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Legal Strategies for Green Development in Iran's Oil Sector: Sustainable Management of Associated Petroleum Gas

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Abstract

Associated petroleum gas (APG) management presents a major environmental, economic, and legal challenge for oil-producing nations. As a byproduct of crude oil extraction, APG is frequently flared or vented, causing extensive greenhouse gas emissions, energy waste, and regional air pollution. Iran, despite its vast hydrocarbon reserves, flares around 17 billion m^3 of APG annually—equivalent to 70 million tons of CO_2 emissions—constituting roughly 40 percent of national methane output. The Amak project, launched to curb this practice through technological modernization and institutional coordination, targets a 30 percent reduction in flaring by 2030. Employing a comparative-analytical legal methodology, this study examines Iran's APG regulatory framework, assesses the Amak project's progress, and benchmarks it against exemplary experiences in Norway and Canada. The analysis identifies four interrelated deficiencies: (1) legal conflicts and gaps, notably between the Petroleum Law's production-maximization mandate (Article 22) and weakly integrated environmental statutes; (2) weak enforcement, with nominal penalties and limited regulatory access to real-time flaring data; (3) institutional fragmentation among the Ministry of Petroleum, Department of Environment, and judiciary; and (4) technological and financial constraints under international sanctions. While the Amak initiative has cut flaring by 18 percent regionally, progress remains hindered by these systemic barriers. Comparative insights highlight Norway's 95 percent flaring reduction achieved through carbon taxation (~ US$85 per ton CO_2), emission quotas, and stringent oversight, and Canada's IoT-based "FlareNet" monitoring network ensuring transparency and accountability. To achieve similar outcomes, Iran requires a holistic reform package: integrating environmental objectives within petroleum law, instituting carbon pricing mechanisms, expanding digital monitoring capabilities, strengthening inter-agency governance, and incentivizing gas-capture investment. Aligning legal, economic, and technological strategies can transform APG from a waste stream into a sustainable energy asset, advancing Iran's compliance with the Paris Agreement and its broader sustainable-development and public-health ambitions.

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Introduction

Associated petroleum gas (APG), often referred to as associated gas, is a natural byproduct of crude oil extraction. Globally, the management of APG has emerged as a critical environmental and economic concern due to its substantial contribution to greenhouse gas emissions and energy loss. According to the United Nations Environment Programme (UNEP, 2023), nearly 150 billion cubic meters of APG are flared worldwide each year, releasing immense quantities of carbon dioxide and methane—two potent greenhouse gases that intensify climate change.

As one of the world's leading oil producers, Iran faces considerable challenges in controlling APG flaring. Despite possessing some of the largest natural gas reserves globally, the country flares approximately 17 billion cubic meters of associated gas annually (UNEP, 2023). This amount equates to almost 70 million tons of CO_2-equivalent emissions and accounts for around 40% of Iran's total methane emissions (Iranian Ministry of Petroleum, 2022). The environmental, economic, and social repercussions of this practice are far-reaching, encompassing air pollution, health risks for local communities, and the loss of valuable energy resources.

This study is the first to introduce an integrated legal–economic–technological framework for APG management in Iran. The proposed framework concurrently: (i) revises Article 22 of the Petroleum Law to prioritize environmental protection, (ii) implements a phased carbon tax explicitly tied to flaring volumes, and (iii) requires real-time monitoring through IoT and satellite systems with publicly accessible data streams. In contrast to previous studies that treat these dimensions separately, this paper synthesizes them into a unified reform package designed to align national policy with Iran's commitments under the Paris Agreement.

The legal framework governing the management of associated petroleum gas (APG) in Iran remains fragmented and internally inconsistent. Article 22 of the Iranian Petroleum Law (1954, amended 2019) prioritizes crude oil production, often at the expense of environmental protection. This provision stands in conflict with environmental statutes such as the Environmental Protection and Enhancement Act (1974) and the Law on Air Pollution Control (1995), both of which mandate pollution abatement and the safeguarding of public health.

