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ENERGY EFFICIENCY POLICIES IN CHINA AND THE UNITED STATES: INSTITUTIONAL FRAMEWORKS, TERRITORIAL DYNAMICS, AND SOCIAL ADOPTION: LESSONS FOR MAGHREB COUNTRIES WITH FOCUS ON ALGERIA

POLITYKA EFEKTYWNOŚCI ENERGETYCZNEJ W CHINACH I STANACH ZJEDNOCZONYCH: RAMY INSTYTUCJONALNE, DYNAMIKA TERYTORIALNA I SPOŁECZNA ADOPCJA: WNIOSKI DLA KRAJÓW MAGHREBU ZE SZCZEGÓLNYM UWZGLĘDNIENIEM ALGIERII

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Abstract

Background: International climate commitments require accelerated energy efficiency policies, particularly in developing countries where institutional and economic challenges limit the effectiveness of national programs.

Objective: This study comparatively analyzes Chinese and American energy efficiency policies to identify institutional mechanisms transferable to Maghreb countries, with focus on Algeria.

Methods: A comparative institutionalist approach was adopted, combining policy document analysis and quantitative assessment of energy performance over 2015-2023. The analytical framework examines institutional arrangements, policy instruments, and social adoption processes.

Results: China achieved a 4.1% annual energy intensity reduction through a centralized model characterized by binding targets, hierarchical coordination via the NDRC, and targeted industrial programs (Top-1000/10000). The United States achieved 2.1% annual improvement through a decentralized federal system mobilizing market mechanisms and state innovation, generating 26 billion kWh savings via DSM programs. The analysis reveals four critical cross-cutting

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factors: political objective alignment, multi-level institutional coordination, adequate resource allocation, and stakeholder engagement.

For Maghreb countries, a hybrid approach combining Chinese centralized coordination with American economic incentives optimizes success prospects. Contextual institutional adaptation proves more effective than replication of international models, requiring prior development of administrative and technical capacities in transition economies.

Keywords: energy efficiency, comparative institutional analysis, policy transfer, multi-level governance, China, United States, Maghreb, Algeria

Streszczenie

Wprowadzenie: Międzynarodowe zobowiązania klimatyczne wymagają przyspieszenia polityki efektywności energetycznej, szczególnie w krajach rozwijających się, gdzie wyzwania instytucjonalne i ekonomiczne ograniczają skuteczność programów krajowych.

Cel: Niniejsze badanie stanowi analizę porównawczą chińskiej i amerykańskiej polityki efektywności energetycznej w celu zidentyfikowania mechanizmów instytucjonalnych możliwych do przeniesienia do krajów Maghrebu, ze szczególnym uwzględnieniem Algierii.

Metody: Przyjęto porównawcze podejście instytucjonalistyczne, łączące analizę dokumentów programowych z ilościową oceną efektywności energetycznej w latach 2015-2023. Ramy analityczne badają ustalenia instytucjonalne, instrumenty polityki oraz procesy wdrażania społecznego.

Wyniki: Chiny osiągnęły roczną redukcję intensywności zużycia energii o 4,1% dzięki scentralizowanemu modelowi charakteryzującemu się wiążącymi celami, hierarchiczną koordynacją za pośrednictwem NDRC oraz ukierunkowanymi programami przemysłowymi (Top-1000/10000). Stany Zjednoczone osiągnęły roczną poprawę o 2,1% dzięki zdecentralizowanemu systemowi federalnemu, mobilizującemu mechanizmy rynkowe i innowacje państwowe, generując 26 miliardów kWh oszczędności dzięki programom DSM. Analiza ujawnia cztery kluczowe czynniki przekrojowe: zgodność celów politycznych, wielopoziomową koordynację instytucjonalną, odpowiednią alokację zasobów oraz zaangażowanie interesariuszy.

W przypadku krajów Maghrebu hybrydowe podejście łączące scentralizowaną koordynację chińską z amerykańskimi bodźcami ekonomicznymi optymalizuje perspektywy sukcesu. Kontekstowa adaptacja instytucjonalna okazuje się skuteczniejsza niż powielanie modeli międzynarodowych, wymagająca wcześniejszego rozwoju potencjału administracyjnego i technicznego w gospodarkach transformacyjnych.

