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Energy Security Strategy for Nepal

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Abstract

Climate change, food security, and energy security pose new economic challenges. The main causes of energy crises stem from overconsumption, inadequate infrastructure, overpopulation, and high energy demand. Urgent action is needed to prioritize the energy sector as a key development priority. Addressing three critical issues—affordability risks, electricity security, and the resilience of clean energy supply chains-is essential to ensure Energy Security for All (ESfA). All levels of government—federal, provincial, and local-as well as international organizations, must collaborate using robust policy measures to attract new investors to energy sector projects. Additionally, it is crucial to formulate and implement new strategies for energy sector development while enhancing the capacity of public institutions and business service providers involved in the energy sector.

Keywords: *Sustainable Development Goals (SDGs); Energy Security for All (ESfA); Sustainable Consumption and Production (SCPs) Practices; Power Development Agreement (PDA); Power Purchase Agreement (PPA).*

Global Energy Situation Scenario

Climate change, food security, and energy security represent significant new economic challenges today, and it is crucial that we address them collectively. Current geopolitical tensions also undermine energy security. The main causes of energy crises include overconsumption, inadequate infrastructure, overpopulation, and high energy demand. Various factors affect energy availability, encompassing physical factors, production costs, technology adoption, and political considerations. There is an urgent need to intensify efforts to increase energy production and achieve energy sufficiency for all.

Renewable energy has increasingly become an economical and viable source for ensuring energy security. Rapid development of the alternative/renewable energy sector is essential not only to diversify the energy mix and enhance energy security but also to expand energy access. Nepal's Constitution envisions a policy for reliable, affordable energy supply through alternative energy development to meet basic needs. It is imperative to promote and integrate the alternative energy sector into the development process, collaborating with provincial and local governments to improve energy service access for rural and urban populations and reduce dependence on imported energy.

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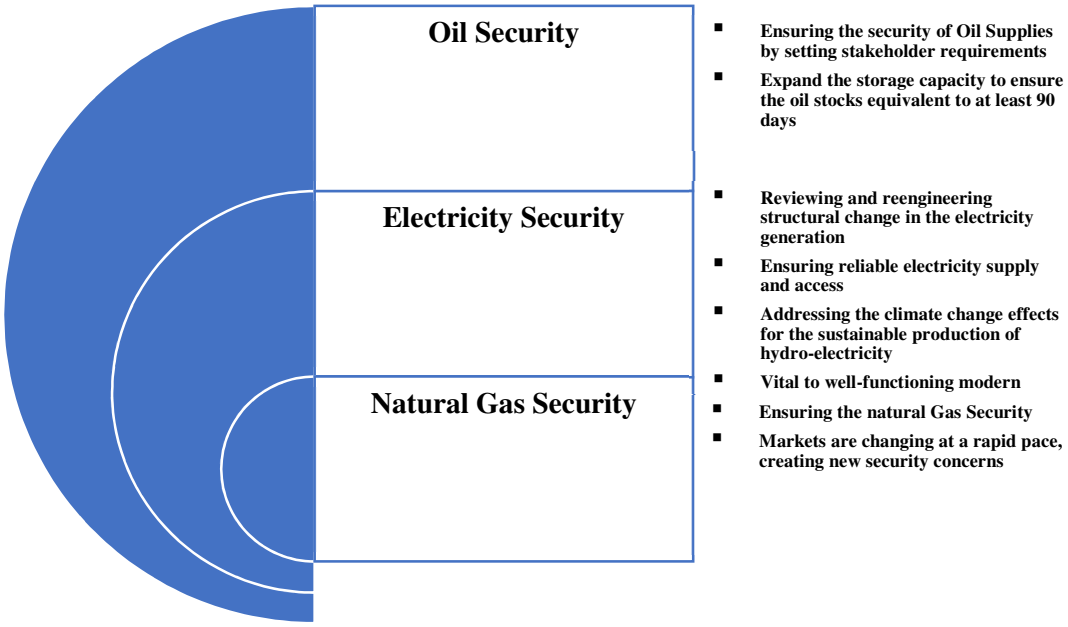
Major Global Energy Demand Sectors

Energy demand in the transport and industrial sectors continues to rise annually, driven primarily by the aviation sector and energy-intensive industries such as iron and steel, chemicals, non-metallic minerals, non-ferrous metals, and paper sectors.

Concept of Energy Security

The global oil market remains vulnerable to risk factors such as natural disasters, major conflicts, and geopolitical tensions. Hence, ensuring a steady oil supply is critical, particularly for the transportation sector. Each IEA country is obligated to maintain oil stocks equivalent to at least 90 days of net oil imports and to collaborate in responding collectively to severe supply disruptions affecting global oil markets.

