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Research Article

Upstream Policy Documents Analysis for Energy Management: A Comparative Comparison with Emphasis on Iran

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ABSTRACT

Effective energy system management is essential to ensuring long-run energy security, competitiveness, and sustainability. This study conducts a comparative content analysis of upstream energy policy documents from selected developed economies—Sweden, Denmark, Finland, Switzerland, France, and Norway—and developing economies including China, Azerbaijan, Malaysia, Qatar, the UAE, Indonesia, Cyprus, Turkey, Saudi Arabia, and Oman. Using qualitative content analysis through MAXQDA (Available from maxqda.com), the study systematically codes and compares strategic orientations related to energy efficiency, institutional integration, and renewable energy transition. The results reveal that selected developed countries demonstrate greater policy coherence, binding targets, and strong institutional coordination, enabling them to achieve more successful transitions toward renewable and low-carbon systems. In contrast, selected developing countries, while possessing multiple strategic plans, face barriers such as fossil fuel dependency, financial and technological constraints, and fragmented governance.

In the case of Iran, despite the presence of numerous upstream energy documents, the absence of a unified national strategy, weak coordination among institutions, and persistent subsidy regimes have limited progress toward diversification and efficiency. The findings highlight that integrated policymaking, enhanced institutional capacity, promotion of renewable energy, and transparent monitoring mechanisms are vital for a sustainable transition. For Iran and similar economies, the priority should be to develop a comprehensive national energy strategy within an integrated governance framework that ensures accountability, verifiability, and performance-based evaluation. Structural reforms, demand-side management, and active public participation can further enhance efficiency and trust. Such an approach, informed by successful international experiences, can guide energy system reform toward greater sustainability, competitiveness, and transparency.

1. Introduction

Energy is a fundamental pillar of economic and social development, playing a central role in industrial growth, social welfare, national security, and environmental preservation. Sustainable, reliable, and affordable access to energy resources not only drives economic and industrial expansion but also underpins improvements in quality of life and the achievement of sustainable development goals (IEA, 2023a; World Bank, 2022). In the contemporary era, where climate change, environmental instability, and declining fossil fuel reserves pose significant global threats, energy policy has gained strategic importance, emerging as a key national and international priority (IPCC, 2022).

To manage energy systems and guide their development, countries formulate upstream energy policy documents. These strategic documents serve as long-term roadmaps, defining quantitative and qualitative objectives, policy instruments, legal regulations, and responsible institutions, thereby providing a coherent framework for resource management,

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efficiency enhancement, renewable energy development, and fossil fuel dependency reduction (REN21, 2023). In this sense, energy policies function not only as planning tools but also as benchmarks for evaluating national success in achieving energy security and sustainable development goals (IEA, 2021).

Experiences from developed countries demonstrate that the formulation and implementation of such policies are effective when they feature legally binding targets, clear and measurable objectives, efficient monitoring mechanisms, and robust institutional support. For instance, the European Union has established a harmonized framework for energy transition among member states through directives and regulations, promoting greenhouse gas reduction, energy efficiency, and renewable energy expansion (European Commission, 2022). In contrast, many developing countries, despite recent progress in energy planning, face challenges such as institutional weakness, financial constraints, and economic pressures stemming from fossil fuel dependence (World Bank, 2021; IRENA, 2022).

Iran, as a major holder of global oil and gas reserves, possesses significant energy potential. Nevertheless, its energy policy faces multiple challenges, including high energy consumption, extensive subsidies, heavy reliance on oil revenues, and the absence of a comprehensive national energy document integrating objectives, programs, and policies into a unified framework (World Bank, 2020). Examining international experiences can provide valuable insights for structural and institutional reforms in Iran.

This study conducts a comparative analysis of upstream energy policy documents in selected developed and developing countries. Its novelty lies in systematically comparing successful European energy transition countries - Sweden, Denmark, Finland, Switzerland, France, and Norway - with developing nations including China, Azerbaijan, Malaysia, Qatar, UAE, Indonesia, Cyprus, Turkey, Saudi Arabia, and Oman, alongside Iran [World Economic Forum, 2025]. This comparative approach illuminates differences, similarities, and common challenges, forming a basis for operational policy recommendations (REN21, 2023; IEA, 2023a). In addition, this study conducts qualitative content analysis for upstream energy documents of selected countries using MAXQDA 2022 software.

This paper is organized as follows: after the introduction in the first section, Section 2 presents the methodology. Section 3 examines energy policies of selected developing countries. Sections 4 and 5 review Iran Energy-related upstream documents. Section 6 provides a qualitative content analysis of upstream energy policy documents. Finally, in the final section, conclusions and policy implications are presented.

2. Methodology

This study adopts a qualitative policy document analysis approach to examine national energy policies of selected countries. The research is designed as a descriptive–analytical qualitative study aiming to identify and interpret the dominant themes, policy orientations, and cross-national patterns within official energy transition documents. Document analysis is widely recognized as a reliable method in political science, public policy, and energy studies because it allows researchers to systematically examine the textual content of official policy materials. To ensure transparency, rigor, and replicability, all stages of this qualitative analysis were conducted using MAXQDA, one of the most advanced tools for qualitative data management, coding, thematic extraction, and visualization. In the first stage, a comprehensive dataset of national energy policy documents was compiled. The sample included selected developed and developing countries. Each document was imported into MAXQDA in a text-compatible format, allowing full use of the software's search, coding, and visualization features. When necessary, excerpts from non-English documents were translated into English to maintain consistency during analysis.

The next phase involved open coding, where the researcher manually identified and tagged relevant concepts related to the energy transition. Every occurrence of these concepts in the texts was tagged using MAXQDA highlight and coding tools. This initial coding phase provided the foundation for deeper thematic synthesis.

The chosen methodology thus combines qualitative depth with semi-quantitative precision. MAXQDA tools allowed for the systematic organization of large textual datasets and the generation of comparative visualizations that reveal subtle variations in policy emphasis. The final outputs include thematic tables, code frequency charts, and conceptual maps illustrating the relational structure among energy transition themes. These results provide an empirical basis for identifying transferable lessons across countries and deriving policy implications for Iran sustainable energy transition.

