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# Strategies for Optimizing Human Resource Management in Electric Power Enterprises under the Energy Transition

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**Abstract:** As decarbonization targets tighten, the energy mix is being restructured and the reform of state-owned power enterprises continues to deepen. The electric power industry has therefore entered a new configuration characterized by renewable substitution, intelligent upgrading of the grid and market-based electricity trading. Human resource management (HRM) models that were built around conventional energy operations no longer match the requirements of new-type power system construction, digital transformation and the expansion of renewable business. Typical problems include an imbalanced talent structure, lagging incentive mechanisms, a rigid training system and poor person–job fit. Drawing on current industry conditions and on HR practice in power enterprises, this paper systematically analyses the core pain points of HRM and proposes optimization strategies along five dimensions: talent attraction and development, compensation and incentives, performance appraisal, talent deployment and digital management. The aim is to construct a modern HRM system adapted to the energy transition, to remove bottlenecks in talent development and to activate organizational vitality, thereby providing core talent support for high-quality and sustainable corporate development.

**Keywords:** energy transition; electric power enterprises; human resource management; talent development; performance appraisal

## 1. Introduction

The electric power industry is passing through a critical transition marked by the greening of conventional energy, the scaling-up of new energy sources, the intelligent operation of the grid and the marketization of electricity trading. Wind power, photovoltaics, energy storage, ultra-high-voltage transmission and smart grids are expanding rapidly and have fundamentally changed an industry landscape previously dominated by thermal and hydro generation. For power enterprises, which are central actors in both energy supply security and the energy transition, the basis of competitiveness is shifting from equipment, technology and resource endowments toward the combined advantages of talent, management and innovation.

The human resource department is the core functional unit responsible for talent management, organizational development and the activation of employee motivation; it carries key responsibilities for talent reserves, team building, mechanism innovation and organizational optimization. Large power enterprises have long organized HRM around standardization and stability, concentrating on personnel control, file administration and basic payroll calculation, which produced a relatively rigid management model. Driven simultaneously by the energy transition and by digital reform, the drawbacks of this conventional personnel-management model are becoming evident. The gap in senior renewable-energy engineers, digital operation and maintenance specialists and market-oriented managers continues to widen, while the inherited systems for talent development, incentives and appraisal cannot accommodate the requirements of emerging businesses, which constrains the pace of corporate transformation. Optimizing

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the HRM system and reshaping the talent development mechanism in line with the new industry situation have therefore become necessary conditions for high-quality corporate development.

## 2. New Requirements for Human Resource Management under the Energy Transition

### *2.1. Talent Structure Shifting Toward Composite and Specialized Profiles*

The workforce of a conventional power enterprise consists mainly of staff in thermal operation and maintenance, grid inspection and repair, supply services and dispatch; their expertise is concentrated in conventional generation and O&M. The construction of a new-type power system has brought energy storage, renewable generation, power-sector big data, intelligent O&M and electricity-market trading into operation, and these businesses require composite capabilities that combine power engineering with digital and market competence. Staff must master the core technologies of the industry while also being familiar with big-data applications, renewable-energy principles and market operating rules. Single-skill employees can no longer meet the requirements of business development.

### *2.2. Management Model Shifting Toward Market-Based and Lean Operation*

With the progressive liberalization of the electricity market, power enterprises have left the traditional monopoly model and face simultaneous pressure from competition, cost control and profitability. HRM is consequently required to abandon the extensive "control-first, incentive-last" logic and move toward lean, market-oriented management. On one hand, labour cost must be controlled and personnel allocated precisely so that person–job matching and resource efficiency improve; on the other hand, a market-based incentive mechanism must break with egalitarianism and base appraisal and distribution on value contribution, thereby releasing employees' capacity for innovation and performance improvement.

### *2.3. Workforce Renewal Toward Younger and More Innovative Staff*

The essence of the energy transition is technological and business-model innovation: renewable technology iteration, digital upgrading of the grid and optimization of service models all require younger, innovation-oriented talent. Power enterprises commonly face an ageing workforce, limited innovative thinking and scarce experience in emerging businesses. The human resource function must therefore accelerate workforce renewal, build development channels for younger employees and cultivate a talent pipeline suited to innovation-driven development, thus sustaining the enterprise's capacity for continuous innovation.

## 3. Main Problems in Current Human Resource Management

### *3.1. Structural Imbalance and Acute Shortages in Emerging Fields*

In most power enterprises the talent structure is unbalanced, with redundant conventional positions and shortages in emerging ones. On one side, thermal O&M, ageing grid maintenance and similar traditional businesses are contracting, leaving surplus staff whose redeployment is difficult; on the other side, reserves in renewable generation, storage O&M, power digitalization, smart-grid dispatch and electricity marketing are seriously insufficient. External recruitment of high-end specialists is difficult and internal development is slow, which directly constrains the deployment of renewable business and the pace of digital transformation. Talent pipelines are also incomplete: the gap in young and mid-career key staff is pronounced and core talent reserves are inadequate.

