# Institutions and the Transformation of Energy-Dependent Cities: A Comparison of Houston and Qingyang

Qingyu Shang

The High School Affiliated To Renmin University Of China

DOI: 10.46609/IJSSER.2026.v11i08.021 URL: https://doi.org/10.46609/IJSSER.2026.v11i08.021
Received: 8 July 2026 / Accepted: 16 August 2026 / Published: 23 August 2026

## ABSTRACT

*The global energy transition poses existential challenges for cities historically dependent on fossil-fuel industries, which frequently confront industrial lock-in, fiscal reliance on resource extraction, and limited economic diversification. Drawing on a most-different-systems comparative design, this paper compares Houston, a U.S. city, and Qingyang, a Chinese city, to analyze how institutional context shapes the transformation of energy-dependent cities. Both cities share deep fossil-fuel dependence, yet they operate within sharply divergent governance structures: Houston exemplifies a market-driven, entrepreneurial model characterized by private investment, technological innovation, and labor-market flexibility, whereas Qingyang illustrates a state-oriented, policy-driven path reliant on top-down industrial planning, fiscal redistribution, and administrative coordination. The comparison suggests that the ability of resource-dependent cities to overcome path dependence depends not merely on resource endowments or external shocks, but critically on the institutions and policy mechanisms through which adjustment is managed. These findings provide policy implications for energy-dependent cities seeking to balance economic resilience, industrial upgrading, and environmental goals in the low-carbon transition.*

**Keywords:** Energy-dependent cities; Energy transition; Industrial diversification; Comparative policy analysis

## 1. Introduction

The twenty-first century has witnessed a profound transformation in the global energy system, driven by the urgency of climate change, rapid advances in clean energy technology, and shifting geopolitical conditions. The Paris Agreement of 2015, together with the subsequent adoption of carbon-neutrality targets by over 130 countries covering more than 88 percent of global emissions, has placed unprecedented pressure on fossil-fuel-

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

dependent cities to undertake deep structural adjustment. Globally, an estimated 6 million workers are directly employed in the fossil-fuel extraction sector, with concentration in cities where energy industries have shaped local labor markets, fiscal systems, and industrial ecologies for generations (International Energy Agency, 2023). As the world's two largest energy consumers and carbon emitters, China and the United States play a central role in shaping the direction and pace of this transition. China's "dual carbon" goals—peaking carbon emissions before 2030 and achieving carbon neutrality by 2060—represent one of the most ambitious climate commitments among developing countries, while the United States has pledged to reduce greenhouse gas emissions by 50–52 percent below 2005 levels by 2030 and achieve net-zero greenhouse gas emissions by no later than 2050 .

Within this broader context, energy-dependent cities have emerged as key sites where the economic consequences of decarbonization are most acutely felt. These cities share a common set of structural challenges: industrial lock-in, fiscal dependence on resource extraction, and chronic exposure to commodity-price volatility. Yet they may also possess latent capacities that support adaptation—accumulated industrial knowledge, energy infrastructure, and specialized technological expertise. The central question is therefore not simply whether resource-dependent cities can transform, but how institutional and policy conditions shape their capacity to reallocate capital and labor toward more sustainable growth trajectories.

This paper offers a comparative analysis of Houston and Qingyang, two energy-dependent cities embedded in sharply different institutional settings. The comparison follows a most-different-systems research design: the two cities share a common condition of deep fossil-fuel dependence—Houston's economy has historically derived over 80 percent of its base from energy industries in the mid-20th century, while Qingyang's fiscal revenues remain heavily dependent on oil, gas, and coal extraction—, yet they operate within contrasting governance architectures, factor-allocation mechanisms, and policy environments. This design allows us to hold the underlying structural condition constant while examining how institutional context shapes transformation outcomes. Houston—widely recognized as the "Energy Capital of the World"—exemplifies a market-driven, entrepreneurial model of urban transformation. Following the severe oil-price collapse of the 1980s, the city diversified its industrial base by expanding into healthcare, aerospace, logistics, and high-technology services, while continuously reinventing its energy sector through innovation. This experience illustrates how local autonomy, capital mobility, and institutional flexibility can convert cyclical volatility into long-term economic resilience within a decentralized system. Qingyang, by contrast, illustrates a state-coordinated, policy-driven path of structural change. Located on the Loess Plateau of Gansu Province, the city's development has long depended on coal, oil, and natural gas extracted primarily through the Changqing Oilfield—one of China's largest onshore oilfields. Under

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

China's national poverty-alleviation campaign and the "dual carbon" strategy, Qingyang has been repositioned as a pilot zone for green industrial transition, with current policies emphasizing renewable energy deployment, agricultural modernization, and cultural-tourism development—supported by state-owned enterprise investment and intergovernmental fiscal transfers. This trajectory reflects a top-down planning model in which higher-level governments play a decisive role in guiding structural change and absorbing development risk.

This paper contributes to the literature in three ways. First, it shows how institutions shape economic transformation through capital reallocation, labor adjustment, industrial upgrading, and policy coordination—thereby extending scholarship on the resource curse and path dependence. Second, it contributes to the underdeveloped cross-national literature comparing energy-dependent cities across sharply different political-economic systems, particularly between China and the United States. Third, by focusing at the city level, the paper moves beyond broad national or regional accounts to examine how transformation actually unfolds in practice. In doing so, it also draws attention to mid-sized Chinese resource-dependent cities—a category that remains underrepresented in the literature despite its outsized importance to China's energy transition and dual-carbon ambitions.

## 2. Literature Review

A first important strand is the resource curse literature, which argues that abundant natural resources do not necessarily promote long-run development and may instead be associated with slower growth, weaker institutions, limited diversification, and environmental degradation. Proposed mechanisms include Dutch Disease effects, fiscal dependence on commodity revenues, rent-seeking behavior, and exposure to price volatility (Auty, 1994; Sachs & Warner, 1995; Bresser-Pereira, 2020). At the regional level, these dynamics often translate into single-industry concentration, unstable employment, and vulnerability to external shocks. However, more recent work emphasizes that the resource curse is not deterministic; its effects depend on institutional quality, governance structure, and policy design (Mehlum, Moene, & Torvik, 2006; Ross, 2015; Kansheba & Marobhe, 2022). In this paper, we illustrate how regions with different institutions adopt different approaches to overcome the resource curse. In a more market-oriented economy, Houston illustrates how resource-based growth can be complemented by diversification into services, technology, and knowledge-intensive sectors. In contrast, in more state-led systems such as Qingyang, transformation depends more heavily on top-down policy design, administrative coordination, and fiscal redistribution. Together, these cases suggest that the resource curse is better understood as a conditional and context-specific phenomenon than as a universal development trap.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

A closely related strand of literature is the theory of path dependence, which emphasizes how historical industrial and institutional configurations shape future development trajectories (David, 1985; Arthur, 1989; Martin & Sunley, 2006). When a city is organized around a dominant energy sector, sunk investments in infrastructure, specialized labor markets, and entrenched interest groups can generate self-reinforcing dynamics. These mechanisms reduce strategic flexibility and increase the costs of diversification, even when existing development paths become economically or environmentally unsustainable. This paper shows that Houston's dense petrochemical corridor—comprising refineries, pipelines, and service firms along the Gulf Coast—illustrates how industrial clustering can create both resilience and rigidity. Similarly, Qingyang's reliance on the Changqing Oilfield has deeply embedded fiscal structures and employment patterns in extractive industries, making structural adjustment more difficult. We further argue that overcoming path dependence often requires critical junctures, such as economic crises, technological change, or deliberate policy intervention, that disrupt existing equilibria and open opportunities for new development paths. Importantly, how effectively cities respond to critical junctures depends on institutional context.

Life-cycle theory provides an additional lens for understanding the dynamics of energy-dependent urban transformation. Rooted in evolutionary economics, this framework conceptualizes industries as evolving through stages of emergence, growth, maturity, decline, and renewal (Gort & Klepper, 1982; Klepper, 1997; Peltoniemi, 2011). For resource-based cities, the maturation and eventual decline of extractive industries often create pressure for structural adjustment while also opening opportunities for diversification into new sectors. Comparative experiences from cities such as Pittsburgh and the Ruhr region show that industrial decline can, under supportive institutional and policy conditions, generate opportunities for renewal through education, technology, cultural industries, and green development (Galgóczi, 2014; Ghosh et al., 2018). The life-cycle framework is useful for identifying when transformation opportunities arise, but it is less equipped to explain why some cities seize those opportunities while others do not. By comparing Houston and Qingyang, this paper shows that governance structure is a critical intervening variable: it shapes not only the timing and direction of industrial transition, but also the actors, mechanisms, and distributional consequences through which transition unfolds.