Enforcement mechanisms are also weak. Article 688 of the Islamic Penal Code imposes monetary fines for unauthorized flaring; however, these penalties are typically inadequate to deter non-compliance, and the state's monitoring capacity remains limited. The Department of Environment (DOE) lacks real-time access to flaring data, which severely hampers effective oversight (Iranian Supreme Court, 2021).

A notable attempt to address these shortcomings was the Amak Project, formally launched in 2001 by the National Iranian Oil Company (NIOC) in partnership with the Petroleum Engineering and Development Company (PEDEC). The initiative sought to capture and utilize APG from the Marun, Kupal, and Shadegan oil fields in southwestern Iran (Iranian Ministry of Petroleum, 2023). Designed in alignment with global flaring-reduction initiatives such as the World Bank's Global Gas Flaring Reduction Partnership (GGFR) (World Bank, 2022), the project aimed to eliminate routine flaring at these sites, recover up to 8.5 million cubic meters of gas per day, and redirect this recovered gas for electricity generation, petrochemical feedstock supply, and injection into oil reservoirs to boost recovery efficiency (Shafiei et al., 2021).

The project proceeded in several phases: feasibility studies and financing arrangements (2001–2004); construction and commissioning of gas-gathering infrastructure (2005–2009); and subsequent expansion with technological upgrades such as modular gas compression units and sour-gas sweetening systems (GGFR, 2022). According to the Ministry of Petroleum (2023), partial commissioning has already prevented the flaring of approximately 6 billion cubic meters of gas, thereby avoiding over 20 million tons of CO_2 emissions.

Nevertheless, significant legal and technical obstacles persist. Legally, uncertainty regarding enforcement authority between the Ministry of Petroleum and the Department of Environment has delayed the implementation of stricter flaring penalties (Kashani & Zekavatmand, 2024). On the technical front, international sanctions have constrained access to advanced gas-processing technologies, while inconsistent public funding has slowed field-wide integration (Shafiei et al., 2021). Consequently, the original target of full-scale APG recovery by 2015 has

not been achieved, prompting the integration of the Amak infrastructure into newly planned gas-gathering hubs under Iran's National APG Master Plan (Iranian Ministry of Petroleum, 2023). This study aims to:

- Critically assess the current legal framework governing APG management in Iran, identifying its systemic gaps, contradictions, and weaknesses in enforcement;
- Evaluate international best practices, particularly those of Norway and Canada, where a combination of legal innovation and technological advancement has significantly mitigated gas flaring; and
- Develop a coherent set of legal reforms and institutional strategies adapted to Iran's socio-economic and political conditions, with the overarching goal of strengthening both the enforceability and transparency of APG governance.

Literature Review

Legal Framework of Oil and Gas in Iran

The Iranian legal regime governing oil and gas operations has evolved through distinct phases that mirror the country's shifting political, economic, and environmental priorities. As noted by Kashani and Zekavatmand (2024), two principal periods can be distinguished in the development of Iran's petroleum legislation: an early phase characterized by broad, statutory regulation and a subsequent phase marked by the emergence of detailed contractual frameworks—most notably the Iran Petroleum Contracts (IPC) introduced in 2016.

The IPC model integrates features of both buy-back and production-sharing arrangements, seeking to balance the attraction of foreign investment with the preservation of national sovereignty over hydrocarbon resources. Key legal instruments underpinning this regime include the Constitution of the Islamic Republic of Iran (1979), which enshrines state ownership of natural resources and prohibits foreign economic domination (Article 43). The Petroleum Act (1987, amended 2011) confers ownership and operational authority on the Ministry of Petroleum, granting it oversight over exploration, production, and export. Complementing this, the Law on the Duties and Powers of the Ministry of Petroleum (2012) further delineates institutional responsibilities, while the Sixth Five-Year Development Plan (2017–2022) articulates strategic objectives for the sector, emphasizing environmental sustainability, operational efficiency, and technological modernization.

Environmental Regulations and Upstream Operations

Environmental considerations have gained increasing prominence in recent Iranian oil and gas legislation. A key milestone was the 2016 Cabinet Decree, which mandated comprehensive Environmental Impact Assessments (EIAs) for all upstream oil and gas activities, spanning the full project life cycle from exploration to decommissioning. Under this regulation, the National Iranian Oil Company (NIOC) and its subsidiaries are required to prepare and implement environmental management plans as a prerequisite for contract approval. The decree further introduces contractual performance bonds to guarantee compliance even in cases where direct contamination is not evident, while also permitting the incorporation of international environmental standards into contractual terms.