### *3.2. Rigid Compensation and Incentive System with Weak Incentive and Constraint Effects*

Compensation in power enterprises is still dominated by a "position wage plus seniority wage" structure with a fixed ratio between fixed and variable pay. Pay is only loosely linked to position value, performance and innovative contribution, and egalitarianism remains pronounced. Incentive instruments are limited and biased toward

fixed-salary security; dedicated incentives for emerging business, technological innovation and front-line problem-solving are insufficient, so that greater contribution is not matched by greater reward. Constraint mechanisms are equally underdeveloped: for employees with low engagement, poor performance or poor job fit, there are no effective demotion, transfer or exit mechanisms, which weakens proactivity and leaves organizational vitality difficult to activate.

*3.3. Incomplete Performance Appraisal with Weak Strategic Orientation*

Performance appraisal still relies largely on uniform legacy indicators that emphasize routine task completion and compliance with rules and regulations. Indicators for renewable business, digital work, technological innovation and market expansion are missing, and appraisal standards are highly homogenized, so they cannot match the characteristics of different positions and businesses. The process stresses results over process, and continuous follow-up and precise evaluation are lacking. Appraisal results are also under-used: they are not rigorously linked to promotion, training, pay or recognition, and the incentive, constraint and steering functions of appraisal cannot be realized, nor can appraisal optimize the allocation of human resources.

*3.4. Outdated Talent Development System with Poor Fit*

Existing training is dominated by conventional power-business skills, and content is updated slowly. Courses on renewable technology, digital O&M, market-oriented operation and innovation management are scarce, so training does not match the requirements of transformation. Delivery is narrow, consisting mainly of classroom lectures and theoretical instruction, with few hands-on exercises, case studies or external exchanges; training is consequently neither targeted nor effective. Training is also disconnected from career planning: individual development plans are not designed around position characteristics, capability gaps and development needs, which wastes training resources and produces limited capability improvement.

*3.5. Low Digital Maturity of Human Resource Management*

In most power enterprises, the digital build-out of HR is lagging and work still depends on manual statistics and spreadsheet management. Personnel files, payroll calculation, attendance management, training records and performance appraisal are only weakly digitalized. Data in each HR module are isolated, no unified data-management platform exists, and data sharing and analysis are inadequate. As a result, big-data analysis cannot be used to diagnose structural weaknesses in the talent mix, the current cost of labour or capability gaps, and HRM remains at the level of experience-based management rather than scientific and lean management.

## 4. Optimization Strategies for Human Resource Management under the Energy Transition

*4.1. Optimize Talent Attraction and Development to Balance Supply and Demand*

To correct the structural imbalance, the human resource function should design differentiated recruitment and development plans aligned with the corporate transformation strategy and close capability gaps precisely. For recruitment, the focus should be on renewable energy, digitalization and market-oriented operation: campus recruitment can target graduates in electrical engineering, renewable energy, big data and marketing, while experienced specialists and senior industry managers can be attracted through lateral hiring and industry search. For core scarce talent, dedicated packages covering pay, settlement support and benefits should be designed to improve attractiveness.

For development, a tiered and targeted system is required. Older employees should receive reskilling for emerging business and general digital-skills training, supporting the move from conventional posts to renewable O&M and smart-grid service roles. Young and mid-career key staff should be covered by dedicated development programmes that combine mentoring, hands-on project work, external study visits and job rotation to build

composite core capabilities. New employees should pass through a complete cycle of pre-job induction, on-the-job practice and position-specific cultivation so that job fit improves quickly. A talent reserve pool should also be maintained, reviewing core, scarce and reserved talent dynamically in order to complete the pipeline and close the generational gap.

*4.2. Innovate the Compensation and Incentive Mechanism to Activate Intrinsic Motivation*

Given the dual character of power enterprises-public-service obligations combined with market-based operation-a diversified compensation system should be built on four components: basic security, performance incentives, special awards and long-term incentives. Such a system breaks with egalitarianism and binds pay closely to value contribution. The fixed-to-variable ratio should be optimized, with weighting toward front-line, core-technical and emerging-business positions and a higher share of performance pay, so that differences in position value are reflected. A dedicated award fund can support renewable technology development, digital project delivery, market expansion and energy-saving and carbon-reduction initiatives through special performance awards, innovation awards and problem-solving awards that encourage employees to engage in transformation.

Non-material incentives should be diversified in parallel: recognition, promotion, professional-title evaluation, advanced training and grade advancement should be directed toward high performers and core staff. A dynamic mechanism that allows employees to move up and down and to enter and leave should be established, giving priority in promotion and development to strong performers while providing counselling, coaching and position adjustment for those with sustained poor performance or poor job fit. Incentive and constraint effects would thereby be strengthened and employee proactivity and creativity fully activated.