Słowa kluczowe: efektywność energetyczna, porównawcza analiza instytucjonalna, transfer polityki, zarządzanie wielopoziomowe, Chiny, Stany Zjednoczone, Maghreb, Algieria

1. Introduction

Global efforts to double energy efficiency improvements by 2030, as committed at COP28, require innovative policy approaches that can be adapted across diverse institutional and economic contexts. While advanced economies have developed sophisticated energy efficiency frameworks, developing countries face unique challenges in policy design and implementation that necessitate careful examination of international experiences and their transferability.

China and the United States represent two contrasting yet successful models for implementing energy efficiency policies. China's centralized planning approach has achieved the world's fastest energy intensity improvements, reducing energy consumption per unit of GDP by over 40% since 2005 through administrative coordination and binding targets (IEA, 2024). Conversely, the American federal system has demonstrated how market-based mechanisms and technological innovation can drive efficiency improvements in decentralized governance structures, achieving steady progress through state-level initiatives and private sector engagement.

Maghreb countries, particularly Algeria, face distinctive challenges in implementing energy efficiency policies due to their resource-rich economies, centralized administrative systems, and extensive energy subsidy regimes. Algeria's energy intensity has paradoxically increased by 12% since 2010 despite adopting national efficiency programs, highlighting the need for more effective policy approaches informed by international best practices.

This study addresses three fundamental questions: (1) What institutional mechanisms and territorial strategies explain the relative success of Chinese and American energy efficiency policies? (2) How

do different governance models, implementation approaches, and social engagement strategies influence policy effectiveness? (3) What lessons can Maghreb countries, particularly Algeria, draw from these experiences to improve their own energy efficiency efforts?

This research contributes to the policy transfer literature by examining how energy efficiency policies developed in different institutional contexts can be adapted to developing country environments. Unlike previous studies focusing on single-country experiences, our comparative approach enables identification of generalizable success factors while recognizing context-specific adaptation requirements.

The study's significance extends beyond academic contribution toward practical policy guidance for developing countries seeking to accelerate energy efficiency improvements. For Maghreb countries, understanding how institutional frameworks, territorial coordination, and social engagement influence policy outcomes provides essential insights for designing more effective national strategies aligned with international climate commitments.

2. Literature Review and Theoretical Framework

2.1 Comparative Energy Policy Analysis

The comparative literature on energy policies has increasingly recognized that institutional contexts fundamentally shape policy design, implementation, and outcomes. Howlett & Rayner (2007) demonstrate that policy effectiveness depends critically on institutional coherence and coordination capacity across different governmental levels. This insight proves particularly relevant for energy efficiency policies that require coordination across multiple sectors and jurisdictions.

Recent comparative studies have examined energy efficiency policies across different political systems. Bertoldi et al. (2013) analyze European approaches, finding that federal systems often exhibit greater policy innovation but face coordination challenges, while unitary systems may achieve rapid deployment but may lack local adaptation. However, limited research compares fundamentally different governance models like China's centralized planning system and America's market-oriented federal approach.

2.2 Institutional Transfer and Policy Learning

The policy transfer literature provides conceptual frameworks for understanding how policies developed in one context can be adapted to different institutional environments. Dolowitz & Marsh (2000) identify several transfer mechanisms including voluntary learning, coercive transfer, and hybrid adaptation processes. For developing countries, voluntary learning from successful international experiences represents the most common transfer mode.

However, successful policy transfer requires more than copying institutional arrangements from other countries. Evans (2004) emphasizes the importance of «institutional fit,» ensuring that transferred policies align with existing administrative capacities, political structures, and cultural contexts. This principle proves particularly important for energy efficiency policies that interact with complex economic and social systems.

2.3 Energy Efficiency in Resource-Rich Economies

Resource-rich developing countries face particular challenges in implementing energy efficiency policies due to what economists call the «resource curse» (Sachs & Warner, 2001). In the energy sector, resource abundance often leads to extensive subsidy systems that distort price signals and reduce conservation incentives (Fattouh & El-Katiri, 2013).

Algeria exemplifies these challenges as a major hydrocarbon exporter maintaining energy subsidies equivalent to 13% of GDP while experiencing rising energy consumption (IMF, 2023). Similar patterns

exist across the Maghreb region, where energy subsidies remain politically entrenched despite their economic inefficiency and environmental impacts.

