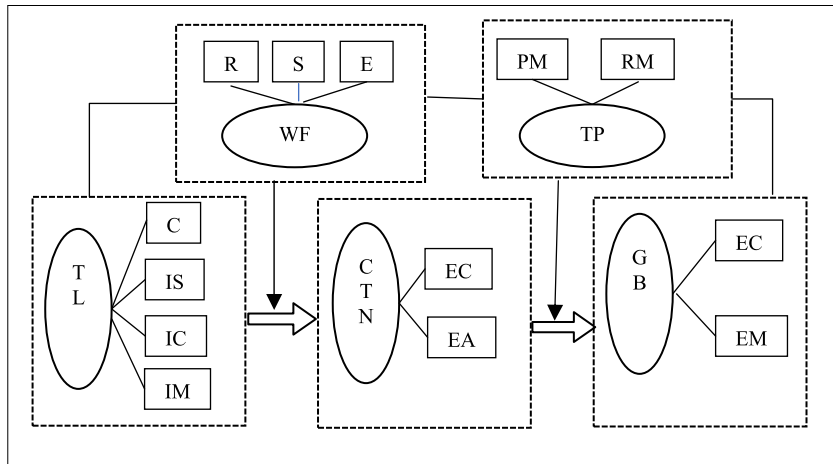
FIGURE 1. A two-stage mediating diagram of the transformational leadership influencing the team green behavior.

the task-oriented green behavior can be applied promoted it to the team level [18], [19]. We define the task-oriented green behavior as the performance that the team try to complete its main tasks in a way that protects the environment and save resources.

Deduction 1: We believe that the transformational leadership stimulates green behaviors in team. As team members, employees understand that their leader considers the environmental protection as the main task of the team. The leader is willing to work together to make more environmental protection behaviors that expected by the organization, thus form a shared vision of environmental protection in the future. Therefore, we have hypothesis 1.

Remark 1-1: the four dimensions of transformational leadership are as follows:

a) Charisma: It means that the leader plays an exemplary role in environmental protection and gains their recognition, respects, and trust.

b) Intellectual Stimulation: It means that the leader inspires employees to innovate ideas, encourages employees to challenge outdated ideas, and helps them to solve problems in the work with new methods.

c) Individualized Consideration: It means that the leader respects the individual needs, abilities, and desires of different employees. The leader coaches and guides different employees in diversity way.

d) Inspirational Motivation: It means that the leader expresses high expectation on employees and motivates them to participate the team.

Remark 1-2: During the repeated social interaction processes, the green management idea in the team happened in above four dimensions. The leader keeps the commitment to the environment. And the leader encourages the team to incorporate social responsibility and environmental protection into main tasks of the team.

Remark 1-3: To pursue the harmonious development of company together with the natural environment, the

transformational leader in the team creates a green working environment. It includes the natural environment, and the environment protection groups into the scope as its key stakeholders. It is not only to shape the green environmental protection action of employees, but also to promote the enterprise green dynamic ability and green product development.

Hypothesis 2: The transformational leadership has a positive effect on the formation of the connectedness to nature.

Definition 2-1: The connectedness to nature is an emotional experience that people consider themselves as a part of the natural environment and connect their happiness with it. Accordingly, this article defines the connectedness to nature as shared emotional experiences of team members about their connections to environment and their feelings that link their happiness with the natural environment.

Definition 2-2: The environmental atmosphere means to that in a team, members will unconsciously coordinate and imitate the facial expressions, voices, and actions of others. These actions lead to the transfer of personal emotions [18], [19] and promotes the formation of environmental atmosphere. The formation of the environmental protection atmosphere is a kind of emotional contagion.

Definition 2-3: The emotional contagion discussed the mutual contagion of emotions and mood among people [29]. It is usually divided into two stages. In the first stage, the individual unconsciously mimics the emotions openly expressed by others. In the second stage, individuals have feedback on facial expressions, verbal, and physical mimicry. Then they generate emotional experience associated with these behaviors.

Deduction 2: The social interaction and the emotional contagion within a team can form shared emotional experience among team members. Therefore, based on the AET theory, we believe that the transformational leadership can promote the generation of natural connection between teams. Therefore, we have hypothesis 2.