3. Developed European Countries Strategies for Energy Transition

In recent years, energy transition in advanced European countries has emerged as one of the most significant structural transformations in public policy. Aligned with global climate objectives and the Paris Agreement, this transition not only addresses greenhouse gas emission reduction and climate change mitigation but also occupies a central role in economic performance and energy security. Policy design in these countries is based on a combination of legally binding regulations, clearly defined quantitative targets, long-run planning, technological investment, and economic instruments, which together facilitate the shift toward a low-carbon economy and a sustainable energy system (European Commission, 2021; IEA, 2023a). A distinguishing feature of these policies is the structural linkage between national objectives and the European Union regional frameworks, which, in addition to ensuring institutional coherence, enables

the simultaneous implementation of developmental and climate goals through multi-level governance (REN21, 2023).

Leading European countries, including Sweden, Denmark, Finland, Switzerland, France, and Norway, demonstrate that success in energy transition requires a combination of stringent policies, economic incentives, and technological innovation. Financial support mechanisms, such as feed-in tariffs for renewable electricity and fossil fuel taxation, have encouraged private investment in clean technologies and facilitated the expansion of renewable energy capacity. The deployment of wind, solar, and biogas power plants, along with reduced fossil fuel dependency and enhanced grid resilience, has played a critical role in carbon emission reduction (Danish Energy Agency, 2020; Swedish Energy Agency, 2021).

Energy efficiency policies also play a pivotal role. Strict regulations in the building, industrial, and transport sectors, coupled with equipment retrofitting and consumption optimization programs, have substantially reduced energy use and environmental impact. Instruments such as five-year carbon budgets and multi-year energy plans enable progress tracking and policy evaluation, enhancing transparency and accountability in energy governance (Finnish Ministry of Economic Affairs and Employment, 2022). Energy security policies including electricity storage infrastructure, early-warning systems, and consumption management protocols, have strengthened grid resilience and mitigated the risk of energy crises (European Commission, 2018).

Comparative analysis of selected European countries indicates that Sweden 2017 Climate Act provides a legally binding framework to achieve net-zero carbon by 2045 and sets a clear path for 100% renewable electricity by 2040 (Swedish Energy Agency, 2021). Denmark 2020 Climate Act commits to a 70% emission reduction by 2030 and carbon neutrality by 2050, prioritizing offshore wind energy and innovative carbon capture and storage technologies (Danish Energy Agency, 2020). Finland 2022 Climate Act mandates carbon neutrality by 2035 and implements digital emission monitoring across all sectors, linking energy transition to a knowledge-based digital economy (Finnish Ministry of Economic Affairs and Employment, 2022). Norway, leveraging hydropower and supportive transport policies, supplies over two-thirds of its energy from renewable sources and simultaneously expands the electric vehicle market through subsidies and tax incentives (Norwegian Ministry of Climate and Environment, 2021).

France, despite significant reliance on nuclear power, targets a 40% renewable energy share by 2030 and net-zero carbon by 2050 (French Ministry for Ecological Transition, 2019).

Switzerland exemplifies the integration of climate policy, energy security, and social participation. Ranked fourth globally in energy transition in 2024, it enacted the comprehensive 2050 Energy Strategy following a national referendum, operational since 2018. Embedded in the new Energiegesetz, the strategy targets reduced energy consumption, enhanced efficiency, and extensive renewable energy development, while phasing out new nuclear plants. Quantitative objectives, such as adding 5,400 GWh of renewable electricity by 2030, are central. The 2011 CO_2 Reduction Act provides the main climate policy framework, employing fossil fuel taxation and emissions trading, although a 2021 referendum to revise it failed. Additionally, the 2023 Renewable Energy Security Act, approved in the 2024 referendum, significantly increased domestic renewable generation capacity and reduced energy import dependency.

Overall, the experiences of successful European countries demonstrate that key success factors include legally binding climate legislation, empowered and independent regulatory institutions, transparency and accountability mechanisms, active private and societal participation, and strategic use of national comparative advantages.

By adopting a systemic and synergistic approach, these countries have effectively integrated energy, climate, industrial, and societal policies. Comparisons indicate that energy transition in Europe is not merely a technological or environmental process but a deeply multidimensional endeavor requiring institutional cohesion, social commitment, and sustained investment in innovation (REN21, 2023; IEA, 2023a).

Table (1) compares the energy policies of selected European countries.

4. Energy policies of selected developing countries

In recent years, developing countries—including China, Azerbaijan, Malaysia (40), Qatar (50), the United Arab Emirates, Indonesia, Cyprus, Saudi Arabia, Turkey, and Oman—have increasingly prioritized the formulation and implementation of energy strategies aimed at facilitating an energy transition. This trend has been driven by rapid population growth, rising energy demand, and the challenges posed by climate change.

The overarching objectives across these countries are largely consistent: reducing dependence on fossil fuels, strengthening energy security, increasing the share of renewable energy, and curbing carbon emissions. To achieve these goals, each country has developed an array of laws, strategic plans, and policy instruments, which, while aligned in strategic vision, differ substantially in institutional arrangements, legal enforceability, and the scale of investment in advanced energy technologies (IEA, 2023a; BP, 2024). China has expanded its renewable energy capacity significantly through legislation such as the Renewable Energy Law, the Nuclear Safety Law, the Oil and Gas Pipeline Protection Law, and amendments to the Energy Conservation Law, positioning itself as the world largest producer of solar and wind electricity. Its Five-Year Plans emphasize reducing energy intensity, expanding non-fossil and nuclear energy sources, and fostering technological innovations such as smart grids and energy storage systems (NDRC, 2016; State Council, 2014).