Electricity security is indispensable for modern societies and economies, supporting digital technologies, communication infrastructure, and industrial operations. Natural gas markets, initially divided into regional markets connected by dedicated pipelines, are evolving rapidly, introducing new security concerns. The three components of energy security are illustrated in the following diagram.



Nepal's Energy sector Scenario

Nepal possesses abundant natural resources for energy generation, including significant potential in hydropower, solar energy, and wind energy. Currently, alternative energy sources contribute an installed capacity of 67.8 MW, providing electricity to 10 percent of the country's population. A

national energy efficiency strategy has been developed and is actively being implemented. Additionally, projects such as micro and small hydropower, biogas, improved stoves, and enhanced water mills are being pursued as part of carbon projects.

One of the primary challenges is to transition from traditional energy sources, still used in approximately 74 percent of households for cooking, to cleaner, cost-effective, and modern energy solutions. Enhancing access to modern technologies for small enterprises and reducing dependence on traditional energy technologies are crucial goals. Adopting a policy framework that promotes a diversified energy system is essential for ensuring energy security.

Planning, policies, strategies, and the overall national vision and goals will play a pivotal role in forecasting the country's future energy demand. Adequate government interventions are required to enhance generation capacity, expand grid connectivity, and create an enabling environment. These efforts will effectively meet increasing electricity demand.

Key opportunities include the government's commitment to improving electricity and clean energy access across all sectors, learning from best practices in neighboring countries, and increasing involvement of provincial and local levels along with development partners in advancing these initiatives. Emphasizing technology expansion and utilization within Sustainable Development Goals (SDGs) related programs and activities is also critical for future progress.

Constitutional and Legal Provisions

Article 51 (f) 3 of the constitution of Nepal has mentioned "ensuring reliable and affordable energy supply and proper utilization of energy by generation and development of renewable energy for the fulfillment of citizen's basic needs." There is a need for sufficient and reliable energy supply to achieve this goal. Nepal has been facing some complex but mutually interrelated energy challenges, such as, nearly one fourth of the total population still being outside the reach of modern energy sources; a wide gap between energy demand and supply; supply vulnerability and reduction in foreign currency reserves due to existing dependence on energy import.

With economic, physical and social development, Nepal has aimed to achieve the sustainable development goals set by the United Nations and reach the level of medium income countries by 2030 A.D. Among the sustainable development goals, the seventh goal is aimed to ensure the accessibility of affordable, reliable, sustainable and modern energy for all whereas the twelfth goal is aimed to promote sustainable and accountable production and use. To achieve these goals, it is necessary to establish policy, legal and institutional framework that ensures the availability of affordable and reliable energy and its efficient use. The current fifteenth plan has also mentioned to establish policy and institutional framework to promote energy efficiency in Nepal. An integrated national energy policy incorporating energy efficiency and demand side management of energy as well as legal and institutional arrangements are yet to be established for promotion of energy efficiency.

In order to promote sustainable supply of biomass energy available from animal waste, human excreta, fuel wood, agricultural residue, trees, and forest residues including any biodegradable matters and to improve the efficient use of such biomass energy, the government of Nepal has

already developed and adopted the Biomass Energy Strategy 2016. This strategy has been prepared for the promotion of energy efficiency and demand side management of energy, energy conservation, for the sustainable development of primarily modern and improved energy sources including hydropower, solar energy, wind energy, coal, natural gas, LPG and other petroleum products except biomass energy (which is also called traditional energy).

In Nepal, efforts like study and analysis related to energy efficiency can be found to have started since 1985 whereas during 1999 to 2005 AD, initiatives like energy audits of industries; energy efficiency related trainings and increase in public awareness as well as management of loans for energy efficiency in industries were carried out. After that from 2009 to 2011, initiatives like demand side management of electricity, energy audit, study of electricity load profile, preparation of policy suggestions for promotion of energy efficiency as well as replacement of traditional bulbs with energy efficient bulbs were done under Nepal Electricity Authority.

By giving continuation to past attempts, since 2010, the tasks like providing policy suggestions related to energy efficiency and demand side management, energy auditing, energy efficiency human resource development etc. have been implemented through Nepal Energy Efficiency Programs. Additionally, Industrial Energy Management Project under the Ministry of Industry, Commerce and Supplies has been conducting different training and awareness raising programs like energy auditing, energy auditor training the promotion of energy efficiency. In the process of establishing policy provisions, the government of Nepal has made a policy decision to supply electricity produced by sugar mills through cogeneration to the national grid as well as developed and approved the Biomass Energy Strategy, 2016.