Remark 2-1: According to AET theory, the team leader creates a green working environment and makes team member gain relevant emotional experiences during work. These experiences contribute to a shared emotional experience of the team through the internal social interaction and emotional contagion [8], [9].

Remark 2-2: The transformational leader conveys the environment friendly attitude to team members. The leader also has the green vision and the commitment to protect the environment. The leader tries to stimulate the employees to pursuit the environmental protection working mode and enables them to experience the connectedness to nature through the interactions with the leader.

Remark 2-3: The transformational leader delivers the green vision and the pro-environment behaviors within the team. The leader coach employees and makes them sense the support from the leader and the organization. Then employees are more willing to be involved in the environment.

Hypothesis 3: The connectedness to nature has a positive effect on the formation of team green behaviors.

Deduction 3: We believe that the emotional experience of the team related to the natural environment will drive employees to show green behaviors in the work. They will have pro-environment behavior that improve the natural environment which are expected by the organization. Therefore, we get hypothesis 3.

Remark 3-1: The AET theory believes that the specific emotional response of the team will further contribute to the emotional driven behavior of the team at work [8], [9]. According to the theory, when employees have emotional experience connected with the natural environment, they will not damage the natural environment but protect it.

Remark 3-2: Employees believes that their happiness is connected to the environment. It drives them to engage in pro-environment behaviors that the organization expected, which is the green behavior.

Hypothesis 4: The connectedness to nature promotes the relationship between transformational leadership and team green behavior.

Deduction 4: The transformational leadership drives employees to act team pro-environment behaviors and creates organizational performance while satisfying their own needs and achieving individual performance. The transformational leadership can promote green behaviors of the team that the organization expects by stimulating the emotional experience of the connectedness to nature, therefore we get hypothesis 4.

Remark 4-1: The AET theory believes that the leadership behavior creates the team environment, generates work events, and activates the relevant emotional response of the team. Then the relevant emotional performance occurs [8], [9].

Remark 4-2: The transformational leader creates an environment that the team consider the environment as key stakeholders. Employees realize the importance of their commitment and then the emotional experience leads to high

levels of demand. The social responsibility of employees will be strengthened under this mode.

Hypothesis 5: Compared with teams with obvious work features, the transformational leadership has a stronger positive impact on teams with ambiguous work features connectedness to nature.

Definition 5: The work features approach theory explains the intrinsic motivation of employees from the work aspect. The theory has three critical psychological status are crucial to the motivation of work:

a) Employees must feel they are responsible for the results of their work, such as quality and quantity

b) Employees must feel that their work is meaningful

c) Employees must sense the know the actual results of their hard work clearly.

Deduction 5: The strong similarity leads to a weak stimulate effect of the transformational leadership on the emotional experience of the team connectedness to nature. In contrast, a team with weaker green work features has less interest to deal with the relationship with the environment properly. The transformational leader propagates environmental protection ideas, completes the environment protection commitment, and affects employees. Therefore, the transformational leadership have a stronger stimulating effect on the weak work features team and the connectedness to nature emotional experience. Therefore, we have hypothesis 5.

Remark 5-1: Besides three critical psychological status, the work features has five dimensions. They are the diversity, the completeness, the significance, the autonomy, and the feedback. This theory believes that when the work design can be improved in these five work features, it will improve the work identification of employee, the work motivation, and the employee satisfaction. Then the employee will express high quality work performance.

Remark 5-2: According to the AET theory and related studies, team characteristics can strengthen or weaken the impact of work events generated by leadership behaviors on team emotional experience.

Remark 5-3: The leader has the development philosophy of harmony and win-win outcomes with the natural environment, will hold high ethical standards in the practice of social responsibility and environmental protection [29]. These characteristics will reflect in the work features of the team. The transformational leadership can strengthen such understanding in team, and help employees sense their response for the work result. Then the first psychological status in work features will be stimulated.

Remark 5-4: Based on the condition of remark5-3, employees form high identification and initiative for their work. Employees can recognize the relationship between human and the environment accurately, then perceive the meaning of their work. They realize the responsibility of their work and pursue realizes the person and the harmony development between human and environment [14], [15].

Remark 5-5: There is a significant similarity in team with strong green work features. We can find that they have

similar attitudes to the environment and the environmental protection. This strong similarity makes the transformational leadership does not need to impose environmental concepts and promote environmental practices on the team. Since the team is familiar with these concepts and can clearly recognize the actual green results achieved by individual hard work and get feedback in the work.