Despite these advances, effective enforcement remains problematic. The Department of Environment (DOE) continues to face capacity constraints in monitoring real-time emissions, and the fines prescribed under Article 688 of the Islamic Penal Code are often insufficient to deter unauthorized flaring. In addition, Article 22 of the Petroleum Law, which prioritizes production objectives, creates a persistent legal tension with environmental statutes mandating pollution reduction.

Research in Persian-language scholarship similarly underscores the potential of fiscal instruments, particularly carbon taxes and green taxation, in mitigating industrial pollution and improving energy efficiency (Feizpour et al., 2017; Forootan et al., 2016; Shakerin et al., 2019). These studies emphasize that integrating environmental fiscal mechanisms into upstream oil and gas operations could provide powerful incentives for flare-gas recovery and more sustainable resource utilization.

International Best Practices in APG Management

Comparative research identifies Norway and Canada as leading benchmarks in effective associated petroleum gas (APG) management. Norway's success is grounded in a comprehensive regulatory framework that combines a high carbon tax—approximately USD 85 per ton of CO_2—with a stringent emission-quota system and robust environmental oversight (Norwegian Petroleum Act, 1996; Environmental Protection Act, 2007). Empirical analyses confirm that the interaction of carbon taxation, quota enforcement, and advanced monitoring mechanisms has been instrumental in reducing flaring by more than 95% since the 1970s (Aasness & Nilsen, 2020).

In Canada, policy effectiveness has been reinforced by the introduction of the FlareNet system, an IoT-based real-time monitoring network that enhances regulatory transparency and ensures continuous measurement of flaring volumes (Ainley & Waverman, 2019). This framework incentivizes operators to reduce flaring and invest in gas-capture technologies while providing regulators with verifiable data for compliance assessment. Legal provisions further support this regime by authorizing regulatory agencies to impose substantial penalties for violations, thereby strengthening enforcement and public accountability (Supreme Court of Canada, 2022).

The Role of Contracts and Legal Instruments

Contracts within Iran's oil sector—particularly the Iran Petroleum Contracts (IPCs)—play a pivotal role in defining both operational parameters and environmental obligations. While these instruments preserve the constitutional principle of state ownership over natural resources, they increasingly incorporate provisions addressing environmental performance standards, liability for non-compliance, and penalty mechanisms aimed at promoting sustainable practices.

A notable development is the gradual integration of international best practices into contractual frameworks, reflecting a policy shift toward aligning Iran's upstream petroleum operations with global environmental and governance standards. This evolution marks an important institutional convergence between resource management objectives and environmental accountability in the Iranian oil industry.

Materials and Methods

This study employs a comparative-analytical legal methodology to examine the structural challenges and potential opportunities within Iran's framework for managing associated petroleum gas (APG), while identifying relevant international best practices. Norway and Canada have been selected as benchmark cases owing to their demonstrated success in minimizing gas flaring through the combined implementation of carbon taxation, advanced real-time monitoring technologies, and stringent legal enforcement mechanisms.

Research Findings

Legal Challenges in Iran's Associated Petroleum Gas Management

Iran's legal framework governing the oil and gas sector is anchored in the Constitution, the Petroleum Law, and a range of complementary environmental statutes; however, it exhibits several structural deficiencies that impede the effective management of associated petroleum gas (APG). Under Article 45 of the Constitution, all natural resources—including oil and gas—are recognized as public property subject to exclusive state administration (Legal 500, 2025). The Ministry of Petroleum, primarily through its state-owned enterprises such as the National Iranian Oil Company (NIOC), holds exclusive authority over exploration, production, and export operations (ICLG, 2025).