Table 1. Important Policies of Energy in Selected European Countries

Country	Main Climate/Energy Law	Targets	Key Policies & Instruments	Regulatory Body/Institution
Sweden (1)	Climate Act (2017)	Net-zero GHG by 2045; 100% renewable electricity by 2040; 50% improved energy efficiency by 2030	Independent Climate Policy Council; crisis preparedness plan; subsidies for renewables	Swedish Energy Agency; Climate Policy Council
Denmark (2)	Climate Act (2020)	70% GHG reduction by 2030 (1990 baseline); net-zero by 2050	Focus on offshore wind; CCS technologies; binding climate law	Danish Energy Agency
Finland (3)	Climate Act (2022)	Carbon neutrality by 2035; negative emissions after 2035	Digital monitoring of emissions; energy efficiency in buildings; R&D in clean tech	Ministry of Economic Affairs and Employment
Switzerland (4)	Energy Strategy 2050 (2018); CO_2 Act (2011); Secure Electricity Act (2023)	5400 GWh renewable electricity by 2030; phase-out of new nuclear plants; CO_2 reduction consistent with Paris Agreement	Feed-in tariffs; ban on new nuclear plants; carbon tax; public referendum approval	Federal Office of Energy
France (5)	Energy Transition Law; Multiannual Energy Plan (2015, 2019)	40% renewable share by 2030; Net-zero by 2050	Nuclear + renewables mix; carbon budgets; energy efficiency programs	CRE (Energy Regulatory Commission)
Norway (6)	Climate policies & National Transport Plan	Net-zero by 2050; 50–55% GHG reduction by 2030 (1990 baseline)	Hydropower-based system; EV subsidies; carbon tax	Ministry of Climate and Environment
EU	EU Renewable Energy Directive; Energy Efficiency Directive; Green Deal (2019)	55% GHG reduction by 2030 (1990 baseline); climate neutrality by 2050	ETS system; Renewable targets; Energy efficiency standards; Carbon border adjustment mechanism	European Commission; European Parliament

Reference: Gathered by Present Research
Numbers in parentheses (in the first column) indicate the country ranking in energy transition in 2024

While large-scale public and private investments have driven this transition, centralized policymaking and limited transparency in monitoring remain key challenges.

Azerbaijan, heavily reliant on oil and gas, entered the energy transition later but has articulated targets through its National Renewable Energy Development Strategy and State Energy Efficiency Program, aiming for 30% renewable electricity by 2030. International partnerships and the creation of green energy zones provide strategic opportunities, though institutional limitations and dependence on oil revenues have slowed progress (Ministry of Energy of Azerbaijan, 2021; Azerbaijan 2030, 2021).

Malaysia has issued multiple frameworks—including the National Energy Efficiency Action Plan (2015), the Malaysia Renewable Energy Roadmap (2021), and the National Energy Policy (2022–2040)—focusing on reducing electricity consumption, achieving over 30% renewable energy by 2025, enhancing energy efficiency, and promoting green technologies, alongside support for natural gas-based industries, biofuels, and electric vehicles.

Qatar Second National Development Strategy (2018–2022) and National Greenhouse Gas Emission Reduction Commitment (2021) emphasize energy efficiency improvements, solar energy expansion, and a 25% emissions reduction target by 2030, prioritizing industrial efficiency, gas flaring mitigation, and deployment of 800 MW of solar capacity. The UAE, through its Energy Strategy 2050 and 2023 Industrial Decarbonization Roadmap, targets a 44% increase in clean energy and a 93% reduction in industrial CO_2 emissions, with prior fuel price liberalization in 2015 contributing to energy efficiency gains.

Indonesia General National Energy Plan (2017) commits to 23% renewable energy by 2025, leveraging biofuel policies and industrial energy efficiency measures to reduce fossil fuel dependence. Cyprus, guided by EU regulations, adopted the National Climate and Energy Plan (2020), aiming for 23% renewable energy, 39% energy efficiency improvements, and 24% reductions in greenhouse gas emissions, with Net Metering and Net Billing facilitating citizen participation and rooftop solar adoption. The EastMed gas project further enhances Cyprus energy security by enabling a shift from heavy fuel oil to natural gas.

Saudi Arabia, through Vision 2030 (2016) and the National Renewable Energy Program (2017), targets 50% electricity generation from renewables by 2030, while its Energy Efficiency Program and Saudi Green Initiative promote industrial and transport efficiency, green hydrogen, and carbon capture technologies (SEEC, 2021; SGI, 2021).

Turkey, highly dependent on imported fossil fuels, has advanced energy transition policies through the National Energy and Mining Policy and the National Energy Efficiency Action Plan, emphasizing renewable and nuclear energy expansion, sectoral efficiency improvements, and infrastructure development. The independent Energy Market Regulatory Authority (EMRA) has strengthened market competitiveness, yet financial and enforcement constraints remain challenges, with policy focus on wind, solar, nuclear, and green hydrogen (World Bank, 2023).

Oman, via Oman Vision 2040 and the National Energy Strategy, has charted a long-term transition path, targeting renewable energy shares of 20% by 2030 and approximately 40% by 2040. Investments in projects such as Ibri 2 and Miraah, coupled with green hydrogen development, have positioned Oman as a regional leader in energy transition (Ministry of Energy and Minerals of Oman, 2025).

Analysis of these policies demonstrates that the core priorities of the developing countries' energy strategies include expanding renewable energy, reducing fossil fuel consumption, improving energy security, decreasing import dependence, and enhancing energy efficiency and intensity (IEA, 2023a; BP, 2024). Investments in advanced technologies—such as smart grids, energy storage, electric vehicles, and green hydrogen—

are increasingly central. Comparative evaluation shows China leading in industrial-scale investment and global renewable supply chains; Turkey prioritizing market competitiveness and energy diversification under financial constraints; Azerbaijan focusing on clean energy exports; Oman leveraging institutional reforms and foreign investment; Malaysia and Indonesia emphasizing efficiency and biofuels; Qatar and Saudi Arabia investing heavily in solar and hydrogen; the UAE targeting industrial decarbonization and market liberalization; and Cyprus following a structured EU-aligned transition.

In conclusion, energy transition in these countries functions not merely as an environmental policy but as a strategic instrument to secure energy independence, reduce foreign reliance, and enhance economic and geopolitical positioning. Success requires institutional coherence, enforceable legislation, investment in advanced technologies, and sustainable energy infrastructure development. Table (2) provides a comparative overview of energy policies in selected developing countries.