Remark 5-6: Compared with the team with strong work features, the team has weak features disregards the relationship with the environment and has less understanding about the social responsibility and the environmental protection. The way that the transformational leadership affects employee behavior by promoting environment protection ideas, completing the environmental related commitment, and setting up examples.

Hypothesis 6: Compared with teams with weak performance, teams with strong performance and connectedness to nature have a stronger positive effect on the formation of team green behaviors.

Definition 6: The task performance is a criterion that has direct relation with working output. It is used to evaluate the working achievement. The task performance is the most direct criteria that evaluate employee contribution to the team or organization. It is not only highly related to its specific work content, but also closely related to individual ability, proficiency, knowledge, and the technology.

Deduction 6: The weak performance will have a negative impact to employee. It is not good for team to form the green behaviors environment. On the other side, in an environment with high task performance, employee who is effectively motivated and recognized will be more actively engaged in their work. Therefore, the positive emotional experience of the team has a strong transformation effect on the green behaviors expected by the organization. Therefore, we have hypothesis 6.

Remark 6-1: According to the AET theory, individuals experience the emotional and value significance of the roles of group members from the community they belong to. The transformational leadership, on the one hand, put more effort into coaching and guiding their employees. Therefore, employees do not only accept the values and styles of their superiors, but also identify the goals and strategies of the team or organization. On the other hand, the good communication and interaction system that established by the transformational leadership enables leader and employees to better understand each other. The understanding is about the way of doing work well. Then the achieve mutual recognition in cognition appear.

Remark 6-2: Employees in the team with low task performance are not effectively motivated. It is difficult for them to experience the emotional and value significance of being a member in the group.

Remark 6-3: To recognize and incentive the team, the transformational leadership improves the employee evaluation, strengthens employee's identity in the team and experience of connectedness to nature, and carries out the work. Individual

ability is improved, and individual performance and team performance are continuously improved.

Hypothesis 7: The work features and the task performance play a moderating role on the indirect effect that the transformational leadership positively influences team green behavior through the connectedness to nature.

Deduction 7: Consider these two regulating effects together, we further deduct that when the work features is weak and task performance is clear, the positive effect of transformational leadership on the connectedness to nature and the positive effect of the connectedness to nature on the pro-environment behavior of the team are enhanced. Therefore, we have hypothesis 7.

Remark 7: The team with weak work features is more likely to be inspired by the experience of the transformational leadership. The natural environment management philosophy generates greater positive emotional experience and integrate with the natural environment. The good performance has good incentive effect to employees. It can promote the team to recognize the positive significance of its connectedness to nature. At the same time, it can strengthen the effect of green behaviors expected by the organization and lead to the positive emotion of the connectedness to nature.

C. MODEL DESIGN

We will use the regression method, specifically, the structural equation model and the multi-level structural equation model to regulate the multi-level mediated structure. The multilevel model is based on a single level model. First, we establish a single level model based on assumptions.

$$M = b_0^1 + b_1^1 W + b_2^1 X \tag{1}$$

$$Y = b_0^2 + b_1^2 M + b_2^2 M + b_3^2 W + b_4^2 XW + b_5^2 XW + b_6^2 XW \tag{2}$$

For these models, X represents the transformational leadership, Y represents the green behaviors of the team, M represents the connectedness to nature, and W represents the moderator variable. In this article, it is the work features and the task performance. The moderator variables are divided into W_1 and W_2 in the following multi-level model. In addition, the trademark number represents the equation order.

Using the equation (1) to replace the M in the equation (2), the following extended equation can be obtained:

$$Y = (b_0^2 + b_0^2 b_0^1) + (b_1^2 + b_2^2 b_2^1)X + (b_3^2 + b_2^2 b_2^1)W + b_4^2 XW + b_5^2 b_1^1 XW + b_5^2 b_2^1 XW \tag{3}$$

In equation (3), the coefficient b_4^2 represents the direct regulatory effect of W on the relationship between X and Y, while the coefficient $b_5^2 b_1^1$ represents the indirect regulatory effect of W on the relationship between X and Y through M. To support this type of mediated moderation, the indirect effects $b_5^2 b_1^1$ needs to be significantly not zero. When we have equation (3), the single-level model can be further extended to the multi-level scenario.