## 3. Institutional Background

This section presents Houston and Qingyang as two representative energy-dependent cities and traces their transformation trajectories along a common set of analytical dimensions: historical development, industrial structure, governance context, and recent transformation outcomes. Although the two cities are embedded in markedly different institutional environments, both have long depended on fossil-fuel industries and have faced mounting pressure from the global

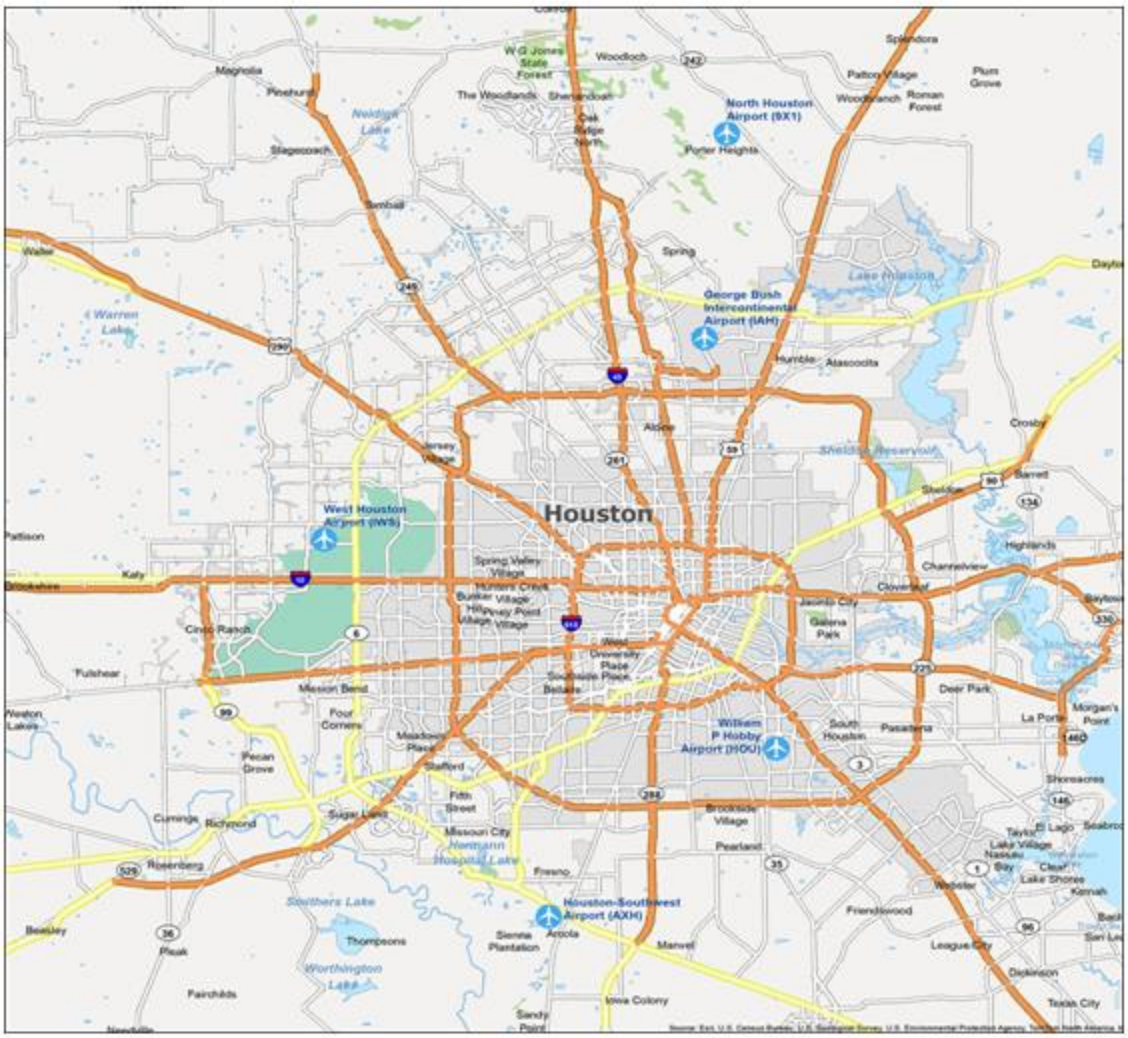
ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

energy transition, environmental regulation, and economic restructuring. Examining them side by side provides an empirical foundation for the comparative analysis in Section 4, where the mechanisms underlying their divergent trajectories are examined in greater depth.

### 3.1 Houston, USA: Market-Driven Transformation

**Figure 1. The Map of Houston**




Houston, Texas, situated on the Gulf of Mexico, is the fourth-largest city in the United States and the economic center of the southern region. Its coastal geography and proximity to major hydrocarbon deposits—including the historic Spindletop oil field discovered in 1901 and offshore reserves in the Gulf of Mexico—have historically endowed it with strategic advantages for petroleum-industry development. The Port of Houston, the nation's second-busiest container

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

port, anchors the city's global trade network and has served as a vital export gateway for crude oil, liquefied natural gas (LNG), and petrochemicals. Together with expansive transport infrastructure and favorable geographic conditions, these factors fostered Houston's emergence as a multifunctional industrial hub integrating energy production, logistics, and manufacturing.

As of 2023, Houston’s metropolitan gross domestic product reached approximately USD 697 billion, making it the second-largest metropolitan economy in the United States after New York. The city retains its identity as the “Energy Capital of the World,” hosting over 4,700 energy-related firms and serving as headquarters for major global corporations such as ExxonMobil, Chevron, Shell, and ConocoPhillips. Nearly 40% of the world’s publicly listed oil and gas enterprises maintain operational or administrative centers in the Houston area, reflecting its unparalleled industrial concentration and global connectivity. This industrial agglomeration also supports a broad ecosystem of professional services, engineering firms, and research institutions.

At the same time, Houston has gradually diversified beyond hydrocarbons. The Texas Medical Center—the largest integrated medical complex in the world—contributes more than USD 25 billion annually to regional GDP and employs over 100,000 professionals. The Johnson Space Center, established in the 1960s under NASA, anchors the city’s aerospace and advanced-manufacturing ecosystem. Together, these institutions illustrate Houston’s expanding reliance on knowledge-intensive industries and high-skill employment.

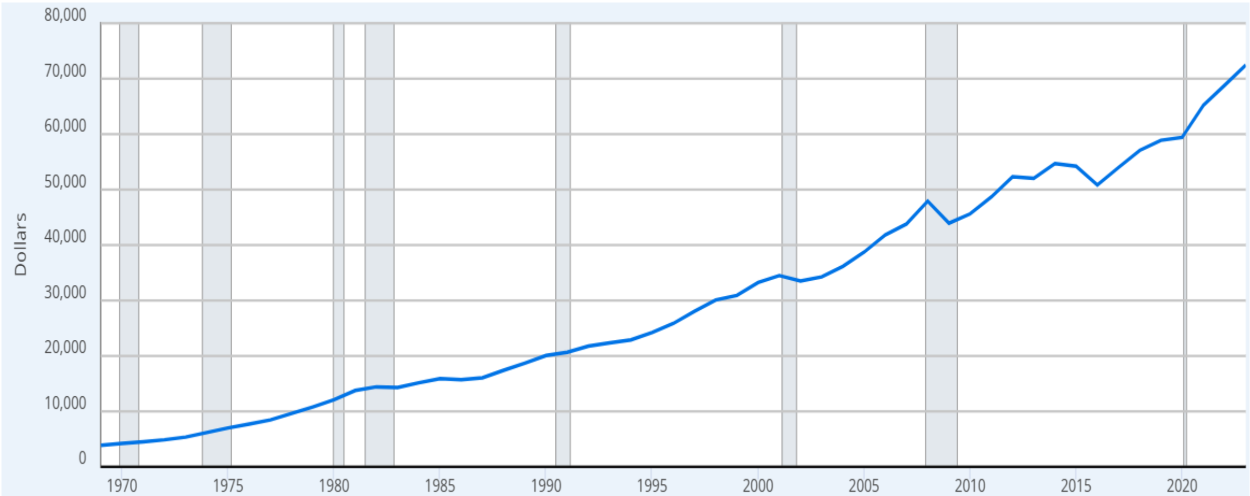
As Figure 2 illustrates, per capita personal income in the Houston metropolitan area rose nearly continuously from $3,877 in 1969 to $72,453 in 2023, reflecting both the city's sustained long-run growth and its capacity to recover from cyclical disruptions. The trajectory reveals three distinct phases. During the oil-boom years of the 1970s and early 1980s, per capita income grew rapidly as rising global energy prices inflated wages and profits across the metropolitan economy. The 1986 oil-price collapse interrupted this trajectory sharply: income growth stalled for nearly five years, with a visible plateau between 1982 and 1988 that reflects the severity of the employment and wage losses during the crisis. The subsequent recovery—driven by diversification into healthcare, aerospace, and professional services—restored upward momentum through the 1990s and early 2000s. A second, briefer plateau followed the 2015–16 oil-price correction, underscoring Houston's continued, if diminishing, sensitivity to energy-market volatility. Despite these interruptions, the overall trajectory is one of sustained income growth.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

**Figure 2. Per Capita Personal Income in Houston-The Woodlands-Sugar Land, TX (MSA)**




*Source: U.S. Bureau of Economic Analysis*

Houston's emergence as an energy powerhouse can be traced to the early twentieth century, when the discovery of the Spindletop oil field triggered a massive inflow of capital and labor into Texas's petroleum sector. The completion of the Houston Ship Channel in 1914 further consolidated the city's role as a national hub for crude oil and refined-product exports. Throughout the twentieth century, successive global energy booms reinforced Houston's dominance in oil and petrochemicals. At the peak of the oil boom in the early 1980s, energy jobs accounted for over 80% of Houston's economic base (*Fiscal year 2015 budget*. City of Houston). This concentration, however, also left Houston highly exposed to fluctuations in global energy prices.

The 1986 oil-price collapse marked a critical turning point. When crude prices fell by more than 50% in less than a year, the metropolitan area lost over 200,000 jobs, and unemployment exceeded 9%. This crisis exposed the structural risks of dependence on fossil fuels and compelled policymakers, firms, and institutions to pursue economic diversification. In response, healthcare, aerospace, logistics, and international trade expanded rapidly, laying the foundation for a more multi-sectoral economy. Importantly, this diversification was largely market-driven, emerging through entrepreneurial adaptation, venture-capital investment, and institutional leadership by universities and research consortia rather than centralized planning.

The early 2000s ushered in renewed growth driven by the shale-energy revolution. Technological breakthroughs in hydraulic fracturing and horizontal drilling revitalized Houston's oil and gas ecosystem, positioning the city as the global command center for shale technology

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

research and development. At the same time, non-energy sectors continued to expand, supported by the growth of biomedical research, advanced manufacturing, and higher education. This period consolidated Houston's transition from a single-sector energy city to a diversified metropolitan economy.