5. Iran Energy-related Upstream Documents: A Critical Review

Despite possessing vast energy resources, Iran has in recent years faced serious challenges in ensuring a sustainable energy supply. In 2023, the country total energy consumption reached 317 million tons of oil equivalent (Mtoe), reflecting an annual growth rate of 3.4 percent since 2010. Natural gas accounted for approximately 70 percent of this consumption, dominating Iran energy mix. By contrast, the combined share of other sources—nuclear, hydropower, coal, and renewables—remained below 2 percent, with oil and gas making up over 98 percent of total primary energy supply. This heavy reliance on fossil fuels places the country at considerable risk of recurring energy supply crises. To address these vulnerabilities, comprehensive reforms in energy policymaking and resource management are urgently required.

A review of Iran upstream policy documents indicates that, although a fully integrated national energy strategy has not been adopted, efforts have been made to legislate and plan at a macro level. These measures have sought to narrow the energy imbalance, improve efficiency, and gradually promote renewable energy. Nevertheless, the implementation and effectiveness of such documents have consistently been hindered by structural, financial, and institutional barriers (IEA, 2022; UNDP, 2020).

The General Policies of Article 44 of the Constitution aimed to reduce state dominance, encourage private sector participation, and stimulate competition and investment. Yet weak enforcement mechanisms and resistance from state-affiliated entities slowed privatization and, in some cases, fostered quasi-monopolies. Similarly, the General Energy Policies emphasized energy efficiency, expansion of natural gas production, and renewable development with a knowledge-based orientation. However, broad and aspirational statements, coupled with the absence of detailed operational plans, prevented their realization. For example, the Oil and Gas Vision 2025 envisaged large-scale wind, solar, and nuclear power expansion, but international sanctions, financial constraints, and technological shortcomings obstructed implementation.

The Targeted Subsidies Law and the Energy Consumption Reform Law were intended to rationalize energy pricing and reduce intensity of use. Yet rising economic pressures on households and industries, coupled with costly and partial execution, revealed flaws in resource allocation and the lack of transparent oversight. Likewise, technical directives such as National Building Regulations Chapter 19 and the General Environmental Policies—which mandated energy-efficient technologies in construction—failed due to weak enforcement, cultural resistance, and insufficient monitoring.

Although the National Energy Strategy Document and the Gas Production and Consumption Balance Plan to 1420 represent relatively comprehensive attempts at integrated planning, their focus remains overwhelmingly on oil and gas, with limited attention to carbon reduction and renewable energy. These documents suffer from overgeneralization, weak enforceability, insular perspectives, dependence on public budgets, insufficient emphasis on innovation, and the absence of an independent regulatory authority.

Policy programs in the 2020s, such as the Regulation on Removing Barriers to Renewable Power Plant Development and the National Plan for Solar Energy Systems, have aimed to create clearer investment pathways for clean energy and knowledge-based companies. Yet dependency on foreign technology, inadequate financial infrastructure, investment risk, and inter-sectoral fragmentation have curtailed their effectiveness. Likewise, resolutions of the Supreme Council of Energy and the Seventh Development Plan stress efficiency, renewable expansion, and productivity, but the absence of transparent resource allocation, clear performance indicators, time-bound targets, and institutional coordination has undermined outcomes. Overall, while Iran has produced a large number of upstream energy documents, the absence of a systemic and integrated approach remains a fundamental weakness. Each document operates in isolation—for instance, the National Energy Strategy stresses price rationalization, while the Gas Balance Document emphasizes supply security, and renewable regulations promote clean power markets. Yet fragmented responsibilities, lack of inter-agency coordination, and missing oversight mechanisms mean these policies often remain theoretical aspirations. Without an independent regulator and continuous monitoring, implementation is marred by opaque resource allocation, conflicts of interest, and delays.

In sum, Iran upstream energy policies suffer from several structural deficiencies including lack of a systemic, integrated framework linking the entire energy value chain, absence of binding legal enforcement and effective monitoring, insufficient transparency and accountability, excessive

proliferation of documents without coherent alignment, limited financial resources, sanctions, technological dependence, and managerial weaknesses.

These factors prevent Iran from seizing opportunities for an effective energy transition and efficiency improvements. Without institutional reforms including the creation of an independent regulatory authority, measurable indicators, clear timelines, transparent resource allocation, and a system-wide management approach, the country upstream energy strategies risk remaining fragmented, declarative, and largely ineffective. While key policies have emphasized increasing natural gas output, reducing energy intensity, modest diversification, promoting competitiveness, and encouraging knowledge-based innovation, the absence of coherence and structural capacity has hindered their realization. Ultimately, despite the existence of over thirty strategic documents, methodological flaws, fragmented governance, weak monitoring, financial and technological constraints, and institutional inertia have obstructed long-term energy transition goals. Only through a fundamental revision of upstream energy policy, institutional restructuring, and adoption of a systemic roadmap can Iran transform its extensive policy framework into tangible outcomes for energy security, sustainability, and efficiency. Table (3) highlights the main strengths, weaknesses, opportunities, and threats associated with Iran upstream energy-related documents.

6. Qualitative Content Analysis of Upstream Energy Policy Documents

In this section, according to the methodology, upstream documents of the selected countries (selected developed and developing countries including Iran) are examined by using MAXQDA. Firstly, as shown in the Figure (1), the frequently used words in the policy documents of selected countries indicates that terms such as energy, electricity, gas, technology, emissions, flexibility, hydrogen, demand, climate, green, policies, energy system, renewables, strategy, model, and target lie at the core of the policy discourse in these nations. These lexical clusters reflect the cognitive frameworks and differing priorities of countries along their respective energy transition pathways.

Conceptually, the words energy, electricity, gas, and oil signify their fundamental role as cornerstone categories in policy design—although they carry distinct meanings across developed and developing contexts. For instance, in developed countries, gas is mainly portrayed as a transitional fuel, whereas in developing nations it remains the central pillar of energy security and a vital source of government revenue. The word technology, from a thematic analysis perspective, reveals the linkage between policy and innovation. In the documents of advanced economies, this term often co-occurs with concepts such as innovation, digitalization, storage, and energy transmission, while in developing countries it is more commonly associated with production technologies. This distinction underscores the different levels of technological maturity and policy focus between the two groups. The high frequency of the term emissions highlights the close interconnection between energy and climate policies.