Despite this centralized governance, Article 22 of the Petroleum Law explicitly prioritizes the maximization of crude oil production, often at the expense of environmental protection. This mandate conflicts with the Environmental Protection and Enhancement Act (1974) and related implementing regulations, which require pollution control and the conduct of Environmental Impact Assessments (EIAs) (Legal 500, 2025). The resulting

legal tension creates a regulatory gap in which environmental obligations are subordinated to production targets, thereby contributing to the persistence of routine flaring.

Comparable challenges have been reported in other hydrocarbon-producing jurisdictions, where the pursuit of production goals has frequently undermined environmental governance. In the Middle East, weak enforcement of flaring regulations has been attributed to limited institutional capacity and overlapping administrative mandates (Parvaneh & Khalili, 2021). Comparative evidence further suggests that countries with clearer delineation of legal authority and stronger economic disincentives achieve significantly higher flare-gas recovery rates (Kryukov & Tokarev, 2022).

Domestic scholarship similarly highlights several systemic barriers—including low domestic gas and electricity prices, the absence of carbon-pricing mechanisms, and the lack of mandatory flare-gas recovery requirements—as major obstacles to achieving environmental objectives within Iran's oil sector (Tabatabaei Yazdi, 2015; Ghaderi et al., 2021).

Moreover, enforcement mechanisms remain weak. Article 688 of the Islamic Penal Code prescribes fines for unauthorized flaring; however, these penalties are insufficient to deter violations, and monitoring capacity is constrained by the Department of Environment's (DOE) limited access to real-time operational data (Kashani & Zekavatmand, 2024). The DOE's reliance on self-reporting mechanisms by oil operators further undermines transparency, oversight, and public accountability.

Institutional and Regulatory Fragmentation

Iran's institutional framework for environmental governance in the oil and gas sector remains highly fragmented, characterized by overlapping mandates among the Ministry of Petroleum, the Department of Environment (DOE), and the judiciary. This fragmentation has resulted in persistent coordination failures and blurred lines of accountability. Such deficiencies were notably evident in the Amak Project, where conflicting institutional competencies and the absence of an explicit legal authority to oversee flaring enforcement contributed to significant implementation delays (Ministry of Petroleum, 2023). Furthermore, the effectiveness of policy enforcement has been undermined by the continuing impact of international sanctions and trade restrictions, which constrain access to advanced monitoring and verification technologies essential for real-time environmental oversight (ICLG, 2025).

Comparative Analysis: Norway and Canada

Norway and Canada provide instructive comparative models, each demonstrating how the integration of legal, economic, and technological instruments can achieve effective and sustainable management of associated petroleum gas (APG).

Table 1. Comparative Legal and Institutional Dimensions of APG Management across Iran, Norway, and Canada

Aspect	Iran	Norway	Canada
Legal Priority	Oil production prioritized (Art. 22 Petroleum Law)	Environmental protection integrated with production goals (Petroleum Act 1996)	Balanced approach with environmental mandates in oil regulations
Carbon Tax	No carbon tax on flaring	$85/ton CO2 tax (Environmental Protection Act 2007)	$40/ton CO2 tax with provincial variations
Monitoring Technology	Manual, limited real-time data	Satellite and IoT-based real-time monitoring	FlareNet IoT sensor network since 2015
Enforcement	Low penalties, weak enforcement	High fines, strict enforcement, public reporting	Strong regulatory oversight, judicial enforcement
Public Participation	Limited	Legal right to sue, transparency laws	Mobile reporting platforms, community engagement

Norway's remarkable achievement—reducing gas flaring by more than 95 percent since the 1970s—has been primarily driven by the introduction of a comprehensive carbon taxation regime combined with a robust legal and

monitoring infrastructure established under the Norwegian Petroleum Act (1996). In parallel, Canada's FlareNet initiative demonstrates how the integration of real-time digital monitoring systems with enforceable legal sanctions can substantially strengthen regulatory compliance and transparency across the oil and gas sector (Supreme Court of Canada, 2022).

The Amak Project: Progress and Limitations

The Amak Project, initiated in 2019, seeks to achieve a 30 percent reduction in gas flaring by 2030 through a combination of technological innovation and legal reform. Early outcomes indicate an 18 percent decline in flaring within the designated project zone over a two-year period (Ministry of Petroleum, 2023). Nonetheless, persistent legal ambiguities, particularly concerning institutional enforcement authority and the scope of applicable penalties, have hindered further progress.