Entering the 2020s, Houston's development entered a new phase characterized by green transformation and sustainability transition. The Houston Climate Action Plan (2020) articulated a commitment to achieving carbon neutrality by 2050. Building on its existing industrial base, the city has advanced initiatives in hydrogen energy, carbon capture, utilization and storage (CCUS), renewable power generation, and climate-resilient infrastructure. These developments illustrate Houston's capacity to integrate legacy energy assets with emerging low-carbon technologies.

From an industrial-structure perspective, Houston's economy has become significantly more diversified. By 2024, manufacturing, professional and business services, real estate, government, and healthcare and education together accounted for more than half of metropolitan GDP. The direct share of oil and gas extraction declined from 7.7% of local GDP in 2014 to 3.8% in 2024, indicating reduced exposure to commodity price volatility. Table 1 documents the structural shift in Houston's nonfarm employment between 2000 and 2025. Total employment expanded by more than 1.17 million jobs — while the sectoral composition shifted markedly toward knowledge-intensive and service-oriented activities. The sharpest gains occurred in education and health services (10% to 14%) and professional and business services (14% to 16%) . By contrast, manufacturing's share declined from 10% to 7%.

**Table 1. Employees on nonfarm payrolls by industry supersector in Houston Metropolitan Area 2000 vs 2025**

| | 2000 | | 2025 | |
|---|---|---|---|---|
| | Numbers in Thousands | Share | Numbers in Thousands | Share |
| Total nonfarm | 2,281.4 | 100% | 3,455.8 | 100% |
| Mining, logging, and Construction | 236.2 | 10% | 313.4 | 9% |
| Manufacturing | 232.0 | 10% | 238.5 | 7% |
| Trade, transportation, and utilities | 489.9 | 21% | 698.7 | 20% |

ISSN: 2455-8834

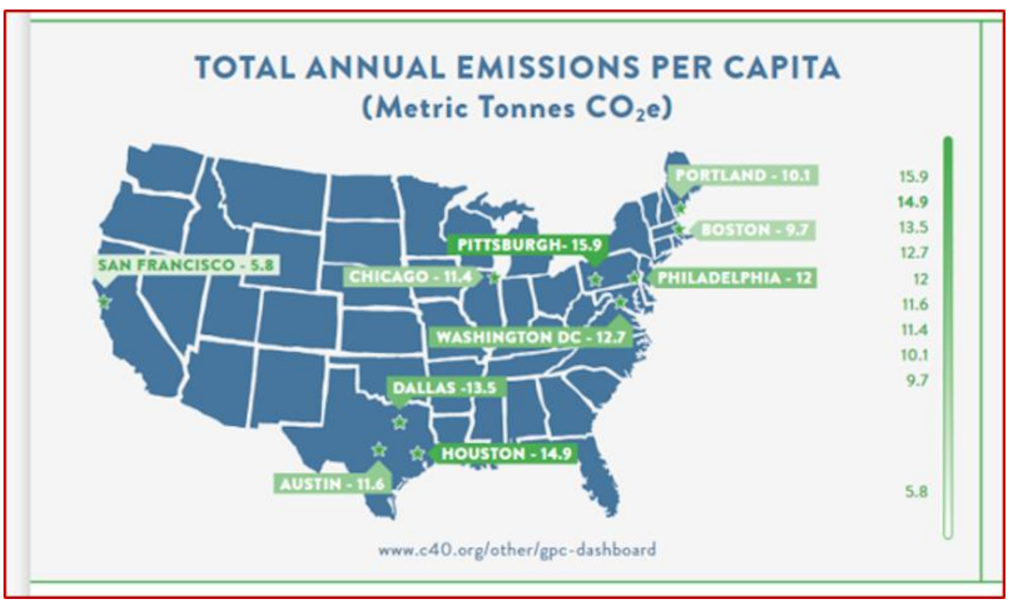
Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| Information | 48.0 | 2% | 29.2 | 1% |
| Financial activities | 133.7 | 6% | 181.1 | 5% |
| Professional and business services | 324.5 | 14% | 556.9 | 16% |
| Education and health services | 223.3 | 10% | 466.8 | 14% |
| Leisure and hospitality | 184.1 | 8% | 364.2 | 11% |
| Other services | 93.9 | 4% | 135.9 | 4% |
| Government | 315.8 | 14% | 471.1 | 14% |

*Source: U.S. Bureau of Labor Statistics*

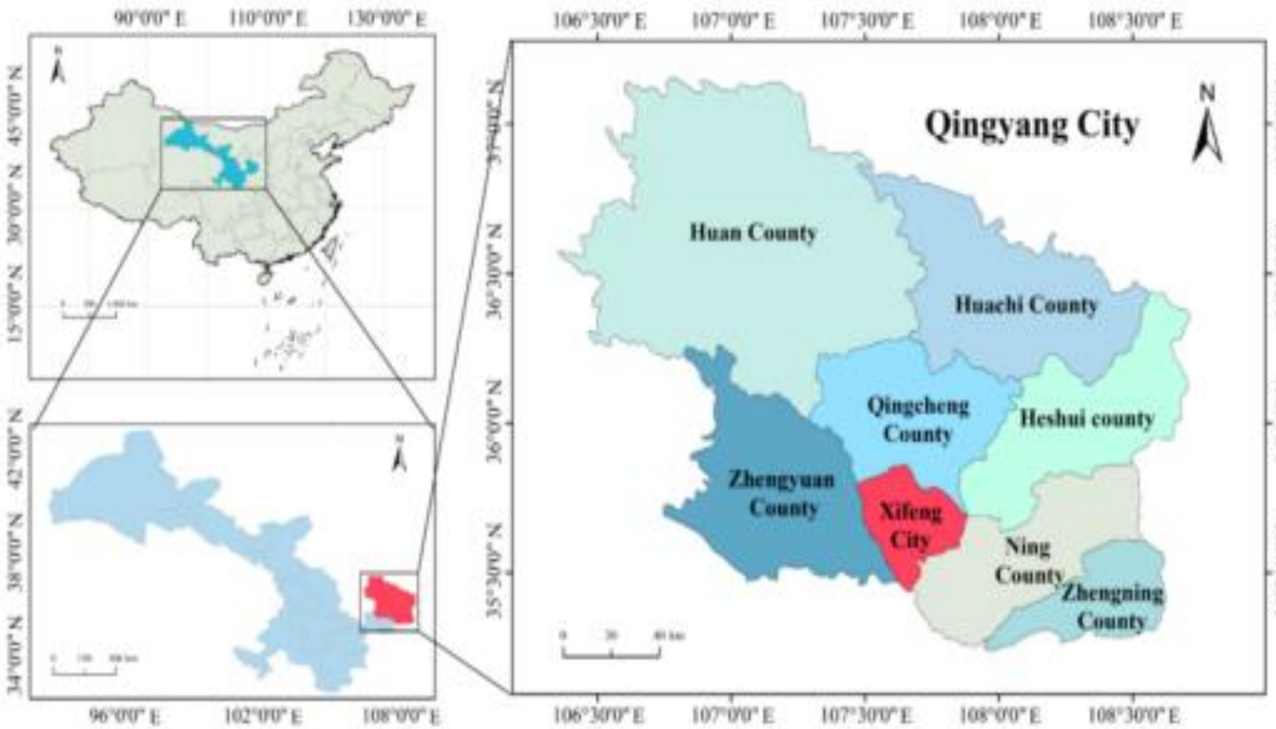
Overall, Houston represents a market-driven, bottom-up model of urban transformation characterized by adaptive diversification, technological upgrading, and institutional flexibility. Although this model has strengthened economic resilience and innovation capacity, Houston remains a major greenhouse-gas-emitting urban region, which still has one of the highest per capita greenhouse gas emissions in the country, and its transformation has been accompanied by persistent challenges related to inequality, spatial segregation, and environmental justice.

**Figure 3. Annual Emissions Per Capita of Major US Cities**



### 3.2 Qingyang, China: Policy-Driven Transformation

**Figure 4. Location of the Qingyang city in Gansu Province, China**




Qingyang is located in eastern Gansu Province on the western edge of the Loess Plateau and has long been recognized as one of China's important energy-producing regions. Historically, Qingyang developed from a revolutionary base area into a strategic national energy base following large-scale exploitation of coal, oil, and natural gas resources. As the core production area of the Changqing Oilfield—one of the largest onshore oilfields in China—the city's economic structure, industrial organization, and fiscal system have been deeply shaped by fossil-fuel extraction and related activities.

Despite its abundant resource endowment, Qingyang faces significant ecological and geographical constraints. The region is characterized by an arid to semi-arid continental climate, fragile loess landforms, and limited water resources. Severe soil erosion and ecological vulnerability have raised the environmental costs of industrial expansion, while these same natural conditions have constrained agricultural productivity and restricted the development of alternative industries—reinforcing Qingyang's long-term structural dependence on extractive sectors.