In this article, all variables are measured at the level 1, then the level 2 is equipped with between-group variance. Even all variables are constructed and measured at the individual level, data is still nested within different groups when using data from group members to test hypotheses. Therefore, the inter-group variances of all variables should be considered.

Based on the equation (3), we develop the following equation to test the mediating effect of the two-stage regulation.

$$M = b_0^4 + b_1^4 X + b_2^4 W_1 + b_3^4 X W_1 + b_0^4$$
$$+ (b_1^4 + b_3^4 W_1) X \, b_2^4 W_1 \quad (4)$$
$$Y = b_0^5 + (b_1^5 + b_3^5 W_2) M + b_2^5 W_2 + b_4^5 X$$
$$+ b_5^5 W_1 + b_6^5 X W_1 \quad (5)$$

When W_1 and W_2 take different values, the mediated effect of two-stage regulation is supported if the difference of indirect effect is not significant zero. In other words, when the W_1 value is low and the W_2 value is high, the difference of indirect effects is not significant zero.

D. SAMPLE SELECTION AND DATA ANALYSIS

In this article, the questionnaire survey was sampled from 19 energy companies in the Pearl River Delta region. In these companies, 8 of 19 are solar panels enterprises, 7 of 19 are solar-powered streetlamp enterprises, 4 of 19 are energy consumption monitoring system enterprises.

In these 19 companies, a total of 457 teams participated in the survey. To avoid the bias on the results, we collected matching data from two sources, team leaders and team members, and three time points, connected time points separated by one week.

At the first time point, the transformational leadership, the work features, and control variables were assessed by team members. At the second time point, the connectedness to nature and the task performance were assessed by team members. At the third time point, the green behavior was assessed by team leaders. In addition, the demographic characteristics of the participants were obtained at the first time point. With the help of corporate executives, we got the name list of participants before the whole survey started. All the team clearly understand the research purpose, and they acknowledged that the result of the survey is only used for academic research purposes. They filled different questionnaires that have the leader version and the employee version. We recorded questionnaires data and checked and analyzed data.

In this study, we distributed questionnaires to 539 directors and 3 821 employees, respectively. After three rounds of questionnaire distribution and recall, we eliminated questionnaires that are not qualified with standards, unable to match the standards and have abnormal data. Finally, we got effective matching questionnaires from 457 leaders and 3 165 employees, with effective rate 84.787% and 82.853%, respectively.

In the valid sample, males accounted for 96.226%, with an average age of 26.873 years for SD = 5.457, an average education level of 13.692 years for SD = 2.185, and an average experience as a team leader of 2.527 years for SD = 2.115. In the valid employee sample, males accounted for 79.883%, with an average age of 22.938 years for SD = 4.774, an average education level of 12.763 years for SD = 1.827, and an average experience in their team of 1.544 years for SD = 1.565. The effective team size ranged from 3 to 22 people, with an average size of 9.053 for SD = 4.967. Except the work features scale, the other construct scales in this study are all from foreign research literature.

We used the parallel double-blind two-way mutual translation method to translate the English scale [31] into Chinese version and distributed them to teams. Likert 1~5 score standards were used for scales. Usually, 1 point means very disagree and 5 points means very agree. Except the team green behavior scale, other scales constructed under the Direct Consensus Approach for data integration of team members. Followed the theory of Bliese [31], we tested the intra-group consistency$_{\gamma wg}$, the intra-group correlation ICC (1) and ICC (2) and other indicators before data integration.

We used Robertson scale to gain the transformational leadership data. The reliability coefficient of this 12-item-scale was 0.954. Stakeholders in this questionnaire can include customers, employees, partners, managers, trade unions, community groups such as association and the church, non-governmental organizations such as social movement and environmental protection groups, shareholders or investors, government regulatory agencies or departments, suppliers, and top managers. An example entry is, "My direct manager engages stakeholders in the decision-making process". 1 point means "never", and 5 point means very frequently. The results before data consolidation show that median and mean values of different team$_{\gamma wg}$ are 0.914 and 0.871, and ICC (1) = 0.217, ICC (2) = 0.691, F = 3.252, P < 0.001, which support the feasibility of data integration [18], [19].