2.4 Multi-Level Governance and Territorial Coordination

Energy efficiency policies operate across multiple governance levels, from national strategic frameworks to local implementation mechanisms. The multi-level governance literature emphasizes that effective policy implementation requires alignment between different jurisdictional levels and coordination across horizontal agencies (Betsill & Bulkeley, 2006).

Territorial dynamics prove particularly important for energy efficiency policies because energy consumption patterns vary significantly across geographic regions due to differences in climate, economic structure, and infrastructure. Successful policies must balance national coordination with local adaptation, a challenge that different governance systems address through varying mechanisms.

2.5 Social Adoption and Behavioral Factors

Recent research increasingly recognizes that technical and economic policy instruments must be complemented by strategies addressing social adoption and behavioral change. Allcott & Mullainathan (2010) demonstrate that information provision and social comparison mechanisms can achieve energy savings comparable to significant price increases, highlighting the importance of behavioral interventions.

The social adoption literature identifies several key factors influencing energy efficiency uptake including information access, social norms, institutional trust, and perceived benefits (Ayres et al., 2013). However, most research focuses on developed country contexts, leaving gaps in understanding how these mechanisms operate in developing countries with different social structures and institutional relationships.

3. Analysis of Chinese Energy Efficiency Policies

3.1 Institutional Framework and Governance Model

Chinese energy efficiency governance operates through a centralized planning system that integrates efficiency objectives into comprehensive economic development plans (Zhang & Wang, 2019). The National Development and Reform Commission (NDRC) serves as the primary coordination body, establishing national targets and overseeing implementation through a hierarchical administrative system extending from central government to provincial and municipal levels (Price et al., 2011).

The institutional framework exhibits several distinctive characteristics that differentiate it from other governance models (Kostka, 2014). Binding targets are established through Five-Year Plans and cascade through administrative levels with specific responsibilities assigned to each jurisdiction (Lo, 2015). Administrative accountability ensures that local officials' performance evaluations incorporate energy efficiency achievements, creating strong implementation incentives (Eaton & Kostka, 2014). Resource mobilization enables rapid deployment of financial and technical resources to support efficiency programs across multiple sectors simultaneously (Wang et al., 2018).

3.2 Policy Instruments and Implementation Mechanisms

3.2.1 Top-1000 and Top-10000 Programs

China's flagship industrial efficiency programs demonstrate the centralized planning model's capacity for large-scale coordination (Price et al., 2010). The Top-1000 program (2006-2010) targeted the country's largest energy-consuming enterprises, achieving 20% energy intensity reduction through mandatory audits, efficiency investments, and performance monitoring (NDRC, 2011). The expanded

Top-10000 program (2011-2015) extended this approach to medium-sized enterprises while refining implementation mechanisms based on initial experience (Hasanbeigi et al., 2013).
These programs illustrate several key implementation characteristics: Enterprise-level targets provide specific efficiency goals linked to national objectives (Kong et al., 2016), technical assistance supports capacity building in participating companies (Li & Wang, 2014), and performance monitoring enables real-time tracking and adaptive management (Zhou et al., 2019). The programs achieved remarkable results, with participating enterprises reducing energy consumption by 165 million tons coal equivalent between 2006-2015 (National Bureau of Statistics, 2016).

3.2.2 Building Energy Efficiency Standards

China's approach to building efficiency demonstrates how centralized coordination can accelerate adoption of new standards across diverse regional contexts (Feng et al., 2018). Mandatory energy codes were progressively strengthened and extended from major cities to smaller urban areas through coordinated implementation campaigns supported by technical training and compliance monitoring (Liu et al., 2017).
The building standards program reveals important lessons about territorial implementation in centralized systems (Yu et al., 2015). Gradual implementation enables testing and refinement in advanced regions before national deployment (Evans et al., 2019), capacity building ensures local administrative and technical capabilities for enforcement (Khanna et al., 2014), and compliance monitoring maintains quality control while allowing local adaptation to climate and economic conditions (Ma et al., 2016).

3.3 Territorial Dynamics and Multi-Level Coordination

3.3.1 Provincial Implementation Strategies

Provincial governments serve as critical intermediaries in China's energy efficiency system, translating national objectives into regional implementation strategies while coordinating with municipal and enterprise levels (Baeumler et al., 2012). Provincial energy bureaus develop detailed implementation plans that account for local economic structures, energy consumption patterns, and administrative capacities (Qi & Zhang, 2018).