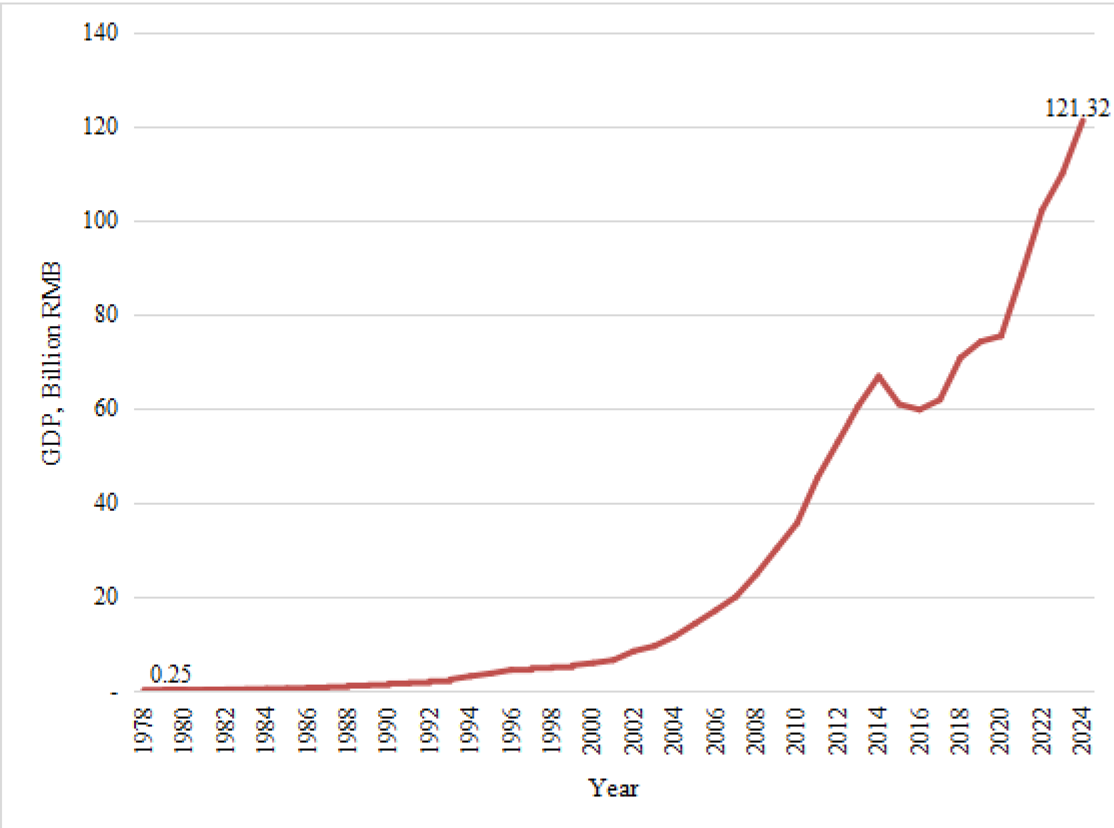
  

International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

**Figure 5. Total Gross Domestic Product of Qingyang, Billion RMB**




*Source: Qingyang Statistical Yearbook*

Figure 4 shows the trajectory of Qingyang's gross domestic product from 1978 to 2023. GDP growth was modest through the 1990s but accelerated sharply after 2000, driven almost entirely by the expansion of energy extraction. By 2024, GDP reached approximately 121 billion yuan (≈USD 17.8 billion), with a permanent population of about 2.1 million. Growth has been rapid in aggregate terms, but the underlying industrial structure remains highly concentrated: in 2021, fiscal revenues derived from energy-related industries—including oil, gas, and coal—accounted for more than 60% of total municipal fiscal income, exceeding commonly cited thresholds for resource dependence and highlighting the city's structural vulnerability to resource-market fluctuations.

Qingyang's modern industrialization began in the 1970s, when the Changqing Oilfield was incorporated into China's national energy supply system. During this period, large-scale extraction of oil, natural gas, and coal was promoted through centralized planning mechanisms aimed at ensuring national energy security and supporting regional development. State-owned

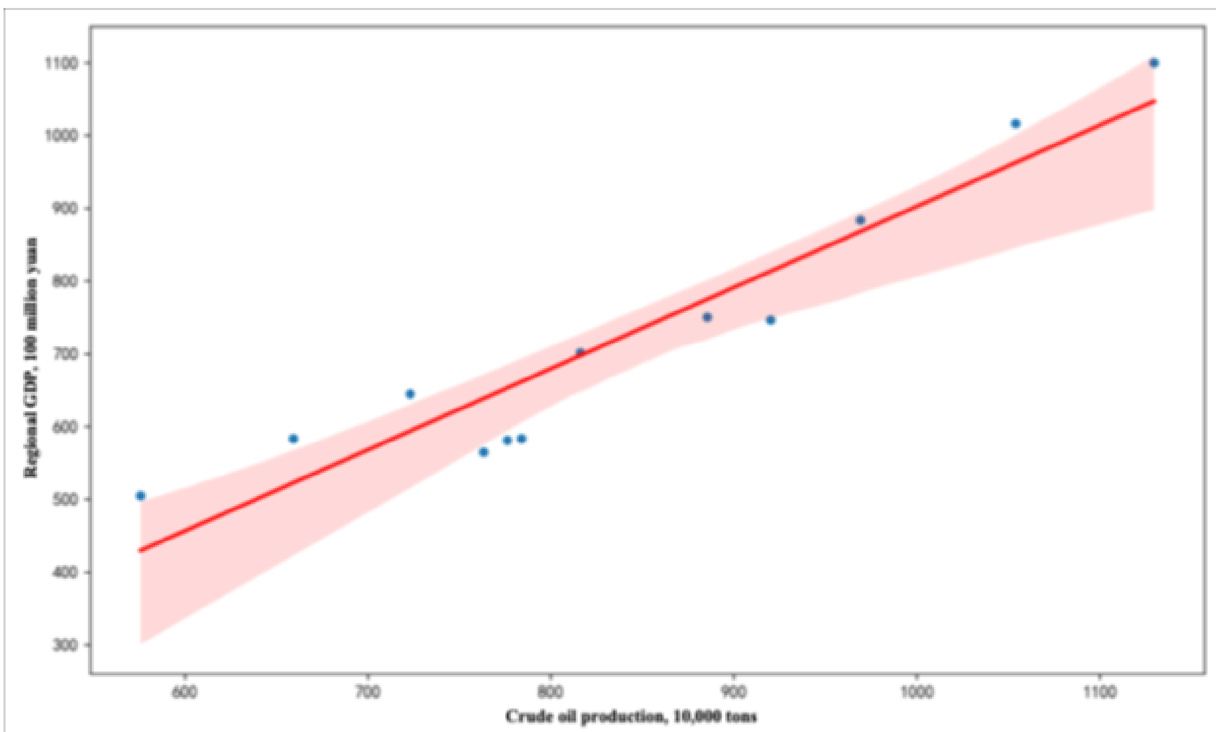
ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

enterprises played a dominant role in production, investment, and employment, while local fiscal systems became increasingly dependent on resource-related revenues.

During the 1970s through the 2000s, development was characterized by rapid growth in extractive industries, extensive infrastructure construction, and rising fiscal income from resource taxes and royalties. Energy production served as the primary engine of economic growth, but diversification remained limited. Environmental degradation intensified, and a significant portion of resource rents was transferred to higher administrative levels, constraining local reinvestment capacity.

**Figure 6. Correlation between Qingyang's Crude Oil Production and Regional GD**




Entering the 2010s, Qingyang faced growing pressures related to environmental protection, sustainable development, and economic restructuring. In 2013, Qingyang's poverty incidence rate stood at 26.58% — more than double the national average — placing it among the most economically vulnerable prefectures in western China. In response, national poverty-alleviation policies channeled substantial fiscal transfers and targeted investments into the region, financing rural infrastructure, photovoltaic poverty-alleviation programs, afforestation projects, and agricultural modernization initiatives. The Western Development Strategy complemented these efforts by expanding transport connectivity and improving market access. At the municipal level,

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

the government launched diversification initiatives in coal-chemical processing, agricultural product processing, and cultural and red tourism centered on the Nanliang Revolutionary Base. These combined interventions produced measurable results: Qingyang achieved comprehensive poverty alleviation by 2020, lifting the remaining rural poor above the national poverty line. While this outcome demonstrated the effectiveness of state-coordinated redistribution in addressing extreme deprivation, the scale of non-energy sectors remained limited and dependence on state-led investment persisted. To illustrate the strong dependence of Qingyang's economy on the energy sector, Figure 6 plots the bivariate relationship between crude-oil production and gross regional product from 2013 to 2024. The two series move closely together over the sample period, with a correlation coefficient of 0.83, consistent with a development pattern in which overall economic performance is tightly coupled to energy-sector output.

**Figure 7. Evolution of Qingyang's Industrial Structure, 1978–2023**

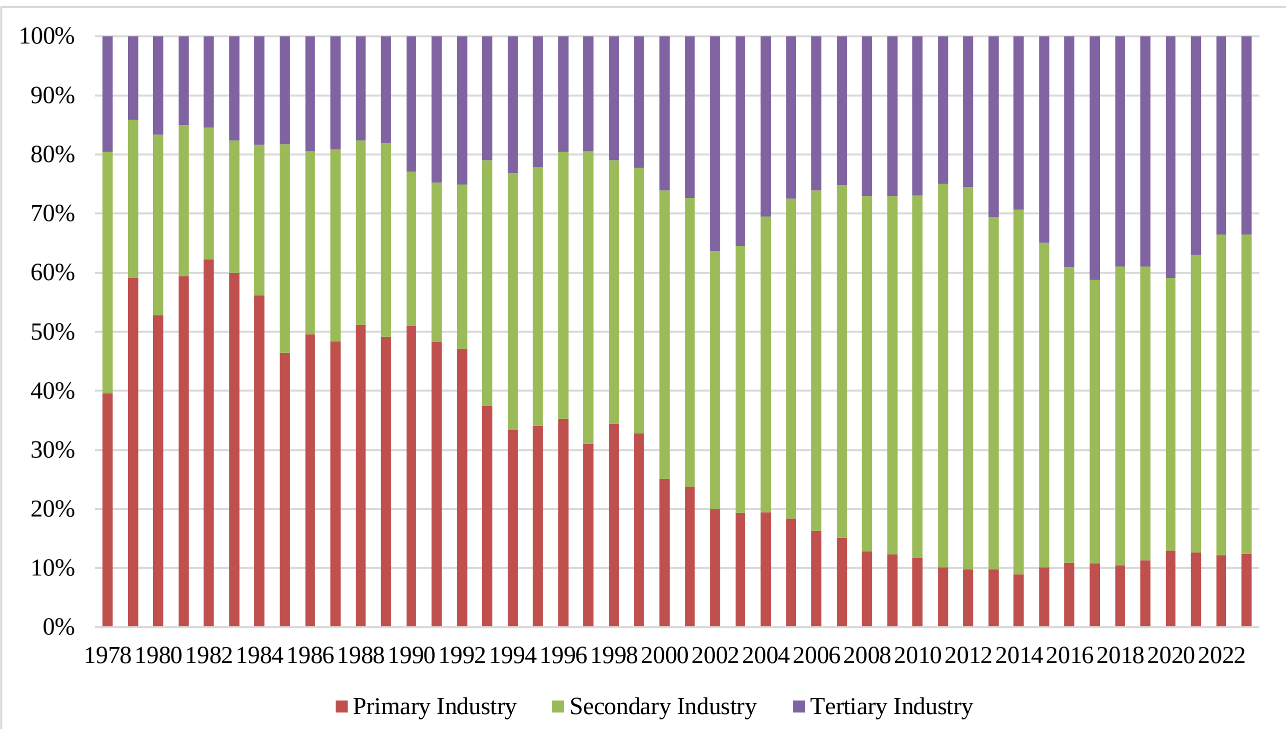



Figure 7 traces the evolution of Qingyang's industrial structure over four decades. The primary sector—dominated by agriculture—accounted for the largest share of output through the 1980s, but its relative weight declined steadily as extractive industries expanded. The secondary sector, led by oil, gas, and coal production, grew rapidly from the 1990s onward and reached its peak share in the mid-2010s before moderating slightly as national environmental regulations