The project also underscores the urgent need for enhanced inter-agency coordination and the integration of economic instruments, such as carbon-pricing mechanisms, which remain absent from Iran's current legal and fiscal architecture.

Overall, the analysis demonstrates that Iran's legal and institutional framework governing associated petroleum gas (APG) management requires substantive structural reform to converge with international best practices. The continued primacy of production objectives over environmental imperatives, combined with weak enforcement capacity and the absence of real-time technological monitoring, constitutes the principal barrier to achieving effective, sustainable APG governance.

Discussion and Conclusion

The findings reveal a complex and fragmented legal–institutional landscape governing the management of associated petroleum gas (APG) in Iran, characterized by conflicting policy priorities and persistent enforcement deficiencies. The enduring primacy of oil production, institutionalized under Article 22 of the Petroleum Law, routinely supersedes environmental protection mandates, thereby constituting a systemic obstacle to the reduction of gas flaring. This structural imbalance is further exacerbated by weak enforcement capacity, insufficient penalty frameworks, and limited access to advanced monitoring technologies, all of which undermine the overall effectiveness of regulatory mechanisms.

The Amak Project's partial achievements demonstrate that technological modernization and institutional coordination can produce measurable reductions in flaring. Supporting this observation, a recent Iranian study on natural resource governance found that integrated institutional coordination and strengthened environmental governance substantially enhance policy coherence across environmental sectors (Faraji Sabokbar, Tahmasi, & Jamshidi, 2022). Yet, the project's limitations highlight the imperative for comprehensive legal reform and the adoption of economic instruments capable of sustaining and scaling these gains.

International experience, particularly from Norway and Canada, underscores the effectiveness of combining carbon-taxation schemes, real-time monitoring technologies, and explicit legal mandates to align economic activities with environmental objectives. The successful incorporation of carbon-pricing mechanisms into petroleum legislation in multiple jurisdictions demonstrates that such measures can be simultaneously environmentally sound and economically viable. For instance, embedding carbon tax provisions within sector-specific petroleum laws has incentivized flaring reduction while generating revenue for technological innovation and infrastructure upgrading (Ozawa & Takahashi, 2021).

Beyond fiscal policy, aligning petroleum legislation with sustainability principles through explicit statutory mandates—as evidenced in several emerging economies—has proven effective in reconciling production imperatives with broader environmental stewardship objectives (Stevenson & Verma, 2020). Comparable perspectives have also emerged in Persian-language environmental and legal scholarship, advocating the integration of carbon taxation, technology-transfer mechanisms, and local-content requirements for

flare-reduction technologies, thereby ensuring dual benefits for environmental protection and domestic industrial development (Abadi & Irani, 2020).

The absence of a carbon-pricing mechanism within Iran's regulatory architecture represents a significant structural gap in its environmental governance framework. The introduction of a carbon tax or emissions-trading scheme, modeled after Norway's USD 85-per-ton CO_2 tax or Canada's FlareNet-supported regulatory framework, could provide powerful economic incentives for oil companies to invest in gas-capture technologies and minimize routine flaring. Enhancing transparency and accountability through mandatory real-time digital monitoring would further empower both regulatory authorities and civil society to oversee operator compliance and environmental performance.

Consistent evidence from domestic research on environmental management in the gas sector similarly suggests that active participation of local stakeholders substantially strengthens environmental accountability and policy legitimacy (Pashaei, Shateri, & Ashrafi, 2022).

At the institutional level, fragmentation remains a critical impediment. The overlapping jurisdictions of the Ministry of Petroleum, the Department of Environment (DOE), and the judiciary have produced recurring enforcement ambiguities and coordination failures. Establishing a dedicated national coordinating authority endowed with clear statutory competence, inter-agency integration mechanisms, and stakeholder representation could significantly enhance policy coherence, regulatory clarity, and the implementation efficiency of APG management initiatives.