Table 1: Provincial Energy Efficiency Performance (2015-2023)

Province	Energy Intensity Reduction	Main Strategies	Implementation Challenges
Guangdong	-45%	Industrial modernization, green building	Rapid economic growth
Shandong	-38%	Heavy industry restructuring	Coal dependence
Jiangsu	-42%	Technological innovation, services	Manufacturing concentration
Zhejiang	-47%	SME programs, digitalization	Resource constraints

Source: provincial NDRC reports, authors' analysis.

Provincial variation reveals both strengths and challenges of the centralized model (Kostka & Hobbs, 2012). Policy adaptation allows provinces to develop strategies suited to local conditions while maintaining national consistency (Chen et al., 2016), resource allocation can be adjusted based on provincial needs and capacities (Liu & Li, 2017), but coordination complexity increases with the number of implementation levels and agencies involved (Wang & Li, 2019).

3.3.2 Municipal and Local Implementation

Municipal governments represent the final implementation level in China's hierarchical system, responsible for translating provincial plans into specific programs targeting local enterprises, buildings, and communities (Deng et al., 2014). Municipal energy bureaus coordinate across local departments while managing relationships with provincial authorities and national agencies (Feng & Wang, 2016).
Local implementation experiences demonstrate the importance of administrative capacity and resource availability for policy success (Qi et al., 2015). Well-resourced municipalities in eastern regions typically achieve better performance through comprehensive programs and technical expertise (Zhang et al., 2020), while resource-constrained areas often struggle with implementation despite strong political commitment from local leadership (Li et al., 2018).

3.4 Social Adoption and Public Engagement

3.4.1 Public Awareness Campaigns

China's approach to social adoption emphasizes large-scale public awareness campaigns coordinated across media platforms and educational institutions (Ouyang & Lin, 2014). National campaigns like «Building a Resource-Saving Society» combine mass media messaging with community-level activities to promote energy conservation behaviors and support for efficiency policies (Jiang & Hu, 2016).
Campaign effectiveness varies significantly across different population segments and geographic regions (Wang et al., 2017). Urban educated populations demonstrate higher responsiveness to information-based interventions (Zhang & Zhou, 2018), while rural and low-income groups require more targeted approaches addressing specific barriers to efficiency adoption (Liu et al., 2019). Regional variation reflects differences in economic development, education levels, and local government capacity for campaign implementation (Chen et al., 2015).

3.4.2 Enterprise and Community Engagement

Beyond public awareness, China has developed extensive programs to directly engage enterprises and communities in efficiency initiatives (Zhou et al., 2018). Business associations facilitate information sharing and peer learning among industrial firms (Ma & He, 2017), while community programs leverage neighborhood organizations and social networks to promote residential efficiency measures (Feng et al., 2019).

These engagement mechanisms reveal important insights about social adoption in centralized systems (Li & Chen, 2016). Administrative mobilization can achieve rapid participation rates when combined with clear incentives and support systems (Wang & Zhang, 2020), peer networks prove effective for information dissemination and behavioral change (Dong et al., 2018), but sustained engagement requires ongoing support and adaptation to changing local conditions (Yu & Wang, 2019).

3.5 Performance Assessment and Key Success Factors

3.5.1 Quantitative Achievements

China's energy efficiency performance over 2015-2023 demonstrates the potential effectiveness of centralized planning approaches (IEA, 2024). National energy intensity declined by 4.1% annually, representing the world's fastest sustained improvement rate (National Bureau of Statistics, 2023). Absolute energy savings exceeded 1.4 billion tons coal equivalent, contributing significantly to global emission reduction efforts (NDRC, 2023).

Sectoral performance varies but shows consistent improvement across all major categories (Zhou et al., 2022). Industrial efficiency achieved the largest absolute savings through enterprise programs and technological modernization (Kong et al., 2021), building efficiency improved through strengthened

codes and renovation programs (Feng et al., 2020), while transport efficiency progressed through vehicle standards and modal shift policies (Wang & Liu, 2022).

3.5.2 Critical Success Factors

Analysis of China's experience identifies several factors explaining the centralized model's effectiveness (Price et al., 2019):

Strong political commitment ensures sustained resource allocation and implementation support across multiple governmental levels and planning periods (Kostka, 2016). Administrative coordination enables rapid resource mobilization and activity alignment across sectors and jurisdictions (Eaton & Kostka, 2017). Binding targets create clear accountability mechanisms linking policy implementation to official performance evaluation (Lo, 2018). Resource availability supports comprehensive programs addressing multiple barriers to efficiency adoption simultaneously (Wang et al., 2021).