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

tightened. The tertiary sector has expanded in recent years, driven largely by public-sector services and state-sponsored infrastructure investment rather than by private-sector commercial activity.

Table 2 reveals two overlapping shifts between 2004 and 2019. Total non-farm employment nearly doubled, raising its share of all employment from 34% to 54%, as agricultural workers moved into construction, services, and public administration. Within non-farm employment, the largest gains occurred in construction (9.9% to 13.2%), social services (5.7% to 12.2%), and transportation (1.9% to 5.9%), all sectors closely tied to state-funded infrastructure and poverty-alleviation programs. Wholesale and retail held steady at roughly 19%, indicating limited private commercial dynamism. These patterns suggest that Qingyang's non-farm employment growth has been driven primarily by public-sector expansion rather than market-led diversification — consistent with the city's broader policy-driven transformation model.

Following the introduction of China's dual-carbon goals, Qingyang's transformation entered a new stage emphasizing green and low-carbon development. Large-scale wind and solar projects, ultra-low-emission retrofits of coal facilities, ecological compensation mechanisms, and distributed rural photovoltaic systems have been implemented, largely financed and coordinated through central and provincial government programs. These investments have yielded measurable environmental gains: wind and solar expansion has reduced carbon intensity per unit of GDP, and ecological restoration programs have mitigated some land degradation pressures. Nevertheless, structural environmental challenges persist, including groundwater depletion and the ecological risks associated with coal-to-chemicals projects—underscoring that green transition in a resource-dependent city requires more than renewable energy deployment alone.

**Table 2. Urban and Rural Employees by Industry in Qingyang 2004 vs 2019**

| | 2004 | | | 2019 | | |
|---|---|---|---|---|---|---|
| | Thousands | Share of total | Non-farm share | Thousands | Share of total | Non-farm share |
| All employees | 1,193.5 | 100% | — | 1,411.3 | 100% | — |
| Agriculture, forestry, animal husbandry, and fishery | 788.1 | 66% | — | 650.9 | 46% | — |
| Non-farm total | 405.4 | 34% | 100% | 760.4 | 54% | 100% |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | 2004 | | | 2019 | | |
|---|---|---|---|---|---|---|
| Manufacturing | 53.9 | 5% | 13.3% | 95.1 | 7% | 12.5% |
| Construction | 40.1 | 3% | 9.9% | 100.3 | 7% | 13.2% |
| Transportation, warehousing, and postal services | 7.9 | 1% | 1.9% | 44.8 | 3% | 5.9% |
| Wholesale, retail, accommodation, and catering | 78.6 | 7% | 19.4% | 147.1 | 10% | 19.3% |
| Education, culture, sports, and entertainment | 40.9 | 3% | 10.1% | 96.7 | 7% | 12.7% |
| Social services | 23.3 | 2% | 5.7% | 92.9 | 7% | 12.2% |
| Public administration and social organizations | 23.1 | 2% | 5.7% | 81.9 | 6% | 10.8% |
| Other | 137.6 | 12% | 33.9% | 101.6 | 7% | 13.4% |

*Source: Qingyang Statistical Yearbook*

Overall, Qingyang exemplifies a policy-driven, top-down transformation model in which the state assumes primary responsibility for coordination, investment, and risk management. While this approach has ensured stability and social inclusion during the transition, it has also reinforced fiscal dependence and constrained endogenous innovation — a tension that will be examined further in the comparative analysis of Section 4.

## 4. Comparative Analysis

Drawing on the empirical evidence presented above, this section analyzes the mechanisms underlying the divergent transformation trajectories of Houston and Qingyang. The analysis is organized around three dimensions—institutions and governance structure, factor allocation, and transformation path—and in each case foregrounds the institutional mechanisms that explain observed differences in outcomes. The central argument is that cities with comparable levels of resource dependence can follow sharply divergent transformation trajectories depending on how their institutional environments shape investment, adjustment, and innovation.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

### 4.1 Institutions and Governance Structures

Institutions are a central determinant of transformation capacity in energy-dependent cities, yet their effects operate through mechanisms that differ substantially across political-economic systems. Houston operates within a decentralized and market-oriented governance system in which municipal authorities retain substantial local autonomy over land use, taxation, and economic development, while private firms serve as the primary agents of investment, innovation, and industrial adaptation. The Texas model of limited municipal government—characterized by low business taxes, minimal regulatory barriers to entry, and strong property rights—has concentrated core public functions on infrastructure provision, public safety, and other service delivery, thereby creating a relatively predictable environment for private investment. Within this framework, major firms such as ExxonMobil, Shell, Halliburton, and Schlumberger have played leading roles in industrial upgrading and technological experimentation, accounting for billions of dollars in annual R&D expenditure. Besides, public–private partnerships have supported investment in transportation, medical infrastructure, and clean-energy projects, such as the Port of Houston, the Texas Medical Center, and the Houston Climate Action Plan. The Greater Houston Partnership, a privately funded economic development organization, further illustrates how market-oriented governance can coordinate strategic vision without centralized state direction. This governance structure facilitates rapid capital mobilization, competitive innovation, and entrepreneurial risk-taking. Its principal limitation is distributional: the predominance of market incentives and the limited role of redistribution have contributed to persistent income inequality, with a Gini coefficient of larger than 0.52 in 2024, and pronounced spatial disparities between affluent west Houston and historically underserved east-side neighborhoods near the petrochemical corridor.

Qingyang, by contrast, operates within China's vertically integrated administrative system hierarchy, a system characterized by multi-level policy transmission and state-owned enterprise dominance. The central government sets broad strategic priorities, such as the dual-carbon goals, the Western Development Strategy, and national poverty-alleviation targets; the Gansu provincial government translates these priorities into sectoral plans, allocates fiscal transfers, and sets performance evaluation criteria for municipal officials; and the municipal government implements specific projects, predominantly through state-owned enterprises such as the **Changqing Oilfield,** a PetroChina subsidiary accounting for over half of industrial output, and the Qingyang Energy Group. This governance structure provides several distinct advantages: policy stability derived from five-year planning cycles, coordinated investment capacity facilitated by state control over land and capital allocation, and strong risk-management capability through fiscal transfers that averaged 7.2 billion yuan annually between 2015 and 2022—representing approximately 48 percent of total municipal fiscal resources. These transfers

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

have enabled Qingyang to undertake large-scale infrastructure construction, poverty alleviation, and ecological restoration without relying solely on volatile resource revenues. However, the same structure also limits bottom-up experimentation: private enterprises face higher barriers to entry in sectors dominated by state-owned enterprises, local officials prioritize compliance with upper-level targets over entrepreneurial initiative. In addition, the absence of competitive electoral accountability reduces responsiveness to business and citizen preferences compared with Houston's more pluralistic governance environment. Compared with Houston's market-responsive model, Qingyang's system thus trades entrepreneurial adaptability for administrative coordination and policy continuity —a trade-off that has delivered social stability at the potential cost of long-term innovation capacity.

### 4.2 Factor Allocation

Differences in factor allocation further explain the divergence between Houston and Qingyang. In Houston, capital allocation is primarily market-based and driven by private investment. Venture capital, private equity, and corporate R&D funding targeting high-technology and clean-energy sectors have supported industrial upgrading. Institutions such as the Rice University innovation hub and the Houston Angel Network connect research, entrepreneurship, and finance—attracting more than $500 million in cleantech funding between 2015 and 2022. Corporate R&D expenditure by energy and technology firms—totaling approximately $4.2 billion annually across the metropolitan area—provides a substantial endogenous funding base for industrial upgrading. This diversified capital structure, in which risk is distributed across numerous private actors rather than concentrated in state institutions, enables rapid reallocation toward emerging opportunities but also exposes the city to market-driven boom-bust cycles. In Qingyang, by contrast, capital investment depends more heavily on policy banks banks, notably the China Development Bank and the Agricultural Development Bank of China, intergovernmental fiscal transfers, and state-owned enterprise reinvestment. Between 2015 and 2022, central and provincial fiscal transfers averaged 7.2 billion yuan annually, while state-owned enterprises accounted for an estimated 65 percent of fixed-asset investment. This capital structure offers greater stability and a stronger capacity to manage risk, but it is generally less responsive to changing market signals, provides weaker incentives for entrepreneurial experimentation, and creates dependency relationships that may constrain long-term fiscal autonomy.