*4.3. Rebuild the Performance Appraisal System to Strengthen Strategic Orientation*

The human resource function should construct a differentiated, full-process and effectiveness-oriented appraisal system aligned with the transformation strategy and the characteristics of each business, eliminating homogenized and formalistic assessment. Appraisal dimensions should be differentiated across conventional business, renewable business, digital business and functional management, with indicators set accordingly. Conventional O&M and supply-service positions should be assessed on safe operation, service quality and efficiency; renewable and digital positions on technological innovation, project delivery and the conversion of results; market-oriented positions on business indicators, market expansion and customer service.

The appraisal process should be completed as a full cycle covering daily tracking, monthly review, quarterly assessment and annual evaluation, balancing process management with outcome evaluation. Appraisal results should be applied rigorously, linked comprehensively to pay distribution, position adjustment, promotion, training and recognition, so that appraisal drives performance, improvement and merit-based selection. In this way, performance appraisal can optimize human resource allocation and concentrate talent in core businesses, emerging businesses and front-line positions, raising person–job fit across the enterprise.

*4.4. Upgrade the Talent Training System to Match Transformation Needs*

The training system should be optimized in line with the energy transition and business development so that training, corporate strategy, position requirements and employee development are closely integrated. Course content should be updated dynamically: outdated conventional courses should be reduced and core courses added on renewable generation technology, storage O&M, power big-data applications, smart-grid construction, electricity-market trading and digital office work.

Delivery should also be diversified, moving beyond single-mode lecturing toward a combination of theoretical teaching, hands-on practice, project experience and case discussion, with joint programmes involving industry colleges, equipment manufacturers

and benchmark enterprises and with employee participation in key project work and industry exchange. Individual development records should be maintained so that personalized training and growth plans can be designed around position characteristics, capability gaps and development aspirations, closing the loop from learning to capability improvement, promotion and value creation and supporting the joint growth of employees and the enterprise.

*4.5. Advance the Digital Transformation of Human Resource Management*

An integrated HR information platform should be built on digital technology, consolidating data from personnel files, payroll, attendance, training, performance appraisal and talent reserves. Breaking down data silos enables online, intelligent and visualized HR management. Big-data analysis can then be used to diagnose the talent structure, labour cost, capability gaps and person–job fit, providing evidence for recruitment, deployment, training planning, compensation optimization and appraisal reform, and shifting HRM from experience-driven to data-driven practice.

The platform should also simplify HR processes, handling recruitment applications, attendance statistics, payroll declarations, training registration and appraisal announcements online, which reduces manual cost and improves efficiency. Digital tools can further support an online learning platform that pushes personalized courses so that employees can study at any time and continuously improve their overall competence, raising the scientific and lean level of human resource management.

## 5. Safeguards

*5.1. Strengthen Top-Level Strategic Guidance*

Corporate management should attach high importance to HRM optimization, recognize human resources as the primary resource for transformation and incorporate talent development planning into the overall corporate strategy. The human resource function should be granted greater autonomy for reform, with support for mechanism innovation, model upgrading and digital construction, so that recruitment, development, incentive, appraisal and team-building initiatives are advanced in a coordinated manner and the optimization strategy is implemented effectively.

*5.2. Improve the Institutional Framework*

In line with transformation requirements, the human resource function should revise and complete a series of management rules covering talent recruitment, employee training, compensation management, performance appraisal, position promotion and talent pipeline development, forming a standardized, normalized and systematic HR institutional framework. Responsibilities, working standards and appraisal requirements should be specified for each position, so that reform outcomes are consolidated in institutions and HR work proceeds in an orderly and standardized way.

*5.3. Build Team Capability*

The professional capability of the HR team should be strengthened through regular training on enterprise-reform policies, industry regulations, modern HRM concepts and digital management skills, improving market-oriented thinking, lean management capability and digital operation capability. A professional, efficient and innovative HR team would then provide expert support for talent development and organizational growth.

## 6. Conclusion

The combined changes brought by the energy transition, enterprise reform and digital upgrading present power enterprises with new opportunities while raising the requirements placed on HRM. Current HRM in power enterprises suffers from an imbalanced talent structure, lagging incentives, incomplete appraisal, poorly matched training and low digital maturity, all of which constrain transformation and high-quality development.

The human resource function should adapt proactively to the new industry situation and corporate requirements and, guided by strategic objectives, optimize the HRM model through five core measures: improving talent attraction and development, innovating compensation and incentives, rebuilding performance appraisal, upgrading talent training and advancing HR digital transformation. Such an approach removes bottlenecks in talent development, activates organizational and individual vitality and builds a high-quality, composite and innovative workforce suited to the construction of a new-type power system, thereby providing solid talent and organizational support for seizing the opportunities of the energy transition and achieving sustainable, high-quality development.

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