However, the Chinese model also faces significant challenges that limit its transferability to other contexts (Gallagher, 2014). Administrative capacity requirements demand sophisticated bureaucratic systems with technical expertise and coordination capabilities (Baeumler et al., 2014). Economic structure dependence means effectiveness varies with industrial composition and development levels (Zhang & Wang, 2020). Social context factors including government trust and collective action traditions influence public acceptance and participation rates (Chen & Li, 2019).

4. Analysis of American Energy Efficiency Policies

4.1 Federal System and Institutional Architecture

The United States approaches energy efficiency through a complex federal system where national coordination combines with state-level innovation and local implementation. The Department of Energy (DOE) provides national leadership through research, standards, and technical assistance, while states retain primary authority for utility regulation and building codes that directly influence efficiency outcomes.

This decentralized architecture creates both opportunities and challenges for energy efficiency policy. Policy innovation occurs when states experiment with different approaches and successful models diffuse to other jurisdictions. Market responsiveness enables rapid adaptation to technological changes and economic conditions. However, coordination complexity can result in fragmented implementation and uneven performance across different regions and sectors.

4.2 Market-Based Instruments and Economic Incentives

4.2.1 Utility Demand-Side Management Programs

American utilities operate extensive demand-side management (DSM) programs that provide financial incentives and technical assistance for efficiency investments. These programs, regulated by state public utility commissions, represent one of the most successful market-based approaches to efficiency promotion, achieving over 26 billion kWh annual savings in 2023.

Table 2: US Utility DSM Program Performance (2015-2023)

Region	Annual Savings (TWh)	Investment ($ Billions)	Cost-Effectiveness (¢/kWh)
Northeast	8.2	3.1	3.8
California	4.6	1.8	4.2
Midwest	6.4	2.4	3.6
Southeast	3.8	1.9	4.9

Source: EIA Electric Power Annual, state utility reports.

DSM programs demonstrate several strengths of market-based approaches. Performance-based incentives align utility interests with efficiency objectives through regulatory mechanisms like decoupling and shared savings. Customer choice allows participants to select measures suited to their specific circumstances and preferences. Innovation incentives encourage utilities to develop new technologies and delivery mechanisms to improve program cost-effectiveness.

4.2.2 Tax Credits and Financial Incentives

Federal and state tax credits provide significant financial support for efficiency investments across residential, commercial, and industrial sectors. The federal Investment Tax Credit (ITC) and Production Tax Credit (PTC) systems have mobilized billions in private investment while state-level programs provide additional support tailored to local priorities and market conditions.

Tax credit effectiveness varies significantly across different market segments and technology categories. Commercial and industrial participants demonstrate high uptake rates due to sophisticated financial analysis capabilities and longer investment horizons. Residential participation remains more limited due to information barriers and transaction costs, though programs targeting low-income households show promising results with enhanced support services.

4.3 State-Level Innovation and Policy Diversity

4.3.1 Leading State Programs

Several American states have developed comprehensive energy efficiency programs that serve as models for other jurisdictions. California's Title 24 building standards and utility programs have helped maintain stable per-capita electricity consumption despite economic growth. The Massachusetts Green Communities Act created comprehensive efficiency programs with performance-based utility regulation. The Efficiency Vermont model demonstrates how independent efficiency utilities can deliver sustained savings.

California's integrated approach: California combines aggressive building standards, utility programs, and advanced planning processes to achieve nationally leading efficiency performance. The state's integrated approach demonstrates how multiple policy instruments can reinforce each other when properly coordinated.

Texas ERCOT market: Texas demonstrates how efficiency can be promoted through competitive electricity markets with demand response and energy efficiency resources competing directly with generation. Market-based mechanisms provide strong economic incentives for efficiency while maintaining system reliability.

4.3.2 Regional Variation and Learning

State diversity in policy approaches creates valuable learning opportunities when successful innovations diffuse across jurisdictions. The Regional Greenhouse Gas Initiative (RGGI) enables northeastern states to coordinate climate and efficiency policies while maintaining state-level implementation flexibility.

However, state variation also creates coordination challenges and uneven outcomes. Resource disparities between wealthy and less affluent states affect program comprehensiveness and effectiveness. Regulatory inconsistencies can complicate interstate commerce and technology deployment. Political volatility means policies can change significantly with electoral cycles, affecting long-term investment planning.