Labor-market dynamics exhibit a parallel divergence that reinforces the capital-allocation patterns described above. Houston benefits from global talent mobility: the metropolitan area's foreign-born population exceeds 1.4 million (approximately 23 percent of residents), creating a diverse labor pool with skills spanning energy engineering, medical research, and information technology. Strong university-to-industry pipelines—anchored by Rice University, the

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

University of Houston, and the Texas Medical Center— sustain a continuous flow of highly skilled workers, while collaborative research centers such as the Houston Energy Transition Initiative and academic–industry partnerships further help retain talent within the metropolitan economy. The resulting labor-market flexibility enables rapid sectoral reallocation: following the 1986 oil crisis, workers displaced from energy firms transitioned into healthcare, aerospace, and professional services with relative ease compared with more rigid labor markets. In contrast, Qingyang's talent system operates within a more localized and state-managed framework. The city's permanent population of 2.1 million includes a significant rural agricultural workforce with limited transferable skills, and the outmigration of educated youth to Lanzhou, Xi'an, and eastern coastal cities has created a structural talent deficit. State-managed partnerships with universities such as Xi'an Jiaotong University and Lanzhou University provide some skilled labor inflows, but Qingyang continues to face challenges in attracting and retaining skilled workers because of limited urban amenities, lower wages compared with coastal cities, and insufficient private-sector employment opportunities outside state-owned enterprises. The resulting labor-market rigidity constrains the pace of structural adjustment, as transition-dependent sectors such as technology services and advanced manufacturing require human capital that the current institutional framework struggles to produce and retain.

Technological development represents a further point of divergence that crystallizes the institutional differences between the two cities. In Houston, innovation is largely endogenous and emerges from dense interaction among firms, universities, and research institutions within a competitive ecosystem. The Houston–Corpus Christi petrochemical corridor hosts over 130 refineries and chemical plants with integrated R&D facilities, while universities and national laboratories (including Rice University, the University of Houston, and the Johnson Space Center) produce research that feeds directly into commercial applications. This ecosystem supports continuous innovation in areas such as hydrogen energy, carbon capture, utilization, and storage (CCUS), and advanced materials, creating a virtuous feedback loop between research, commercialization, and reinvestment that generates locally owned intellectual property and specialized technical expertise. Between 2015 and 2022, Houston-based firms filed over 3,800 patents in clean energy and related technologies.. In Qingyang, by contrast, technological upgrading remains more exogenously driven. The city relies heavily on technology transfers from central state-owned enterprises, particularly PetroChina's Changqing Oilfield, and external partners, with innovation typically introduced through top-down pilot programs initiated by provincial or national agencies. While this approach provides access to advanced technologies without requiring substantial local R&D investment, it also means that intellectual property, technical expertise, and decision-making authority remain concentrated in external institutions. Qingyang's municipal government reported only 681 invention patents in 2023, a figure that reflects both the limited scale of local research activity and the structural orientation of the city's

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

innovation system toward technology adoption rather than creation. Over the longer term, this exogenous innovation model may constrain local innovation autonomy and reduce the city's capacity to adapt independently to technological disruptions.

### 4.3 Transformation Paths

Both Houston and Qingyang have historically depended on extractive industries — oil in Houston and coal, oil, and gas in Qingyang — but they have taken significantly different paths in industrial restructuring, diversification, and decarbonization. Houston's trajectory exemplifies a model of adaptive diversification in which the energy sector itself becomes a platform for technological upgrading while non-energy sectors expand in parallel. Qingyang's trajectory, by contrast, represents a model of managed vertical extension in which existing energy industries are upgraded and extended along the value chain within a state-coordinated framework, while diversification into non-energy sectors remains more limited and heavily dependent on public investment.

Houston's industrial evolution reflects a deliberate move up the energy value chain combined with the strategic formation of dense industrial clusters designed to maximize knowledge exchange, logistical efficiency, and innovation spillovers. The city has pursued a high-end industrial extension strategy, repositioning itself from a primarily extractive hub to a diversified center of advanced energy technologies, petrochemical processing, and engineering services. Historically, Houston's transformation from a crude-oil production base into a global center for petrochemical processing and specialty chemicals demonstrates a classic value-added progression. The upstream segment—anchored by firms such as ExxonMobil and Shell—focuses on exploration and drilling technologies. The midstream network encompasses pipelines, storage, and refining facilities that consolidate Houston's logistical advantage along the Gulf Coast. The downstream segment has shifted toward high-value chemical derivatives, including ethylene, propylene, synthetic rubbers, and solvents, forming a complex manufacturing ecosystem. Surrounding these stages, a robust ancillary industry of engineering, equipment manufacturing, and technical consulting provides critical support, reinforcing the city's integrated industrial architecture. The Houston–Corpus Christi corridor stands as one of the largest petrochemical clusters in the world, comprising more than 130 refineries and chemical plants interconnected by a sophisticated network of highways, railways, pipelines, and port facilities. Within this cluster, research and development centers specializing in process intensification, carbon management, and alternative feedstocks provide continuous innovation inputs to industrial operations. The cluster-based model fosters economies of scale, facilitates cross-firm knowledge transfer, and sustains global competitiveness. Houston's ability to integrate logistics, technology, and capital within a geographically compact industrial ecosystem

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

exemplifies how clustering can elevate an energy-dependent economy toward high-end specialization and long-term resilience.

Qingyang has followed a different development path, focused on extending its existing coal, oil, and gas industries in order to increase local value added, stabilize fiscal revenues, and maintain employment. Its industrial strategy emphasizes vertical extension of its core energy sectors—coal, oil, and gas—rather than diversification into unrelated industries. The city has advanced coal-to-power generation through direct combustion for electricity, developed coal-to-olefins facilities producing ethylene and propylene via coal gasification, and expanded coal-chemical derivatives such as methanol, urea, and basic plastics. Additionally, PetroChina's regional refining operations anchor Qingyang's oil-processing capacity. However, most of the city's industrial upgrading remains mid- to low-end, oriented toward economic stabilization and employment retention rather than participation in high-value international markets. The industrial base therefore functions as a safety mechanism—mitigating short-term volatility while perpetuating long-term structural dependency. The declining ratio of crude-oil processing to total output suggests that downstream refining and petrochemical capacity has not kept pace with extraction. This imbalance highlights the potential for downstream value-chain enhancement, particularly in refining, petrochemicals, and fine-chemical manufacturing. In the near term, therefore, Qingyang's transformation is likely to depend on whether traditional energy industries can be upgraded toward higher-value and more technology-intensive activities.

To summarize, the comparison suggests that transformation in energy-dependent cities is shaped by the interaction of governance structure, factor allocation, and historical development path. Houston's experience shows that market-oriented institutions can support adaptive diversification and innovation, but may also generate uneven social and environmental outcomes. Qingyang's experience shows that state-led coordination can promote stability and manage transition risks, but may also constrain market responsiveness and local innovation. More broadly, the findings indicate that successful transformation depends not only on resource endowments or industrial structure, but also on the institutional capacity to coordinate adjustment, reallocate factors, and balance efficiency, stability, and inclusion under the transition.