However, while climate discourse has become internalized within developed nations, it remains external and reactive in most developing contexts. The notion of flexibility represents a relatively new concept within the energy discourse: in leading countries, it usually refers to flexibility within electricity grids and energy storage, whereas in many Asian countries it tends to denote policy adaptability and resource diversification. The frequent appearance of hydrogen also clearly signals a forward-looking orientation in energy policy, particularly among industrialized countries. The term demand appears in relation to energy efficiency and consumption management, reflecting either a focus on final demand reduction or an indication of economic growth. The term climate refers to sustainability concerns or international obligations for emission mitigation. Similarly, the presence of green and renewables within the word cloud illustrates a gradual shift from purely industrial development toward sustainable growth and green investment. The term energy system embodies a holistic perspective on the structure and functioning of the energy sector. Finally, the relatively frequent occurrence of model reflects an increasing emphasis on energy modeling, scenario development, and policy analysis within national strategies.

The combined analysis of the word cloud and the code matrix browser (Table 4) highlight clear structural and conceptual contrasts among developed countries, developing countries, and Iran in their energy policy orientations. In developed countries, frequent references to terms such as renewable energy, innovation, governance, and technology reflect a coherent and future-oriented policy discourse in which environmental sustainability, technological advancement, and institutional coordination are closely intertwined. Developing countries, while emphasizing energy efficiency, security, and competitiveness, still exhibit fragmented policy focus with limited integration of innovation and governance dimensions, indicating a transitional phase between energy accessibility and transformation.

In Iran, although multiple concepts are formally present, the dispersion of key terms and weak interconnections among codes reveal the absence of a unified strategic framework, suggesting that energy policymaking remains reactive and fragmented rather than systemic and forward-looking. In other words, renewables are regarded as the main foundation for reducing dependence on fossil fuels, while innovation and technology serve as the instruments for achieving this transition, and energy governance provides the institutional framework that aligns these two dimensions.

Table 2. Energy Policies in Selected Developing Countries

Country (Transition Rank)	Main Policy Documents / Plans	Strategic Goals & Targets	Key Policies & Instruments	Major Challenges
China (17)	Renewable Energy Law; Energy Conservation Law (amendments); 14th Five-Year Plan; Energy Development Action Plans (NDRC, 2016; NEA, 2024).	Peak CO_2 before 2030; carbon neutrality by 2060; increase non-fossil share; reduce energy intensity (NDRC, 2016).	Large-scale deployment of solar & wind; feed-in mechanisms/subsidy reforms; investment in smart grids & storage; support for domestic supply chains (NEA, 2024).	Heavy coal reliance in some regions; governance centralization and limited external transparency; grid integration and curtailment issues.
Azerbaijan (38)	National Strategy for Renewable Energy Development; State Energy Efficiency Program; Azerbaijan 2030 economic vision (Ministry of Energy of Azerbaijan, 2021).	Diversify energy mix; reach ~30% renewables in electricity by 2030; increase exports of clean electricity to Europe.	Designated renewable development zones; incentives for IPP and foreign investors; regional export corridor planning (Azerbaijan 2030).	Hydrocarbon dependency; limited institutional capacity; revenue volatility and investment constraints.
Malaysia (40)	National Energy Efficiency Action Plan (2015); My RER Renewable Roadmap (2021); National Energy Policy 2022–2040; Green Technology Master Plan.	Increase renewable capacity (target scenarios to 2025/2035); reduce electricity intensity; 45% carbon intensity reduction target by 2030 (policy documents).	Energy efficiency programs, demand-side management, rooftop solar incentives, renewable procurement frameworks (SEDA, 2021).	Grid and land constraints for large renewables; need for financing mechanisms and stronger enforcement of EE measures.
Qatar (50)	Second National Development Strategy (2018–2022); Nationally Determined Contribution (NDC) 2021; sector strategies for energy & industry.	Improve energy efficiency (e.g., 10% by 2022 target in strategy); deploy utility-scale solar (planned up to 800 MW and beyond); NDC: ~25% reduction vs. BAU by 2030.	Industrial efficiency programs in oil & gas, solar projects, demand-management campaigns (Tarsheed), and gas flaring reduction measures.	High fossil-fuel export orientation; balancing economic growth with decarbonization; scaling large-scale renewables in desert conditions.
United Arab Emirates (52)	UAE Energy Strategy 2050 (2017); Industrial Decarbonisation Roadmap (COP28, 2023); progressive fuel pricing reforms.	Increase clean energy share to 44% by 2050; improve energy efficiency by 40%; ambitious industrial decarbonisation targets.	Large-scale solar (e.g., Al Dhafra); green hydrogen pilots; CCS and industrial efficiency programs; market reforms including fuel subsidy removal (2015).	Diversification from hydrocarbons; financing large clean projects; ensuring domestic workforce and supply chains for low-carbon tech.
Indonesia (54)	National Energy General Plan (Presidential Reg. No. 22/2017); Biofuel Mandates (2015); Industrial energy efficiency regulations.	Target ~23% renewables in primary energy by 2025; expand electrification and grid access; mandated biofuel blends (B15–B30 / E series).	Mandatory biofuel blending; industrial energy management requirements; incentives for renewables and rural electrification.	Balancing development needs with decarbonization, fossil fuel subsidies and pricing, regional infrastructure gaps, financing for utility-scale renewables.
Cyprus (55)	National Climate and Energy Plan 2021–2030; Net Metering / Net Billing frameworks (post-2015); EastMed gas connectivity projects.	Increase RES share to ~23% of final energy by 2030; improve energy efficiency by up to ~39% in end-use sectors; reduce non-ETS emissions.	Household and commercial rooftop solar incentives, net metering/net billing, grid upgrades and storage pilots; leveraging EU funding.	Island grid constraints, seasonal demand patterns, dependence on imports (addressed via EastMed pipeline potential).
Saudi Arabia (58)	Vision 2030 (2016); National Renewable Energy Program (2017); Saudi Green Initiative & NDC updates; SEEC energy efficiency programs.	Ambitious renewable capacity (c.50% of power from renewables by 2030 stated targets); large green hydrogen projects (NEOM), major emissions reduction pledges.	Utility-scale solar, green hydrogen industrial projects, CCS pilots, energy efficiency regulations across industry and buildings.	Scale of transition relative to hydrocarbon fiscal dependency; water-intensive technologies; need for technology transfer and financing.
Turkey (59)	National Energy and Mining Policy; National Energy Efficiency Action Plan (NEEAP); Electricity & Gas market reforms (EMRA).	Reduce import dependency, raise renewables share (wind & solar), pursue nuclear and green hydrogen development.	Liberalisation measures, renewable auctions and FITs, energy efficiency standards for buildings and industry; EMRA regulatory oversight.	High import reliance for gas and oil, macroeconomic pressures and currency volatility affecting investment costs.
Oman (62)	Oman Vision 2040; National Energy Strategy and Roadmaps; renewable power procurement regulations (e.g., Ibri 2, Miraah projects).	Raise renewables to ~20% by 2030 and ~40% by 2040; develop green hydrogen export potential; reduce gas burn in power & industry.	Direct PPAs for large consumers, renewables auctions, investment in storage and hydrogen pilots, regulatory reforms to attract FDI (Ministry of Energy Oman, 2025).	Limited domestic finance capacity, reliance on hydrocarbon revenues, need for regulatory stability and skilled labor for new industries.