Recommendations:

Based on the preceding analysis, the following legal and policy recommendations are proposed to enhance the management of Associated Petroleum Gas (APG) in Iran:

a) Legislative Reforms

To strengthen the regulatory foundation for environmental protection in the petroleum sector, it is proposed to amend Article 22 of the Petroleum Law to explicitly incorporate environmental protection and carbon-reduction objectives, mandating progressive, enforceable annual reductions in gas flaring volumes. The revised article should establish quantified targets, institutional accountability, and clear compliance mechanisms.

Proposed wording for the amended Article 22:

> *Article 22 – Exploration, development, and production of oil and gas resources shall be conducted in a manner that, while maximizing economic efficiency, also ensures adherence to environmental protection standards and the progressive reduction of greenhouse gas emissions. All operating entities shall implement annual flaring-reduction plans consistent with quotas determined jointly by the Ministry of Petroleum and the Department of Environment, and shall submit independently verified performance reports to the designated oversight authorities. Non-compliance or submission of inaccurate reports shall result in financial sanctions and, in severe or repeated cases, criminal liability.*

(Adapted from the *Norwegian Petroleum Act* 1996 and the *Environmental Protection Act* 2007; Aasness & Nilsen, 2020.)

In parallel, a Carbon Tax Law should be introduced to impose a levy on CO_2 emissions arising from gas flaring. Iran currently lacks a comprehensive carbon-pricing regime; while Article 38 of the Value Added Tax Law authorizes the collection of environmental levies from specific polluting industries, these measures remain limited in both scope and effectiveness. They rely heavily on operator self-reporting and lack a transparent mechanism for revenue allocation towards flaring-reduction or clean-technology programs (Ghaderi et al., 2021; Ozawa & Takahashi, 2021). The proposed tax should begin at a moderate rate—approximately USD 20 per ton of CO_2, increasing incrementally according to a pre-defined schedule. All revenues must be ring-fenced to finance environmental initiatives, technological innovation, and flare-gas recovery infrastructure within the oil and gas sector (Ministry of Petroleum, n.d.).

Moreover, penal provisions under Article 688 of the Islamic Penal Code should be strengthened through increased financial penalties and the introduction of criminal liability for repeated or gross violations of flaring regulations. Enhanced enforcement capacity is critical to deter non-compliance and reinforce environmental accountability (Islamic Republic of Iran, 1991/2003). This approach is consistent with the General Board of the Administrative Court of Justice's Ruling No. 187109 (31 August 2021), which reaffirmed the Department of Environment's authority to initiate legal proceedings against polluting entities under Article 688 (Administrative Court of Justice, 2021).

b) Institutional and Regulatory Enhancements

• Establish a National APG Management Committee comprising representatives from the Ministry of Petroleum, the Department of Environment (DOE), the judiciary, and civil-society organizations to coordinate policy formulation, enforcement, and public reporting (UNODC, 2008). The committee should operate as a multi-stakeholder governance platform, enhancing policy coherence and ensuring that environmental priorities are adequately integrated into the nation's energy strategies.

• Mandate real-time digital monitoring of flaring activities through the deployment of Internet of Things (IoT) sensors and satellite-based detection technologies, with data made accessible to both regulatory agencies and the public to strengthen transparency and accountability. The Iranian Space Agency and the Space Research Institute have already initiated pilot satellite-monitoring programs aimed at detecting methane emissions and other pollutants from oil fields—particularly those located in southern provinces (Iranian Space Agency, 2022). However, these initiatives remain research-oriented and have yet to be systematically embedded within the operational monitoring and enforcement frameworks of the Ministry of Petroleum and the DOE (Ainley & Waverman, 2019; Iranian Space Agency, 2022).

• Implement capacity-building programs for the judiciary and regulatory personnel to enhance their expertise in environmental and petroleum law enforcement. Such programs should draw upon international cooperation mechanisms and adopt proven training models developed under organizations such as the United Nations Office on Drugs and Crime (UNODC, 2008) to ensure consistent and effective application of legal standards.

c) Economic and Technological Incentives

• Introduce targeted subsidies and innovation grants for oil and gas operators that invest in gas-capture, recovery, and utilization technologies, thereby encouraging voluntary compliance that exceeds statutory requirements. These economic instruments should prioritize projects demonstrating measurable environmental performance improvements and high scalability potential within Iran's flaring-intensive regions.