**Table 3. Comparative Analysis Summary: Houston and Qingyang**

| **Dimension** | **Houston: Key Characteristics** | **Houston: Effects and Outcomes** | **Qingyang: Key Characteristics** | **Qingyang: Effects and Outcomes** |
|---|---|---|---|---|
| **Institutions and** | **Governance Model:** | **Positive** | **Governance** | **Positive** |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| **Governance Structures**<br><br>*(Decision-making authority, property rights, and state-market relations)* | - Decentralized federal system with strong municipal autonomy over land use, taxation, and economic development<br><br>- Texas model: low business taxes, minimal regulatory barriers, strong property rights protection<br><br>- Limited municipal government focused on infrastructure, zoning, public safety, and service delivery<br><br>**Actors and Coordination:**<br><br>- Private firms (ExxonMobil, Shell, Halliburton, Schlumberger) as primary agents of investment and innovation<br><br>- Greater Houston Partnership: privately funded economic development organization coordinating strategic vision<br><br>- Public-private partnerships for major infrastructure (Port of Houston, Texas Medical Center)<br><br>**Key Institutional Features:**<br><br>- Market incentives | **Outcomes:**<br><br>+ Rapid capital mobilization: over \$500 million in cleantech venture funding (2015-2022)<br><br>+ Adaptive diversification: oil/gas share declined from 7.7% (2014) to 3.8% (2024) of GDP<br><br>+ Global competitiveness via innovation clusters<br><br>+ Employment growth: total nonfarm jobs expanded by 1.17 million (2000-2025)<br><br>+ Knowledge-intensive sector expansion: education/health services rose from 10% to 14% of employment<br><br>**Negative Outcomes:**<br><br>- Gini coefficient of 0.52 (2024), indicating high income inequality<br><br>- Pronounced spatial disparities between affluent west Houston and | **Model:**<br><br>- Vertically integrated administrative hierarchy: central-provincial-municipal policy transmission<br><br>- Central government sets strategic priorities (dual-carbon goals, Western Development Strategy, poverty alleviation)<br><br>- Provincial government (Gansu) translates priorities into sectoral plans and allocates fiscal resources<br><br>- Municipal government implements projects through state-owned enterprises<br><br>**Actors and Coordination:**<br><br>- State-owned enterprises dominate: Changqing Oilfield (PetroChina subsidiary, over 50% of industrial output)<br><br>- Qingyang Energy Group manages local energy | **Outcomes:**<br><br>+ Comprehensive poverty alleviation: poverty incidence reduced from 26.58% (2013) to zero by 2020<br><br>+ Coordinated large-scale infrastructure construction (transport, rural development, ecological restoration)<br><br>+ Policy stability and social inclusion maintained during transition<br><br>+ Strong risk-management capacity through fiscal redistribution<br><br>+ Renewable energy capacity expansion (wind and solar) via national programs<br><br>**Negative Outcomes:**<br><br>- Limited bottom-up experimentation and entrepreneurial initiative<br><br>- Higher barriers to private-sector entry in SOE-dominated sectors<br><br>- Constrained |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| | drive competitive innovation and entrepreneurial risk-taking<br><br>- Political accountability through competitive local elections<br><br>- Openness to global capital and labor flows | underserved east-side neighborhoods<br><br>- Limited social protection and redistribution mechanisms<br><br>- Environmental justice concerns in communities near the petrochemical corridor | investments<br><br>- Five-year planning cycles provide policy stability and long-term orientation<br><br>**Key Institutional Features:**<br><br>- State control over land and capital allocation enables coordinated investment<br><br>- Fiscal transfers<br><br>- Administrative coordination prioritizes compliance with upper-level targets<br><br>- Performance evaluation based on national objective achievement rather than electoral accountability | market responsiveness: wholesale/retail employment share stagnant<br><br>- Fiscal dependency on intergovernmental transfers may pose sustainability challenges<br><br>- Potential long-term innovation deficit due to limited local R&D investment |
| **Factor Allocation**<br><br>*(Capital, labor, and technology mobilization mechanisms)* | **Capital:**<br><br>- 2,400+ venture capital and private equity firms operating in the metropolitan area<br><br>- Corporate R&D expenditure: approximately $4.2 billion annually<br><br>- Diversified financing: venture capital, corporate R&D, municipal bonds, | **Positive Outcomes:**<br><br>+ Rapid sectoral reallocation: unemployment recovered from 9% (1986) to below 5% within a decade<br><br>+ Locally owned intellectual property and specialized | **Capital:**<br><br>- Predominantly policy banks: China Development Bank, Agricultural Development Bank of China<br><br>- Intergovernmental fiscal transfers<br><br>- State-owned enterprises account | **Positive Outcomes:**<br><br>+ Greater investment stability and stronger systemic risk management<br><br>+ Access to advanced technologies without requiring substantial local R&D investment |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| | private equity<br><br>- Risk distributed across numerous private actors<br><br>**Labor:**<br><br>- Foreign-born population: 1.4 million (approximately 23% of residents)<br><br>- Global talent mobility with skills spanning energy, medical, and technology sectors<br><br>- University-industry pipelines: Rice University, University of Houston, Texas Medical Center<br><br>- Houston Energy Transition Initiative and collaborative research centers retain talent<br><br>**Technology:**<br><br>- Endogenous innovation ecosystem: firms, universities, and national laboratories interact<br><br>- 3,800+ clean-energy patents filed (2015-2022)<br><br>- Johnson Space Center, Rice University, and University of Houston feed research into commercial | technical expertise<br><br>+ Continuous innovation in hydrogen, CCUS, and advanced materials<br><br>+ Flexible labor market enables workers to transition across energy, healthcare, and technology sectors<br><br>**Negative Outcomes:**<br><br>- Vulnerability to market-driven boom-bust cycles<br><br>- Second plateau in income growth after 2015-16 oil-price correction<br><br>- Distributional costs: market flexibility benefits high-skill workers more than low-skill workers | for approximately 65% of fixed-asset investment<br><br>- Limited private capital and venture financing channels<br><br>**Labor:**<br><br>- Permanent population: 2.1 million with significant rural agricultural workforce<br><br>- Structural outmigration of educated youth to Lanzhou, Xi'an, and coastal cities<br><br>- State-managed university partnerships (Xi'an Jiaotong, Lanzhou University) provide limited skilled inflows<br><br>- Limited urban amenities and lower wages compared with coastal cities<br><br>**Technology:**<br><br>- Exogenous technology transfer via PetroChina's Changqing Oilfield and external partners<br><br>- Innovation introduced through top-down pilot | + State-coordinated human capital development through targeted education partnerships<br><br>**Negative Outcomes:**<br><br>- Weak responsiveness to changing market signals<br><br>- Labor-market rigidity constrains pace of structural adjustment<br><br>- Intellectual property and technical expertise remain concentrated in external institutions<br><br>- Dependency on higher-level policy support may reduce long-term fiscal autonomy<br><br>- Brain drain to larger cities limits local innovation capacity |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| | applications<br><br>- Virtuous feedback loop: research to commercialization to reinvestment | | programs<br><br>- Only 681 invention patents reported in 2023<br><br>- Technology adoption orientation rather than creation | |
| **Transformation Paths**<br><br>*(Industrial restructuring, diversification, and decarbonization trajectories)* | **Model: Adaptive Diversification**<br><br>- Energy sector becomes platform for technological upgrading while non-energy sectors expand in parallel<br><br>- Oil and gas extraction share: declined from 7.7% (2014) to 3.7% (2023) of local GDP<br><br>- Cluster-based industrial model: Houston-Corpus Christi corridor with 130+ refineries/chemical plants<br><br>- Integrated upstream (exploration), midstream (pipelines/storage), and downstream (specialty chemicals) value chain<br><br>- Houston Climate Action Plan (2020): carbon neutrality by 2050<br><br>- Initiatives in hydrogen energy, CCUS, renewable | **Positive Outcomes:**<br><br>+ High-end specialization and sustained global competitiveness<br><br>+ Long-term economic resilience despite energy-market volatility<br><br>+ Per capita income growth: \$3,877 (1969) to \$72,453 (2023)<br><br>+ Knowledge-intensive employment growth reducing resource dependence<br><br>+ Legacy energy assets repositioned within low-carbon value chains<br><br>**Negative Outcomes:**<br><br>- Continued greenhouse gas emissions from petrochemical | **Model: Managed Vertical Extension**<br><br>- Existing energy industries upgraded and extended along the value chain within state-coordinated framework<br><br>- Diversification into non-energy sectors remains limited and heavily dependent on public investment<br><br>- Coal-to-power generation through direct combustion for electricity<br><br>- Coal-to-olefins facilities producing ethylene and propylene via coal gasification<br><br>- Coal-chemical derivatives: methanol, urea, basic plastics<br><br>- PetroChina regional refining operations anchor | **Positive Outcomes:**<br><br>+ Short-term economic stabilization during transition<br><br>+ Employment retention in core energy sectors<br><br>+ Reduced carbon intensity per unit of GDP through renewable expansion<br><br>+ Poverty alleviation achieved through state-coordinated programs<br><br>+ Ecological restoration programs mitigated land degradation<br><br>**Negative Outcomes:**<br><br>- Mid-to-low-end value chain position in most industrial upgrading |

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

| | | | | |
|---|---|---|---|---|
| | power, and climate-resilient infrastructure<br><br>**Sectoral Shifts (2000-2025):**<br><br>- Education/health: 10% to 14% of employment<br><br>- Professional/business services: 14% to 16%<br><br>- Manufacturing: 10% to 7%<br><br>- Total employment growth: +1.17 million jobs | operations<br><br>- Environmental justice concerns in communities near industrial facilities<br><br>- Persistent sensitivity to energy prices: visible income plateau after 2015-16 correction | oil-processing capacity<br><br>- Renewable energy (wind/solar) deployed through central-provincial government programs<br><br>- Positioned as dual-carbon pilot zone under national strategy<br><br>**Sectoral Shifts (1978-2023):**<br><br>- Primary sector: 45% to approximately 8%<br><br>- Secondary sector: peaked at 58% (mid-2010s), moderated to ~52%<br><br>- Tertiary sector: 20% to approximately 40% (driven by public services) | - Perpetuated long-term structural dependency on fossil fuels<br><br>- Limited private commercial dynamism: wholesale/retail share stagnant at ~19%<br><br>- Crude-oil processing ratio declining relative to extraction<br><br>- Groundwater depletion and ecological risks from coal-to-chemicals projects |

*Note: Positive outcomes marked with + (blue); negative outcomes marked with* **-** *(red). CCUS = carbon capture, utilization, and storage; SOE = state-owned enterprise; VC/PE = venture capital/private equity. Source: Author compilation based on U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, Qingyang Statistical Yearbook, and policy documents.*

## 5. Policy Implications

The comparison between Houston and Qingyang yields several policy implications for the transformation of energy-dependent cities under the global energy transition. Although the two cities operate in very different institutional settings, both face common challenges associated with resource dependence, structural rigidity, and the need to reconcile economic adjustment with environmental sustainability.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

First, transformation strategies need to be aligned with institutional context rather than imported from fundamentally different political-economic systems. Houston’s experience suggests that market-oriented systems can support gradual diversification through private investment and technological innovation. However, this model requires preexisting conditions—including liquid capital markets, strong property rights enforcement, and capable local governance—that may not obtain in less developed institutional environments. Even where these conditions exist, market-driven transitions generate uneven social and environmental outcomes, indicating the need for complementary policies in areas such as workforce retraining ,social protection, and environmental justice. Houston's high Gini coefficient and persistent spatial disparities between affluent and industrial-zone neighborhoods illustrate these distributional costs. Qingyang, by contrast, demonstrates that state-led coordination can achieve stability, reduce poverty, and initiate green transition projects in regions with limited market capacity, but creates dependence on public investment and constrain endogenous innovation if not paired with deliberate efforts to expand private-sector participation. For cities operating in state-led systems, an important policy priority is to build local institutional capacity incrementally—creating technology transfer offices, incubators, and public-private partnership frameworks that can bridge the gap between state coordination and market dynamism. The key insight is that institutional adaptation must proceed from existing arrangements; attempting to transplant market mechanisms into systems without supporting institutions, or to impose state coordination where private actors already drive investment, is likely to produce suboptimal outcomes.