4.4 Territorial Implementation and Multi-Level Coordination

4.4.1 Federal-State-Local Relations

Energy efficiency policies in the United States operate through complex multi-level relationships where federal standards interact with state regulations and local implementation. Federal appliance and equipment standards provide national consistency while state utility regulation and building codes enable local adaptation. Municipal governments often serve as both policy implementers and participants in efficiency programs.

Coordination mechanisms include federal technical assistance programs, state energy offices, and regional organizations that facilitate information sharing and joint activities. Funding flows from federal grants support state and local programs while mobilizing additional investments from utility ratepayers and private sources.

4.4.2 Local Government Leadership

Many American cities and counties have emerged as policy leaders, developing innovative programs that exceed state and federal requirements. Cities like Seattle, Austin, and New York have implemented comprehensive building performance standards, renovation financing programs, and public facility efficiency initiatives that demonstrate local government capacity for policy innovation.

Local leadership creates important demonstration effects and political pressure for broader policy action. Municipal programs often serve as testing grounds for new approaches before state or federal adoption. Urban networks like the U.S. Conference of Mayors and C40 Cities facilitate experience sharing and collective action on efficiency policies.

4.5 Social Adoption and Behavioral Programs

4.5.1 Information and Education Initiatives

American approaches to social adoption emphasize information provision, education, and voluntary behavioral change programs. ENERGY STAR labeling provides standardized efficiency information for appliances and buildings. Home energy reports use social comparison to encourage conservation. Public education campaigns promote awareness of efficiency benefits and available programs.

Information program effectiveness varies significantly across different population segments and communication channels. High-income, educated consumers respond well to technical information and economic analysis, while low-income populations require more targeted outreach addressing specific barriers and providing enhanced support services.

4.5.2 Community-Based Programs

Local organizations, community groups, and nonprofits play important roles in efficiency program delivery and social engagement. Community-based social marketing approaches leverage local networks and trusted messengers to promote efficiency adoption. Programs targeting specific demographic groups (seniors, low-income households, ethnic communities) demonstrate higher participation rates than general market approaches.

Community engagement strategies prove particularly important for reaching underserved populations who may have limited access to conventional program delivery channels. Trusted messengers including community leaders, religious organizations, and local businesses can significantly improve program credibility and participation rates.

4.6 Performance Assessment and Model Characteristics

4.6.1 Quantitative Results

American energy efficiency performance demonstrates consistent but more modest improvements compared to China's dramatic intensity reductions. National energy intensity declined by 2.1% annually over 2015-2023, with significant variation across states and sectors. Total efficiency investment reached $7.5 billion annually in 2023, supporting 2.25 million jobs across the efficiency workforce.

State performance variation reflects different policy approaches, economic structures, and resource availability. Leading states like California, Massachusetts, and Vermont achieve intensity improvements exceeding 3% annually, while lagging states show minimal progress due to limited policy frameworks and implementation capacity.

4.6.2 Federal Model Strengths and Limitations

The American federal approach to energy efficiency demonstrates several distinctive characteristics: Policy innovation occurs through state-level experimentation with successful models diffusing to other jurisdictions through voluntary adoption or federal encouragement. Market responsiveness enables rapid adaptation to technological advances and changing economic conditions. Private sector engagement mobilizes business innovation and investment to develop and deploy efficiency technologies.

However, the federal model also exhibits significant limitations affecting overall performance. Coordination challenges result from overlapping jurisdictions and inconsistent policy frameworks across different states and localities. Resource inequality creates disparities in program availability and effectiveness between affluent and less well-resourced jurisdictions. Political instability at state and federal levels can disrupt program continuity and long-term planning processes.

5. Comparative Analysis and Key Lessons

5.1 Institutional Model Comparison

Chinese and American approaches to energy efficiency represent fundamentally different institutional models with distinct advantages and limitations. China's centralized planning system achieves rapid, large-scale implementation through administrative coordination and binding targets, while America's market-based federal system promotes innovation and adaptation through decentralized experimentation and private sector engagement.