• Promote public–private partnerships (PPPs) to support the domestic development and deployment of advanced monitoring technologies, including IoT-based and satellite-enhanced detection systems. Such initiatives would strengthen indigenous technological capacity and mitigate dependence on imported equipment constrained by international sanctions. The PPP model also facilitates cost sharing, risk mitigation, and knowledge transfer between governmental agencies, research institutions, and private enterprises.

• Foster community participation and accountability by creating localized reporting and feedback platforms for populations living near flaring zones. These platforms would enable the public to document environmental nuisances, enhance regulatory oversight, and reinforce social trust through transparent communication channels. Empirical evidence from green development financing studies in Iran demonstrates that managerial commitment to environmental objectives is positively correlated with both financial performance and innovation capacity (Parandi, Khosravi, & Momeni, 2023, *Journal of Green Development and Management Studies*, 2(1), 45–59).

d) Policy Implications and Future Outlook

Effective implementation of the proposed reforms requires strong political will, institutional coordination, and cross-sectoral collaboration. The government's recent emphasis on financial reform and environmental sustainability creates a favorable policy environment for advancing a new era of Associated Petroleum Gas (APG) management in Iran (Eurasia Group, 2024; Pezeshkian, 2024). Aligning national APG policies with international climate commitments would not only strengthen Iran's diplomatic standing but also improve access to green technologies and environmental financing instruments.

The Amak Project should be expanded and restructured as a pilot platform for comprehensive reform, enabling continuous monitoring, evaluation, and adaptive governance. This model could serve as the foundation for testing legislative amendments, institutional innovations, and technological deployments, offering an empirical basis for scaling successful practices across the national upstream sector. Future research should examine pathways for Iran's integration into global carbon markets and the potential to leverage international environmental finance mechanisms, including carbon credit trading and climate-aligned investment funds.

Collectively, these initiatives have the potential to transform Iran's APG management system, providing a balanced framework that reconciles economic development, environmental stewardship, and public health protection.

This study has examined the legal strategies necessary for advancing APG governance, with particular attention to the Amak Project and comparative insights from Norway and Canada. The findings reveal that Iran's current legal regime suffers from conflicting policy priorities, weak enforcement, and limited technological integration, all of which impede substantive progress in flare-gas reduction. While the Amak Project's early achievements demonstrate the feasibility of institutional and technical upgrades, sustained progress will depend on the enactment of comprehensive legal reforms. Drawing upon international best practices, this article advocates amending the Petroleum Law to embed environmental standards explicitly, introducing a phased carbon taxation mechanism, and operationalizing real-time digital monitoring systems to enhance transparency and enforcement.

Institutional coherence must further be strengthened through the creation of a National APG Management Committee, supported by capacity-building programs for judicial and regulatory personnel. These measures will address existing governance fragmentation and improve legal compliance. Complementary economic incentives and community-based reporting mechanisms can reinforce enforcement frameworks by promoting bottom-up accountability and stakeholder participation.

Adoption of these strategies is consistent with Iran's long-term environmental and economic objectives, offering a realistic pathway to reduce gas flaring by at least 30 percent by 2030. Increasing domestic scholarship also underscores the mediating role of green taxation and innovation in achieving sustainable industrial transformation (Davoudi, Rahmani, & Heidari, 2024, Journal of Green Development and Management Studies, 2(3), 95–110). Expanding the Amak Project as a pilot for integrated reform would further align Iran's policies with its obligations under the Paris Agreement (2015) and within its Nationally Determined Contributions (NDCs), which prioritize methane and CO_2 emission reductions in the energy sector (UNFCCC, 2015; Ozawa & Takahashi, 2021).

In conclusion, formulating and enforcing a multifaceted legal and institutional framework—one that balances production imperatives with environmental protection—is essential for Iran to confront the persistent challenges associated with APG management. Such a framework not only limits environmental degradation but also promotes sustainable resource utilization, technological innovation, and the long-term protection of public health.

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