To address energy transition and ensure energy security, equal focus must be placed on four critical aspects: energy availability, affordability, accessibility, and acceptability. Rapid deployment of renewable energy, increased energy efficiency, and diversification of energy sources and technologies can yield significant economic and energy security benefits. Energy efficiency, in particular, enhances both short- and long-term energy security by reducing dependence on imported fossil fuels.

It is urgent to develop a comprehensive energy strategy that addresses factors affecting energy availability, including physical constraints, production costs, technology, and market access. Collective efforts are necessary to align resources, expertise, and policies to tackle energy crises in a cohesive manner. Strategies should include modernizing resource management, researching the impacts of energy subsidies and taxes, and promoting consumer behavior towards efficient energy use.

Energy efficiency measures throughout production, supply chains, and end-user consumption are crucial for bridging demand-supply gaps effectively. This involves adopting energy-efficient equipment, minimizing system losses, and implementing effective energy demand analysis and management techniques.

Governments globally must collaborate to prioritize green investments and incentivize sustainable practices among their populations. Stronger policies are needed to stimulate significant investments in energy projects, mitigating future price volatility and meeting future energy demands.

Governments should actively attract new investors to energy sector projects to ensure robust development and resilience in the energy sector.

Nepal's Energy situation analysis Table: The following table clearly depicts the present Energy scenario of Nepal.

Total Energy supply (Terra Joule)	Total Energy Production (Terra Joule)	Electricity Production (GWh)	Total Energy Consumption (Terra Joule)
• Coal: 49970.0 TJ (7.7 %) • Oil: 122738.0TJ (18.9 %) • Hydro: 34321.0TJ (5.3%) • Wind, Solar etc: 5443.0 TJ (0.9%) • Biofuels and waste: 435531.0TJ (67.2%)	• Hydro: 34321.0TJ (7.2%) • Wind, Solar etc: 5443.0TJ (1.2%) • Biofuels and Waste: 435531.0TJ (91.6%)	• Hydro:9533.0 GWh(98.6%) • Solar PV: 133.0G Wh(1.4%)	• Coal: 49970.0TJ (7.7%) • Oil Products: 122660.0TJ (19%) • Electricity: 32277.0TJ (5%) • Wind Solar etc: 4962.0TJ (0.8%) • Biofuels and Waste: 435144.0TJ (67.5%)

Source: World Energy Outlook, 2023

Nepal's Energy Security Situation Analysis

The following table clearly described the Nepal's Energy security components audit. Nepal's status and position is very low for all the components and related infrastructures facilities to achieve the energy security.

Energy Security Audit for Nepal will be presented by the following Table.

S.N.	Energy Security Components	Nepal's Status	Remarks
1.	Oil Security	Not achieved yet	▪ Country's 90 days stock requirement guarantee not meet yet; ▪ Nepal Oil Corporation could not able to extract the crude oil ▪ Extra initiatives and more efforts would be needed from the Government side for the survey and extract crude oil
2.	Electricity Security	Not achieved yet	▪ Insufficient production

3.	Natural Gas Security	Not achieved yet	▪ Not extracted
4.	Investment in the Energy Sector	Low	▪ Insufficient investment from the public and the private sectors
5.	Electricity Production	Not sufficient	▪ Not fully utilize the available water resources to generate electricity ▪ Attract more FDI and domestic private sector's investment with strong policy incentives
6.	Oil Production	Not yet	▪ Less focus to the production of Oil and petroleum minerals
7.	Transmission Lines and Grid connectivity	Insufficient	▪ Need Dedicated Budget funding from the government

The comparative analysis of the existing Plan, Policy and Institutions regarding the Energy Sector

The comparative analysis of the policy measures and initiatives regarding the energy sector implemented by the government of Nepal and the institutions involved in the energy sector development are presented through the following table.

Nepal's Key Policy Initiatives and measures	Institutional Arrangements
▪ Hydropower Development Policy, 2001 ▪ Rural Energy Policy of Nepal,2006 ▪ National Rural and Renewable Energy Program(NRREP) of Nepal, 2012 ▪ Renewable Energy Subsidy Policy of Nepal, 2016 ▪ National Energy Efficiency Strategy ▪ Green Hydrogen Policy, 2023 ▪ The 16 th plan approach paper	▪ Investment Board Nepal ▪ Water and Energy Commission Secretariat ▪ Ministry of Energy, Water Resources and Irrigation ▪ Department of Electricity Development ▪ Nepal Electricity Authority ▪ Electricity Regulatory Commission ▪ Alternative Energy Promotion Center ▪ Rastriya Prasaran Grid Company Limited ▪ Vidhyut Utpadan Company Limited ▪ Hydroelectricity Investment and Development Company Limited ▪ Nepal Energy Efficiency Program