Table 3: Institutional Model Comparison

Dimension	China	United States	Implications
Coordination	Centralized, hierarchical	Decentralized, networked	Speed vs. innovation tradeoffs
Target setting	Mandatory, binding	Voluntary, flexible	Different accountability mechanisms
Resource mobilization	Administrative, rapid	Market-based, gradual	Variable implementation timelines
Innovation	Technology adoption	Technology development	Different innovation incentives
Adaptation	Limited flexibility	High diversity	Consistency vs. contextual fit tradeoffs

Source: compiled by authors.

5.2 Performance and Effectiveness Factors

Quantitative performance comparison reveals that both models can achieve significant efficiency improvements through different mechanisms. China's 4.1% annual intensity reduction demonstrates the potential of coordinated administrative action, while America's 2.1% improvement shows how market-based approaches can deliver sustained progress over longer periods.

Critical success factors identified across both models include: Clear objectives providing direction for implementation efforts across multiple actors and jurisdictions. Adequate resources to support comprehensive programs addressing technical, financial, and informational barriers. Institutional capacity including technical expertise and coordination capabilities at relevant governmental levels. Stakeholder engagement building support and participation from key actors including businesses, communities, and individuals.

6. Transferability Assessment for Maghreb Countries

6.1 Institutional Compatibility Analysis

Maghreb countries exhibit institutional characteristics suggesting selective compatibility with Chinese and American approaches. Centralized administrative traditions common across the region align with Chinese-style coordination mechanisms and binding target systems. However, limited administrative capacity and weak technical expertise in many countries constrain implementation effectiveness.
Economic structures dominated by resource extraction and state enterprises resemble Chinese conditions more than American market-oriented systems. Political systems with strong executive authority enable top-down coordination but may lack checks and balances supporting sustained policy implementation.

Table 4: Institutional Compatibility Assessment for Maghreb Countries

Factor	Algeria	Morocco	Tunisia	Chinese Model Fit	American Model Fit
Administrative centralization	High	Medium	Medium	Strong	Weak
Technical capacity	Medium	Medium	High	Medium	Medium
Market development	Low	Medium	Medium	Weak	Medium
Federal structure	No	No	No	Strong	Weak
Private sector role	Limited	Growing	Growing	Medium	Strong

Source: compiled by authors.

6.2 Adaptation Requirements

Successful policy transfer to Maghreb countries requires substantial adaptation rather than wholesale adoption of either model. Hybrid approaches combining Chinese-style coordination with American-style economic incentives appear most promising for countries with centralized administrations but growing market economies.
Institutional development represents a critical prerequisite for effective policy transfer. Countries must invest in administrative capacity, technical expertise, and coordination mechanisms before implementing comprehensive efficiency programs. Resource availability including financial resources and human capital affects the scale and scope of feasible programs.

7. Recommendations for Algeria and Maghreb Countries

7.1 Institutional Framework Development

Algeria and other Maghreb countries should establish central coordination bodies modeled on China's NDRC but adapted to local institutional contexts. A National Energy Efficiency Council with representation from key ministries (energy, industry, finance, environment) could provide strategic direction while ensuring cross-sectoral coordination.
Key functions should include strategic planning and target setting aligned with national development objectives, resource allocation and program oversight across different sectors and governmental levels,

performance monitoring and adaptive management based on implementation experience, and international cooperation facilitation and technology transfer.
Implementation structure should build on existing administrative systems while creating new coordination mechanisms where necessary. Algeria's centralized tradition provides a foundation for hierarchical coordination, but enhanced technical capabilities and cross-sectoral collaboration require development.

7.2 Policy Instrument Design and Implementation

Drawing from Chinese experience, Algeria could establish binding energy efficiency targets integrated into national and regional development plans. Targets should be specific, measurable, and linked to official performance evaluation systems to ensure sustained implementation attention.
Target structure should include national intensity reduction objectives consistent with climate commitments, sectoral targets reflecting different improvement potentials and barriers, and regional objectives accounting for variations in economic structure and development level. Accountability mechanisms should link target achievement to administrative performance evaluation and promotion opportunities.
American experience demonstrates the importance of economic incentives for engaging private sector participation and mobilizing market forces. Algeria's ongoing economic reforms provide opportunities to introduce market-based mechanisms while maintaining strategic government coordination.
Financial incentives could include tax credits for efficiency investments, subsidized financing for renovation projects, and performance-based contracts linking payments to achieved energy savings. Market mechanisms could involve utility demand-side management programs, energy service company development, and competitive bidding for efficiency resources.