Table 3. Iran upstream energy-related policy documents

Document	Strengths	Weaknesses	Opportunities	Threats
General Policies of Article 44 of the Constitution (2005)	• Encourages participation of the non-state/private sector in the energy sector • Reduction of state ownership (reduced state enterprise role) • Increase in efficiency and economic productivity • Promotion of market competition in the energy sector	• Lack of strong enforcement guarantees • Slowness in realizing genuine privatization	• Attraction of private investment into energy projects • Expansion of competitive energy markets	• Resistance by state institutions to transfer of authorities • Risk of creation of private-sector monopolies
General Policies of the System (2006)	• Emphasis on optimizing consumption and increasing natural gas production capacity • Orientation toward new and knowledge-based energy technologies • Support for development of wind, solar and nuclear power	• Policy statements are broad and non-specific (vague) • Lack of a clearly defined operational implementation plan	• Training and development of specialists in new energy technologies • Development of renewable energy and knowledge-based industries	• Shortage of technology and capital required for new energies • International challenges in the nuclear domain
Law on Targeting Subsidies (2009)	• Effort to align energy prices with real cost (price rationalization) • Reforming consumption patterns and reducing energy intensity • Allocation of part of revenues toward energy efficiency	• Increased economic pressure on households and industry • Implementation has been incomplete and costly	• Development and expansion of renewable energy	• Potential social dissatisfaction if price reforms are mismanaged • Broad inflationary impacts if not carefully managed
National Building Regulations — Chapter 19 (Energy Saving) (2010)	• Mandates the use of energy-efficient technologies in buildings • Reduces gas and electricity consumption in buildings • Emphasis on insulation, daylighting and solar energy integration	• Weak enforcement and supervision in construction projects • Low public awareness about the benefits of the regulations • Resistance from builders to upfront costs	• Growth of market for efficient and smart building equipment • Improved building energy performance	• Insufficient financial support for green building projects
Vision for the Oil & Gas Industry toward Horizon 1404 (adopted 2010)	• Sets quantitative targets for oil, gas and petrochemical production • Aims to strengthen Iran regional and global position in energy markets • Emphasis on energy diplomacy and value-added products	• Over-optimism about production capacity and global market conditions • Neglect of investment and technology constraints	• Development of higher value-added product exports (petrochemical value chain) • Diplomatic leverage through energy exports	• International sanctions and financial limitations • Intense competition in global energy markets
Energy Consumption Pattern Reform Law (2010)	• Provides a clear legal framework to reduce energy intensity • Targets optimization of fuel and equipment consumption	• Mandates are broad relative to available resources • Instability in budget allocations for implementation • Incomplete execution across many sectors	• Growth in market for low-consumption equipment and improved energy infrastructure	• Stakeholder resistance to change
Law on Continuous Improvement of the Business Environment (2011)	• Protects industries against energy interruptions • Enhances energy security for the production sector • Obligation to compensate for losses caused by electricity and gas outages	• Focus is primarily on industry with less attention to other sectors • Weak enforcement guarantees and insufficient resources for compensation mechanisms • Potential mismatches between distribution companies and industry needs	• Improvement of the overall business environment and increased investment	• Insufficient allocation of resources to implement compensation measures effectively
General Policies of Resistance Economy (2013)	• Emphasis on self-reliance, reduced dependence on oil, and promotion of gas and electricity exports • Use of sanctions as an impetus for structural reform	• Policy statements are broad and lack precise quantitative indicators • Lack of executional cohesion among implementing bodies	• Capacity building for sustainable energy exports • Enhancement of strategic energy reserves	• Lack of stable international customers for exports • Market instability under sanctions
Comprehensive National Productivity Program (2015)	• Defines sector-specific energy productivity indicators for oil, gas, electricity and water • Promotes productivity gains through technology and training	• No legal obligation for all agencies to implement the indicators • Administrative resistance to process change and weak culture of productivity in public institutions	• Emphasis on green productivity and inter-ministerial cooperation with private sector	• Weaknesses in evaluating real performance indicators