We used Gosling and Williams [18], [19] scale to gain the connectedness to nature data. The reliability coefficient of this 6-item-scale is 0.876. An example entry is "I often feel close to the natural world around me". The results before data consolidation show that median and mean values are 0.948 and 0.932, and ICC (1) = 0.075, ICC (2) = 0.362, F = 1.551, P < 0.05, which support the feasibility of data integration.

We used Golden Orchid et al. [13] scale to gain the work features data. The reliability coefficient of this 6-item-scale is 0.853. An example entry is "Anything carried too far is usually counterproductive". The results before data consolidation show that median and mean values are 0.959 and 0.941, and ICC (1) = 0.132, ICC (2) = 0.465, F = 1.882, P < 0.001, which support the feasibility of data integration.

We used Tsui et al. [16] scale to gain the work features data. The reliability coefficient of this 7-point Richter scale is 0.939. An example entry is "I often reflect on the moral factors of my decisions." Test results before data consolidation show teams$_{\gamma wg}$ number. The median and mean values of the value ranges were 0.952 and 0.931, ICC (1) =0.137,

ICC (2) = 0.471, F =1.853, P < 0.001, which supported the feasibility of data integration.

Based on the Bissing-olson *et al.* [20] scale, we adjusted the original scale to gain the green behavior of the team data. The main adjustment is to change the description object of each item from "I" to "this team". The result has a 0.853 α reliability coefficient. An example entry is "The team performs the tasks assigned to it in an environmentally sound and appropriate manner".

According to the antecedent research literature of the green behavior in the team [23], the team size, the team tenure and the team perception of enterprise social responsibility are included in the scope of control variables in this study. In these variables, the team size is measured by the total number of team members. The team tenure is measured by the average of experience of members in the team. The team perception of enterprise social responsibility is measured by a 5-item-scale with a 0.826 reliability coefficient value. An example entry is "Our business gives enough to charity". The results before data consolidation show that median and mean values are 0.927 and 0.905, ICC (1) = 0.068, ICC (2) = 0.382, F = 1.534, P < 0.05, which support the feasibility of data integration. Also, we set a dummy variable to measure the corporate type and include it into the scope of control variables to control the effect of the corporate type on the team green behavior.

III. RESULTS DISCUSSED

We used the SPSS 22.0 to conduct statistical tests on each theoretical hypothesis. This is divided into two steps: First, we construct a regression model that measure the total effect and the mediating effect from hypotheses 1 to 4. Then, we incorporated moderator variables into the regression equation and construct a two-stage mediated regression model to test the effect from hypotheses 5 to 7. Based on current research, we centralized the independent variables, the moderating variables, and the mediating variables to do the regulatory effect related tests. At the same time, we used the Bios-corrected Bootstrap method to generate the 95% confidence interval to test the significance of related indirect effects. The repeated sampling time is 20,000.

There are two different sources of survey data in this study, which can effectively reduce the common method deviation to some extent. However, as the data came from team members, we conducted confirmatory factor analysis to verify the discriminant validity of the data.

The test results showed that under the five-factor model, the fitting results are, χ^2 = 813.459, χ^2/df = 2.027, RMSEA = 0.057, SRMR = 0.068, CFI = 0.932, and TLI = 0.991. It is significantly better than the four-factor model fitting results, which are, χ^2 = 1243.620, χ^2/df = 3.139, RMSEA = 0.082, SRMR = 0.046, CFI = 0.833, TLI = 0.861, and $\triangle\chi^2$ = 442.145. It is also significantly better than the one-factor model fitting results, which are, χ^2 = 3237.188, χ^2/df = 8.032, RMSEA = 0.127, SRMR = 0.139, CFI = 0.453, TLI = 0.378, and $\triangle\chi^2$ = 2 453.755. At the
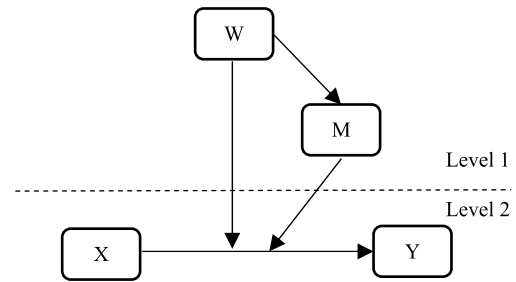

FIGURE 2. Mediation of two - level types.

same time, the matching criteria of the above five-factor model is above the level, and the standardized load coefficient of all its indexes is significant (P < 0.001), which indicates that the above five main concepts have a good discriminative validity in measurement.