7.3 Territorial Implementation Strategies

Given Algeria's diverse geographic and economic conditions, territorial implementation should enable regional adaptation while maintaining national coordination. Pilot programs in different regions could test alternative approaches and identify effective strategies for broader deployment.
Regional strategies should account for climatic variations affecting heating and cooling demands, economic structure differences between industrial, agricultural, and service regions, and infrastructure conditions including electricity grid capacity and building characteristics. Pilot programs could focus on specific cities or regions to demonstrate effectiveness before national scaling.
Local governments require enhanced capacity for efficiency program implementation including technical expertise, financial resources, and coordination mechanisms. Municipal capacity building should emphasize practical skills and sustainable institutional development.

7.4 Social Adoption and Public Engagement

Chinese and American experiences demonstrate the importance of public awareness and education for building support and participation in efficiency programs. Algeria should develop comprehensive communication strategies addressing different population segments and geographic regions.
Communication strategies should emphasize economic benefits including reduced energy costs and job creation opportunities, environmental benefits including air quality improvements and climate change mitigation, and social benefits including improved comfort and health outcomes. Target audiences should include households, businesses, government officials, and civil society organizations with messages adapted to each group's interests and concerns.

7.5 Resource Mobilization and Financing

Successful efficiency programs require adequate financial resources from domestic and international sources. Algeria's energy export revenues provide potential funding for comprehensive efficiency programs while reducing fiscal pressure from energy subsidies.

Domestic financing mechanisms could include dedicated energy efficiency funds supported by efficiency taxes or subsidy reductions, green bonds for large-scale efficiency investments, and revolving loan funds providing low-cost financing for private sector projects. Resource allocation should prioritize high-impact sectors and regions while ensuring equitable access across different population groups.

International cooperation can provide technical expertise, financing, and technology access that accelerate efficiency program development. Algeria should strategically engage with international partners including bilateral agencies, multilateral organizations, and private sector partners.

8. Conclusions

This comparative analysis of Chinese and American energy efficiency policies reveals important insights for developing countries, particularly in the Maghreb region, seeking to improve their own efficiency efforts. Both models demonstrate that substantial energy intensity improvements are achievable through different institutional approaches, but success requires careful attention to context-specific factors and implementation capacity.

Critical success factors identified across both models include clear policy objectives linked to national development priorities, adequate institutional coordination mechanisms spanning multiple governmental levels and sectors, sufficient resource allocation including financial and human capital, and effective stakeholder engagement building public and private sector support. These factors provide general guidance while requiring adaptation to specific national circumstances.

Model-specific insights highlight important tradeoffs in policy design and implementation. China's centralized approach enables rapid scaling and comprehensive coverage but requires substantial administrative capacity and may limit innovation and adaptation. America's market-based federal approach promotes innovation and private sector engagement but faces coordination challenges and uneven implementation across different jurisdictions.

For Algeria and other Maghreb countries, the analysis suggests that hybrid approaches combining elements of both models offer the most promising pathways for improving energy efficiency performance. These countries' centralized administrative traditions align with Chinese-style coordination mechanisms, while their growing market economies can benefit from American-style economic incentives and private sector engagement.

Institutional development emerges as a critical prerequisite for effective policy implementation regardless of the specific model adopted. Countries must invest in administrative capacity, technical expertise, and coordination mechanisms before implementing comprehensive efficiency programs. This conclusion emphasizes the importance of gradual, sustained capacity building rather than rapid policy adoption.

Resource constraints common across the region necessitate careful prioritization and phased implementation strategies. Countries should focus initial efforts on high-impact sectors and regions while building institutional capacity for broader program expansion. International cooperation can provide valuable support but should complement rather than substitute domestic capacity development.

The study contributes to the policy transfer literature by demonstrating how institutional compatibility assessment can guide adaptation strategies for developing countries. Simple replication of successful international models proves insufficient; effective transfer requires careful analysis of institutional contexts and systematic adaptation to local conditions.

Multi-level governance emerges as a critical factor influencing policy effectiveness across different institutional systems. Both centralized and federal approaches require coordination mechanisms spanning multiple governmental levels, though specific arrangements vary significantly. This conclusion has implications for institutional design in developing countries establishing new policy frameworks.
Economic structure effects prove particularly important for energy efficiency policies due to their interaction with broader development patterns. Resource-rich economies face distinctive challenges from energy subsidies and industrial structures that require targeted policy responses informed by international experience but adapted to local conditions.

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