Document	Strengths	Weaknesses	Opportunities	Threats
General Environmental Policies (2015)	• Attention to clean energies, consumption pattern reform and electric transport	• Lack of sufficient binding instruments in environmental policies • Weak coordination with economic development programs	• Use of international resources to develop clean energy • Growth potential for electric transport in large cities	• Widespread pollution from fossil fuel consumption • Absence of effective mechanisms to tackle pollution from energy-intensive industries
National Energy Strategy Document (2016)	• Comprehensive design covering production, transmission, distribution and consumption • Emphasis on price realignment and efficiency improvement	• Incomplete implementation of long-term goals due to lack of resources and political backing • Accumulated debts of energy companies and weak financial infrastructure	• Attraction of investment into energy with a productivity focus • Diversification of the energy mix and increased share of clean energy	• Instability in export markets and international sanctions
Clean Air Act (2017)	• Mandates standardization of fuels and energy-consuming equipment • Expected public health improvements and lower healthcare costs	• Lack of effective monitoring and enforcement mechanisms • Weak implementation especially in large industrial sectors	• Focus on renewable energy to reduce air pollution • Development of markets for clean energy and electric vehicles	• Continued use of low-quality fossil fuels • Resistance from polluting industries against technological change
Natural Gas Production–Consumption Balance Document to Horizon 1420 (adopted 2020)	• Detailed planning for supply security and optimization of gas consumption • Policy differentiation for industry, buildings and power plants	• Insufficient financial resources for gas infrastructure development • Aging transmission and distribution infrastructure	• Development of combined-cycle and renewable power plants • Utilization of knowledge-based companies to improve consumption efficiency	• Rapid demand growth placing pressure on existing resources • Delays in implementation of program components
Resolutions of the Supreme Council of Energy (Oct, 2020)	• Emphasis on consumption optimization as the main pathway for energy development • Official recognition of financial constraints and adoption of a pragmatic approach	• Lack of specific mechanisms for implementing resolutions • Weak linkage between session decisions and long-term policy frameworks	• Potential to adopt the approach as a national roadmap for optimization • Strengthening inter-agency coordination focused on reducing energy losses	• Risk of slow implementation of reform policies due to conflicts of interest • Insufficient resources to execute effective corrective measures
National Land-Use (Spatial) Planning Document (2020)	• Emphasis on diversifying regional energy resources and optimizing local energy mixes • Development of regionally appropriate low-carbon and renewable energy solutions	• Limited executive capacity and weak inter-agency coordination at provincial level • Administrative and bureaucratic barriers to regional policy implementation	• Optimization of energy consumption in transport and industry • Investment opportunities aligned with regional climatic potentials	• Lack of funding for infrastructure rehabilitation and modernization • Risk of political favoritism in resource allocation
Law on Boosting Knowledge-Based Production (2022)	• Requires industries to supply part of their electricity from renewable sources • Supports development of clean electricity markets and energy technology firms	• Operational complexity and multiplicity of implementing agencies • Limited enforcement of Article 16 by large industries	• Financial support for small-scale plants and knowledge-based companies • Increase domestic capacity to manufacture solar equipment	• Industry resistance to new cost burdens • Risk of delays in government subsidy payments
General Policies of the Seventh Development Plan (2022)	• Focus on maximizing output from shared oil and gas fields • Attention to the energy value chain and development of new energies	• Lack of performance indicators and precise scheduling • Potential overlap with previous parallel programs	• Attract investment to improve recovery of fields and develop new energy sectors • Potential to become a regional energy trading hub	• Sanctions and restrictions on entry of technology • Coordination failures among implementing institutions
Resolutions of the Supreme Council of Energy (2023)	• Mandates consumers to reduce consumption and source part of energy from renewables • Plans to expand the market for solar and wind power plants	• Threat of energy disconnection for noncompliant customers without adequate alternative infrastructure • Risk of not meeting the resolution timelines	• Planned development of 15,000 MW of renewable capacity • Facilitation of new technologies entering power plants	• Need for substantial investment and multilateral coordination • Legal and technical challenges in implementing barter, project finance and pricing mechanisms
Regulation for Removing Obstacles to Renewable Power Plant Construction (2023)	• Facilitates land allocation and removes certain permit requirements • Enables attracting domestic and foreign investors	• Potential negative consequences if environmental assessments are not mandatory • Investment shortfalls due to perceived return-on-investment risks	• Possibility of electricity export and full investor ownership • Increase clean power capacity at lower direct government cost	• Need for multi-sector coordination in implementation • Possibility of non-compliance by implementing agencies
National Program for Development of Solar Power Systems and Production Chains (2023)	• Clear target: 8,000 MW of solar electricity generation • Support for domestic development of solar equipment	• Dependence on simultaneous progress in technology and domestic manufacturing • No clear financing pathway for production chains	• Support for local manufacture of equipment and reduction of import dependence • Potential to reduce reliance on imported technologies	• Slow growth in domestic panel and equipment manufacturing capacity • Global price volatility and sanctions affecting raw material imports
Seventh Development Plan (2024)	• Clear quantitative targets for energy production and consumption	• Targets are broad relative to limited financial resources	• Potential to correct national energy imbalances through structural reforms	• Legal and technical challenges in attracting foreign investment

Document	Strengths	Weaknesses	Opportunities	Threats
	• Emphasis on optimization, gas storage, renewables and electric transport	• Dependence on precise implementation across multiple agencies	• Development of smart systems and energy-efficiency certificates	• Risk that many objectives will not be implemented within time limits
Comprehensive Governance Document for Asset Management, Ministry of Petroleum (2024)	• Framework based on the global ISO 55001 standard for asset management • Potential to reduce failures and increase infrastructure productivity	• EAM (Enterprise Asset Management) is nascent in Iran and requires extensive training • High initial implementation costs and lack of sustainable funding for maintenance	• Data-driven management enables better decision-making • Systematization of equipment management	• Resistance from traditional staff to systemic changes • Insufficient budgetary provision for ongoing system development
Statute of the Organization for Energy Optimization and Strategic Management (2024)	• Structural focus on national-level energy optimization • Definition of broad authorities for monitoring and implementing optimization projects	• Potential overlap with existing institutions (e.g., SATBA or the Energy Consumption Optimization Company) • Delays in establishment and organizational structuring of the new body	• Facilitation of creating an energy optimization market • Integrated management of energy subsidies across sectors	• Administrative barriers and resistance from existing organizations in transferring responsibilities • Risk of failure to rapidly form an effective organizational structure

Table 4. Code matrix browser for selected countries - Reference: Present study using MAXQDA (2022)

Code System	Iran	Selected Developing Countries	Selected Developed Countries
energy efficiency			
sustainability			
security			
competitiveness			
governance			
social efficiency			
innovation and technology			
new energies			

From this perspective, developed countries demonstrate a structured and forward-looking approach in which the connection between environmental objectives, technological advancement, and implementation mechanisms is relatively well established.