Source: Existing institutions of Nepal

Proposed Interventions areas for the Energy Security

To achieve energy security milestones and goals in Nepal, several key interventions are necessary:

- Scale up clean energy investments at all governmental levels—Federal, Provincial, and Local.
- Implement a balanced mix of policy incentives and subsidies, particularly for hydro, solar, wind, and green energy projects.
- Foster collaboration among Federal, Provincial, and Local governments to meet Nepal's SDG targets for energy security.
- Develop an Electricity Security Action Plan (ESAP) to ensure future electricity security.
- Introduce Sustainable Consumption and Production (SCP) techniques and strategies in the energy sector.
- Strengthen the supply network to ensure affordable costs for the public.
- Insulate energy sources from the effects of climate change.
- Protect Nepal's mountains, glaciers, and mountain lakes.
- Redirect investment towards exploring hydrogen energy.
- Enhance reliable energy access by transforming the energy system year-round.

Additionally, strategies to reduce energy insecurity include:

- Implement structural reforms in the energy sector through an Energy Governance Framework (EGF).
- Prioritize water storage-type hydropower projects over Run-of-River (ROR) projects.
- Streamline and simplify procedures for Power Development Agreements (PDA) and Power Purchase Agreements (PPA).
- Allocate at least 5% of GDP annually to the energy sector budget.
- Promote energy-efficient instruments and machinery.
- Reduce energy losses by upgrading transmission and distribution lines.
- Educate consumers about energy security and efficiency.
- Implement mitigation measures to ensure water resource sustainability amid climate change.
- Deploy SMART billing systems for efficient energy management.
- Introduce incentives for investors in hydropower infrastructure and transmission lines.
- Build institutional capacities for all energy types-bio, solar, hydro-across production, development, and regulation.
- Enhance connectivity through both grid and non-grid solutions.
- Implement digital monitoring of consumer units.
- Expand energy trade with neighboring countries and regions to integrate supply chains.
- Formulate and execute a long-term energy sector vision paper and value chain development strategy.

These interventions and strategies aim to enhance Nepal's energy security through comprehensive policy frameworks, technological advancements, and sustainable practices across the energy sector.

Conclusion

The impact of energy insecurity will become increasingly complex and far-reaching if we do not address energy issues promptly. Therefore, to tackle energy security, ecological conservation, and climate change, countries must prioritize the development of hydropower and renewable energy projects. This requires robust policy measures such as financial incentives and subsidies, facilitating power grid connections, and allocating dedicated budgets for research and development to encourage new investments in energy generation projects.

Building trust, enhancing cooperation, and fostering partnerships among neighboring countries through both grid and non-grid solutions are essential to achieving our energy security targets, goals, and strategies. This collaboration will serve as a milestone in achieving regional and global energy security. Recognizing that solving issues like climate change, food security, and energy security requires collective efforts, no single country can address these challenges alone.

Furthermore, it is crucial to address all dimensions of energy security—availability, accessibility, environmental acceptability, and affordability—by adopting energy security policies and strategies. Structural strengthening of institutions related to energy generation, investment facilitation, and regulatory authorities is essential to ensure reliability and affordability. An articulated and ambitious vision paper for the energy sector, supported by strong governance frameworks and dedicated budgets, is urgently needed. This vision paper and governance framework will play a critical role in increasing investment in human capital and revitalizing institutional capacity.

References

BOAO Forum for Asia. (2022). *Sustainable Development: Asia and the World Annual Report 2022 - Asia in Action towards Green Transition*. Retrieved from http://www.aepc.gov.np

China Social Service Press. (n.d.). *The Handbook of the Belt and Road*. Retrieved from http://www.vucl.org

Government of Nepal. (2075). *National Energy Efficiency Strategy*. Ministry of Energy, Water Resources and Irrigation. Retrieved from http://www.nea.gov.np

Government of Nepal. (n.d.). *Demand Forecast Report (2015-2040)*. Water and Energy Commission. Retrieved from http://www.rpgcl.com

International Energy Agency. (2023). *World Energy Outlook 2023*. Retrieved from http://www.iea.org

National Planning Commission Nepal. (n.d.). *The 15th Plan*. Retrieved from http://www.vucl.org

National Planning Commission Nepal. (n.d.). *The 16th Plan: Approach paper*. Retrieved from http://www.vucl.org

National Planning Commission Nepal. (n.d.). *The 16th plan approach paper*. Retrieved from http://www.vucl.org

www.iea.org

www.rpgcl.com

www.nea.gov.np

www.aepc.gov.np

www.vucl.org