Second, factor allocations are important in shaping transformation outcomes, and proactive investment in factor mobility infrastructure yields higher returns than reactive crisis management. Houston’s adjustment has been supported by relatively free labor markets, diversified financing channels spanning venture capital, corporate R&D, and municipal bonds, and an innovation system that links over 40 colleges and universities with industry through collaborative research centers and technology transfer offices. Qingyang's experience illustrates the costs of factor immobility: when capital flows primarily through policy banks and state-owned enterprises, and when skilled talent migrates to larger cities rather than remaining locally, the pace and scope of structural change are constrained even when policy intentions are ambitious. This points to a specific and often underemphasized priority: investing in labor mobility infrastructure (such as affordable housing, transportation networks, credential recognition systems), workforce retraining systems, and diversified financing channels (such as local development banks, venture capital incentives, public-private partnership frameworks) before — not after — transition pressures intensify. Cities that wait until resource depletion or price collapse forces adjustment often find that their limited institutional capacity is overwhelmed by simultaneous demands for fiscal stabilization, employment creation, and social protection.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

Third, transformation should be understood as a staged, context-specific process rather than a linear or uniform one. The comparative evidence suggests a three-stage framework: in Stage 1 (resource dependence with limited diversification), cities such as Qingyang should prioritize building basic institutional capacity, investing in human capital through education and training, and establishing vertical extensions of existing energy industries to increase local value capture; in Stage 2 (partial diversification with established non-energy sectors), cities should deepen university-industry linkages, expand innovation ecosystems, and develop complementary service sectors around existing industrial strengths; in Stage 3 (advanced diversification with integrated green transition), cities such as Houston should focus on positioning legacy energy industries within decarbonizing value chains—through hydrogen, CCUS, and renewable integration—while managing the social and environmental legacies of fossil-fuel dependence. Recognizing these differences can improve the effectiveness of policy interventions and reduce transition risks. Successful transformations rarely involve a complete or abrupt abandonment of the energy sector. Instead, effective strategies tend to emphasize gradual restructuring that builds on existing industrial capabilities while reducing excessive reliance on a single resource. Energy-dependent cities that recognize the continued relevance of their legacy industries—while actively repositioning them within evolving value chains—are better able to manage transition risks and maintain economic stability. Therefore, diversification should be approached as a long-term, staged process rather than a short-term policy objective. Cities that attempt rapid diversification without sufficient institutional capacity, labor readiness, or market demand may encounter implementation bottlenecks and social resistance. Aligning diversification strategies with local development stages and factor endowments is therefore critical.

Finally, economic transformation must be coupled with proactive social and environmental governance from the outset, not treated as an afterthought to be addressed once economic restructuring is complete. Energy-dependent cities frequently face heightened social risks during transition, including employment displacement, (Houston lost over 200,000 jobs during the 1986 oil crisis; Qingyang's state-owned enterprise restructuring displaced thousands of workers in the 2010s), fiscal stress when resource revenues decline before alternative tax bases mature, and uneven spatial impacts as investment concentrates in new growth areas while legacy industrial neighborhoods experience disinvestment. Policies that integrate workforce retraining (such as Houston's community college partnerships with energy firms for skills transfer), social protection (such as Qingyang's targeted poverty alleviation and rural development programs), and environmental remediation (including soil restoration, groundwater protection, and air quality improvement) into transformation strategies from the initial design phase can help mitigate these risks, sustain public support for transition policies, and ensure that the benefits of transformation are distributed more equitably across populations and geographies. This integrated approach is particularly critical for cities where energy industries have long served as

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

the backbone of employment and public finance, as the political sustainability of transition policies depends on demonstrating tangible benefits to affected communities.

## 6. Conclusion

This paper has examined the transformation of energy-dependent cities through a comparative analysis of Houston, United States and Qingyang, China—two cities sharing deep fossil-fuel dependence but embedded in sharply different political-economic systems. Drawing on the literature on resource dependence, path dependence, and industrial transformation, it has analyzed how governance structures and development policies influence economic transformations.

The analysis shows that Houston and Qingyang have followed distinct transformation pathways shaped by their institutional environmentspathways. Houston's market-driven trajectory is characterized by diversification, technological upgrading, and the gradual expansion of higher-value activities within and beyond the energy sector. Institutional flexibility, private investment, and a relatively dynamic innovation system have enabled the city to adapt to external shocks while repositioning parts of its industrial base within the low-carbon transition. Qingyang, by contrast, has followed a more policy-driven and state-coordinated path. Its transformation has relied more heavily on administrative planning, fiscal transfers, and state-owned enterprises. This approach has successfully promoted national development goals—reducing poverty incidence from 26.58 percent in 2013 to zero by 2020, expanding renewable energy capacity, and improving ecological conditions—but has also constrained market responsiveness, limited local innovation autonomy, and created fiscal dependencies that may pose sustainability challenges as national fiscal conditions evolve.

The broader theoretical implication is that resource dependence is not a fixed condition but one whose economic and social consequences are fundamentally mediated by institutions operating at multiple scales. The comparison of Houston and Qingyang demonstrates that governance architecture—encompassing the organization of decision-making authority, the allocation of property rights, the structure of capital markets, and the design of labor-market institutions—shapes not only whether resource-dependent cities diversify, but also how they diversify, who benefits from transformation, and how transition risks are distributed across populations. Resource-based cities do not follow a single or uniform path of transition. Instead, their development trajectories depend on how institutions shape investment, labor adjustment, industrial upgrading, and the management of transition risks. There is no universal transformation model applicable to all energy-dependent cities. Market-driven and policy-driven approaches each entail trade-offs. Rather than replicating specific policy instruments, energy-dependent cities may benefit more from adapting underlying principles—such as staged

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

transition planning that matches policy tools to development stages, proactive factor reallocation that builds mobility infrastructure before crises occur, and coordinated governance that balances market dynamism with social protection—to their own institutional starting conditions.

This study has several limitations that suggest directions for future research. First, the focus on two case cities, while enabling deep within-case analysis, necessarily limits the generalizability of findings to the broader population of energy-dependent cities. . Second, differences in data availability and statistical definitions limit the comparability of some city-level indicators. Third, as a comparative case study, the analysis is better suited to identifying mechanisms than to establishing broadly generalizable causal effects. Future research could extend this framework to additional cases — such as resource-dependent cities in Russia, the Middle East, or sub-Saharan Africa and examine whether the institutional mechanisms identified here operate similarly across different political-economic contexts. In addition, the research could extend to quantitative cross-national analyses using institutional quality indices and transformation outcome metrics, and process-tracing studies that examine how specific policy interventions propagate through local institutional structures to produce observed outcomes.

As global efforts to decarbonize accelerate—with the International Energy Agency projecting that fossil-fuel demand will peak before 2030 under stated policies scenarios, energy-dependent cities will increasingly face pressures to restructure their economies and governance systems. The experiences of Houston and Qingyang suggest that this challenge cannot be met through technological solutions alone. Institutional adaptation, policy coordination, and context-sensitive strategy are equally necessary — and in many cases more difficult to achieve. How cities navigate that combination will be among the most consequential urban governance questions of the coming decades.

## References

Arthur W B. Competing technologies, increasing returns, and lock-in by historical events[J]. The economic journal, 1989, 99(394): 116-131.

Auty R M. Industrial policy reform in six large newly industrializing countries: The resource curse thesis[J]. World development, 1994, 22(1): 11-26.

Bresser-Pereira, L. C. (2020). Neutralizing the Dutch disease. Journal of Post Keynesian Economics, 43(2), 298–316.

David P A. Clio and the Economics of QWERTY[J]. The American economic review, 1985, 75(2): 332-337.

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

Galgóczi, B. (2014). The long and winding road from black to green: Decades of structural change in the Ruhr region. *International Journal of Labour Research*, *6*(2), 217–240.

Gort, M., & Klepper, S. (1982). Time paths in the diffusion of product innovations. *The Economic Journal*, *92*(367), 630–653.

Jiang, L., & Wang, X. (2025). Reflections on technology empowerment for the development of the energy and chemical industry: A survey study based on Qingyang City, Gansu Province. *Gansu Science and Technology Horizons, 54*(1), 50–57.

Kansheba, J. M. P., & Marobhe, M. I. (2022). Institutional quality and resource-based economic sustainability: The mediation effects of resource governance. *SN Business & Economics*, *2*(2), 19. https://doi.org/10.1007/s43546-021-00195-x

Klepper, S. (1997). Industry life cycles. *Industrial and Corporate Change*, *6*(1), 145–182.

Li, X., & Wang, S. (2023). Reflections on the high-quality development of Qingyang's energy industry. *Cooperative Economy and Science & Technology, 2023*(13), 24–25.

Liu, X., Pei, T., Zhou, C., Du, Y., Ma, T., Xie, C., & Xu, J. (2018). A systems dynamic model of a coal-based city with multiple adaptive scenarios: A case study of Ordos, China. *Science China Earth Sciences*, *61*(3), 302–316.

Lu, C., Wang, D., Meng, P., Yang, J., Pang, M., & Wang, L. (2018). Research on resource curse effect of resource-dependent cities: Case study of Qingyang, Jinchang and Baiyin in China. Sustainability, 11(1), 91.

Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of Economic Geography*, *6*(4), 395–437.

Mehlum H, Moene K, Torvik R. Cursed by resources or institutions?[J]. World Economy, 2006, 29(8): 1117-1131.

Melosi, M. V., & Pratt, J. A. (Eds.). (2007). *Energy metropolis: An environmental history of Houston and the Gulf Coast* (Vol. 66). University of Pittsburgh Press.

Peltoniemi, M. (2011). Reviewing industry life-cycle theory: Avenues for future research. *International Journal of Management Reviews*, *13*(4), 349–375. https://doi.org/10.1111/j.1468-2370.2010.00295.x

Ross, M. L. (2015). What have we learned about the resource curse? *Annual Review of Political Science*, *18*(1), 239–259. https://doi.org/10.1146/annurev-polisci-052213-040359

ISSN: 2455-8834

Volume:11, Issue:08 "August 2026"

Sachs, J. D., & Warner, A. M. (1995). *Natural resource abundance and economic growth* (NBER Working Paper No. 5398). National Bureau of Economic Research.

Vojnovic, I. (2003). Governance in Houston: Growth theories and urban pressures. Journal of Urban Affairs, 25(5), 589–624. https://doi.org/10.1111/j.1467-9906.2003.00004.x