In addition, the model of five factors includes a common method factor also shows good fitting results: χ^2 = 712.158, χ^2/df = 1.936, RMSEA = 0.027, SRMR = 0.041, CFI = 0.935, TLI = 0.930. We use the proposed CFI change ($\triangle$CFI) as the main basis for evaluating the merits of the two models. The results show that the CFI change between the five-factor plus a common method factor model and the five-factor model, $\triangle$CFI = 0.013, is less than 0.05, indicating that the model of five factors includes a common method factor is not significantly better than the model of five factors, therefore the common method deviation problem in this study is not serious.

A. EMPIRICAL RESULTS

In the first step, a regression model considering the total effect and the mediating effect is constructed to test hypothesis 1 to 4. The coefficient test results based on the model are showed in Table 2.

It is showed that the transformational leadership are significantly positively correlated with the connectedness to nature (r = 0.437, P < 0.001) and the green behavior (r = 0.362, P < 0.01), respectively. Hypothesis 1-4 is also well proved.

The inspection results are as follows.

First, as showed in Figure 3 and Table 2, the regression model estimation results considering the total effect show that the transformational leadership, the X-axis, has a significant positive impact on the team green behavior, the Y-axis, with B = 0.523, S.E. = 0.173, and P < 0.01. Hypothesis 1 is proved.

As showed in Figure 4 and Table 2, the regression model estimation results considering the mediating effect show that the transformational leadership, the X-axis, has a significant positive impact on the connectedness to nature, the Y-axis, with B = 0.339, S.E. = 0.089, and P < 0.01. Hypothesis 2 is proved.

As showed in Figure 5 and Table 2, the connectedness to nature, the X-axis, also has a significant positive impact on the team green behaviors, the Y-axis, with B = 0.537, S.E = 0.256, and P < 0.05. Hypothesis 3 is proved.

TABLE 2. Mean value, standard deviation and simple correlation coefficient.

variable	Mean	SD	1	2	3	4	5	6	7	8
Team size	9.075	4.959								
Team tenure	1.591	0.965	0.010							
Enterprises	0.933	0.268	0.197	0.289						
The Team's Perception of Enterprise Social Responsibility	3.772	0.374	0.021	0.203	0.345**	(0.846)				
Transformational Leadership	3.512	0.531	0.073	0.067	0.153	0.559***	(0.812)			
Connectedness to Nature	3.808	0.311	0.092	0.063	0.079	0.254	0.437***	(0.846)		
Work features	3.883	0.345	0.030	0.141	0.073	0.385**	0.324*	0.352**	(0.891)	
Task Performance	3.646	0.482	0.125	0.251	0.391*	0.437**	0.493***	0.536***	0.197	(0.848)
Green Behavior	3.770	0.657	0.157	0.071	0.163	0.040	0.362**	0.408**	0.173	0.265

Note: * P <.05, ** P <.01, ***p<.001. The numbers in brackets is the cronbach reliability coefficient value. N = 3 821.
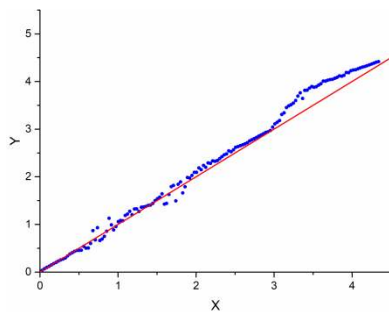

FIGURE 3. The effect between the transformational leadership and the team green behaviors.
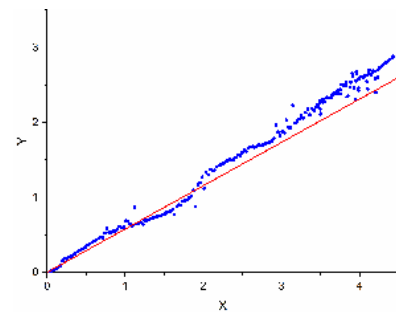