In contrast, developing countries display a more fragmented pattern of codes, with limited emphasis on innovation and governance components. Although issues such as energy efficiency, security, and competitiveness are prominent in these countries, the interaction between these aspects and technology-oriented or governance-driven policies is less evident. This situation suggests that policy priorities in developing countries are more concerned with energy supply and accessibility rather than with structural transformation. In other words, their policy orientation still revolves around maintaining a balance between economic growth and supply security, while the technological transition and environmental sustainability dimensions are yet to be fully embedded in their policy frameworks. As for Iran, the coding pattern primarily reflects conceptual fragmentation and the absence of a coherent strategic framework.

While developed countries pursue the energy transition through a synergistic integration of governance and innovation dimensions, Iran policies tend to be pursued in a sectoral and ad hoc manner. Although multiple components are mentioned in official documents, the lack of a comprehensive and systematic strategy has prevented the formation of an organic interconnection among them.

7. Conclusion and Policy Implications

Energy policymaking is a cornerstone of sustainable development, shaping a nation's ability to achieve long-run energy security, economic resilience, and sustainability. The success of any energy transition depends not merely on articulating broad objectives but on the presence of coherent, transparent, and enforceable upstream policy documents aligned with national economic and environmental strategies. To explore the determinants of successful energy transitions, this study employs a comparative qualitative content analysis of upstream energy policy documents from selected countries, including developed economies—Sweden, Denmark, Finland, Switzerland, France, and Norway—and developing economies—China, Azerbaijan, Malaysia, Qatar, the UAE, Indonesia, Cyprus, Turkey, Saudi Arabia, and Oman—as well as Iran. Using MAXQDA, documents of the selected countries were systematically coded, categorized, and compared to identify structural patterns, governance mechanisms, and policy instruments underpinning effective energy strategies.

The analysis reveals that developed countries exhibit coherent institutional coordination, measurable targets, and robust monitoring frameworks, which facilitate smoother transitions toward renewable and low-carbon energy systems. These findings align with IEA reviews and empirical studies showing that operationalized roadmaps, financial incentives, and regulatory enforcement mechanisms contribute to successful policy implementation (IEA, 2023b; Galeazzi et al., 2024). Independent regulatory institutions, private sector participation, and transparent accountability procedures further strengthen governance, creating adaptive and resilient energy systems capable of responding to technological and market shifts (Marra & Colantonio, 2022; Schaffer & Levis, 2021).

In contrast, many developing economies, despite multiple strategic documents, suffer from institutional fragmentation, limited enforcement capacity, and inadequate monitoring systems. Policies often lack vertical and horizontal integration, leading to inconsistencies between declared goals and actual outcomes. These observations are supported by prior analyses of China, Turkey, and Persian Gulf countries, which highlight the role of fragmented governance and persistent fossil fuel subsidies in hindering energy transitions (Vagliasindi, 2013).

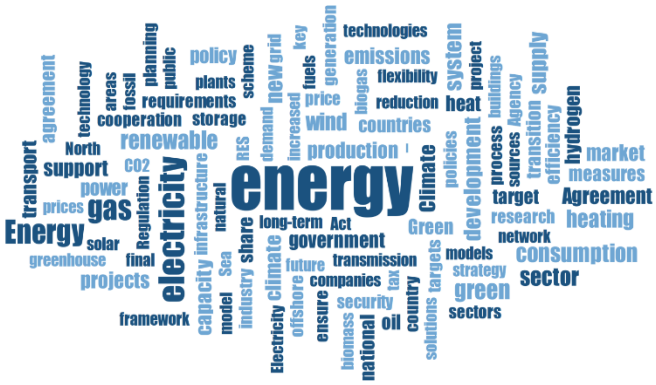

Fig. 1. Word Cloud in upstream energy documents of selected developed and developing countries
Reference: Present study using MAXQDA (2022)

For instance, although China has made substantial renewable energy investments, coordination challenges remain, consistent with findings from Chai et al. (2023). Turkey has advanced wind and solar capacities through targeted incentives, corroborating OECD/IEA reports (IEA, 2021).

Iran presents a complex case. Despite over thirty upstream policy documents, structural inefficiencies, overlapping mandates, and weak institutional coordination have impeded effective implementation. Prior studies have demonstrated that reforms such as the General Policies of Article 44, the Targeted Subsidies Law, and the Energy Consumption Reform Law had limited impact due to design flaws, high fiscal costs, and institutional resistance (Raei et al., 2024; Dehhaghi et al., 2022). Strategic plans such as the Oil and Gas Vision 2025 and the National Energy Strategy similarly fell short because of lack of systemic integration, over-optimism, and external pressures such as sanctions. Even recent initiatives like the Gas Balance Plan to 2041 continue to face fragmentation and weak monitoring. These findings are consistent with previous analyses of Iran energy governance that highlight structural and institutional barriers to policy execution (Raei et al., 2024; Dehhaghi, 2022).

Comparative results indicate that effective energy policymaking depends on coherence, enforceability, measurable indicators, and institutional transparency rather than the sheer number of strategic documents, corroborating global evidence from Europe and selected developing countries (IEA, 2024; Marra & Colantonio, 2022; Schaffer & Levis, 2021). For Iran, advancing toward a sustainable and competitive energy system requires establishing a comprehensive national energy strategy within an integrated governance framework, complemented by operational programs, binding performance indicators, periodic evaluation, and transparent reporting mechanisms. Structural reforms across economic sectors, standardization of production and service processes, demand-side management, and civil society engagement are essential to enhance efficiency, security, and legitimacy. Developing a dynamic, data-driven roadmap that links upstream documents with measurable operational outputs ensures alignment between strategy and execution. Drawing on international experiences and supported by empirical analyses, these reforms can guide Iran toward a resilient, efficient, and sustainable energy transition consistent with accountability, adaptability, and long-term national development (Galeazzi et al., 2024; Marra & Colantonio, 2022; Schaffer & Levis, 2021).

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