FIGURE 5. The effect between the connectedness to nature and the team green behaviors.
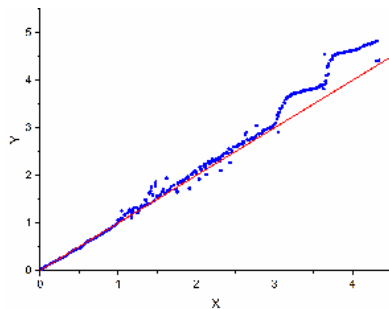

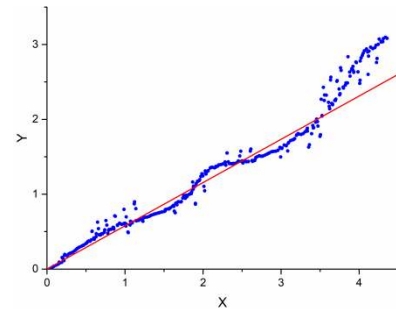**FIGURE 4.** The effect between the transformational leadership and the connectedness to nature.

FIGURE 6. The effect of the connectedness to nature has on the relationship between the transformational leadership and the team green behaviors.

In addition, as showed in Figure 6, the positive mediating effect of the transformational leadership on the green behavior of the team through the connectedness to nature is 0.293, with a 95% confidence interval of [0.003, 0.461]. Hypothesis 4 is proved.

Second, to test hypotheses 5 to 7, we incorporated the moderating variables, the work features, and the task performance into the regression equation to construct a two-stage mediated regression model. The coefficient test results based on the model are showed in Table 3.

It can be seen from Table 3 that the interaction terms of the transformational leadership and the work features have a significantly negative impact on the team's connectivity with nature for B = 0.436, S.E. = 0.227, and $P < 0.05$. To further observe the interaction between the transformational leadership and the work features, we draw the Figure 7 and 8 based on Cohen's study.

As showed in Figure 7 and Table 3, in team with strong work features, the transformative leadership has no significant impact on the team and the connectedness to nature with Simple Slope = 0.147, and s.e. = 0.134, n.s. On the contrary, in team with Weak work features, the transformational leadership had a significantly positive impact on the team connectedness to nature with simple slope = 0.438, the s.e. = 0.128, and $P < 0.001$. The relationship between the

TABLE 3. Non-standardized coefficient estimates of regression models and their standard errors.

	Model 1	Model 2	Model 3	Model 4	Model 5
	Leadership	Connectedness	Green Behavior	Connectedness	Green Behavior
Constant	2.958(0.825)***	2.823 (0.420) ***	1.267 (1.117)	0.037 (0.494)	4.529 (0.884)***
Control variables					
Team size	-0.027 (0.016)	0.005 (0.013)	-0.031 (0.019)	0.012 (0.010)	0.023 (0.053)
Team term	-0.056(0.065)	0.025 (0.043)	-0.071 (0.068)	0.039 (0.034)	0.217 (0.091)
Enterprises	0.602 (0.319)	0.034 (0.174)	0.629 (0.353)	0.015 (0.148)	0.639 (0.346)
Team perception of social responsibility	-0.374(0.251)	0.063 (0.129)	-0.346 (0.281)	0.443 (0.157)	0.381 (0.264)
The independent variables					
Transformational leadership	0.523(0.173)**	0.339(0.089)**	0.374 (0.157)	0.319 (0.065)**	0.293 (0.188)
Intervening variable					
Connectedness to Nature			0.560 (0.263)*		0.851 (0.296) **
Adjust the variable					
Work features				0.163 (0.135)	
Task performance					0.079 (0.254)
Interactive items					
Transformational leadership × Work features				0.436 (0.227)*	
Connectedness to Nature × Work features					1.937 (0.524)**
R²	0.223	0.253	0.248	0.335	0.425
F	2.547*	3.272 *	3.042*	4.162**	4.148 ***

Notes: *P < 0.05, **P < 0.01, ***(p < 0.001). The independent variables, mediating variables and regulating variables in the table were all centralized in the analysis of the regulating effect. N = 3 821.
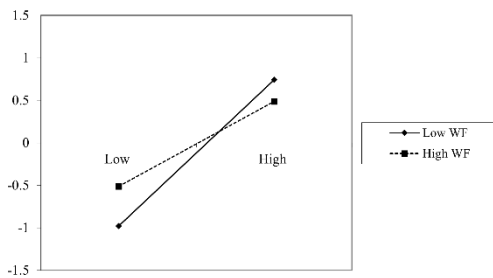

FIGURE 7. The comparison of the effect of the transformational leadership on team with different work features.
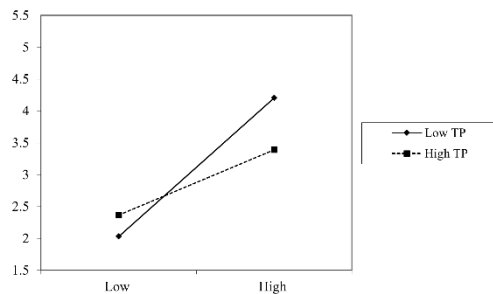

FIGURE 8. The comparison of the effect of the connectedness to nature on team with different performance.

transformational leadership and the connectedness to nature changes significantly when two different condition values of work features are strong and weak. Hypothesis 5 is proved.

On the other hand, it can be seen from Table 3 that the interaction items between the connectedness to nature and the team task performance have a significant negative impact on the team green behavior with simple slope = 1.937, s.e. = 0.524, and P < 0.01. To further observe the interaction between the connectedness to nature and the team task performance, we draw the schematic diagram of the regulatory effect when the team task performance is low and high.

In Figure 8, when the team task performance is low and high, the relationship between the connectedness to nature and the team green behavior changes significantly, that is, the influence of the connectedness to nature on the team green behavior is significantly positive in teams with high task performance that simple slope = 1.647, s.e. = 0.425, and P < 0.001. On the contrary, in team with low task performance, the effect of the connectedness to nature connectivity on the team green behavior is not significant with simple slope = 0.077, and s.e. = 0.353, n.s. Therefore Hypothesis 6 is proved.

Third, the index of moderated mediation of Hayes is −0.962, with a 95% confidence interval of [−2.167, −0.089]. It indicates that the work features and the team task performance together have a significant moderating effect on the indirect effect of transformational leadership on the green behavior of the team through the team connectedness to nature. Specifically, in team with weak work features and high team task performance, the transformational leadership through the connectedness to nature influence the behavior of the green indirect effect is positive. The conditional indirect effect is 0.765 and is the strongest value, with the 95% confidence interval [0.224, 1.573]. In a team with work features

and task performance of the other three teams, the indirect effects are 0.034, 0.010 and 0.230, respectively. Their 95% confidence interval are [- 0.369,0.345], [-0.120, 0.113] and [-0.087, 0.693], hypothesis 7 is proved.

In conclusion, all the theoretical hypotheses in this study are supported by data.

IV. RESEARCH CONCLUSION

Based on the AET theory, this article discusses the influence mechanism of the transformational leadership on the team green behaviors and conducts an empirical test by using multi-source and multi-point survey data from 457 working teams of 19 energy enterprises in the Pearl River Delta region.

The empirical results show that, first, the transformational leadership has a significant positive impact on the team green behavior, and the connectedness to nature plays a significant positive mediating role between the transformational leadership and the team green behavior.

Second, the connectedness to nature plays a significant positive mediating role between the transformational leadership and the team green behavior. On the one hand, analyzing the inhibiting effect of the work features strengthens the understanding of the effectiveness of the transformational leadership in stimulating the linkage between the connectedness to nature. On the other hand, the catalytic role of the task performance is proposed to provide support for explaining the relationship between the connectedness to nature and the team green behavior. The research strengthens the boundary condition analysis of the relationship between the connectedness to nature and the green behavior.

Third, the work features has a significant negative moderating effect on the transformational leadership and the relationship between the connectedness to nature, while the team task performance has a significant positive moderating effect on the relationship between the connectedness to nature and the team green behavior.

Fourth, compared with the other three groups with the work features and the task performance, the transformational leadership has the strongest indirect effect on the green behavior of the team through the positive connection between the connectedness to nature in the team with weak work features and high task performance.

This study extends the explanatory power of emotion-event theory to the analysis of the internal mechanism and boundary conditions of the relationship between transformational leadership and team green behaviors and provides new effective evidence to compensate for the effectiveness of emotion-event theory at the team level.

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