WHITE PAPER

The Destructive Impact of Galamsey on Ghana's Energy Sector and Critical Infrastructure

How illegal small-scale mining threatens hydropower, the national grid and energy security, and what Ghana must do about it

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November 2026
DOI: https://doi.org/10.5281/zenodo.24499250

Suggested citation: Abraham, T. (2026). *The destructive impact of galamsey on Ghana's energy sector and critical infrastructure: A white paper*. Zenodo. https://doi.org/10.5281/zenodo.24499250

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KEY RECOMMENDATIONS

1. **Protect the catchments.** Legally designate river basins that feed hydropower facilities as critical infrastructure protection zones.
2. **Join up water and energy.** Create a framework that links the ministries and agencies responsible for water and electricity.
3. **Watch the sediment.** Install early warning systems that monitor sediment in major hydropower catchments.
4. **Enforce where it matters.** Intensify surveillance and raise penalties in the catchments of key hydropower plants.
5. **Restore what is lost.** Launch a national program to reforest and rehabilitate degraded catchments.

Executive Summary

Ghana's energy sector is a vital part of the country's national infrastructure. Hydroelectric power stations play an important role in the generation of electricity in Ghana. The reliability of Ghana's energy sector is largely dependent on the country's hydropower resources which are threatened by illegal small scale mining popularly known as galamsey. While thermals currently generate the greater part of Ghana's electricity, in 2025 hydro power plants generated 32.4% of the total electricity generated in Ghana (Energy Commission, 2026). Because hydropower remains an important source of low cost electricity in Ghana, the degradation of river basins that feed the country's hydroelectric dams should be of concern from an energy security perspective. Galamsey poses a serious environmental threat to Ghana and degrades rivers, lakes and other water bodies by polluting them with toxic mine waste (Gyasi & Ametepe, 2026; Nti et al., 2023). Mining activities disrupt hydrology and add sediment to water bodies thereby clogging up the water treatment plants.

Alarming levels of mercury and cyanide have been found in some of Ghana's major river basins including the Pra, Ankobra, Birim, Densu and Tano rivers (Adjei et al., 2022; Nunoo et al., 2022). The increased levels of mercury and sediment in rivers negatively impact water treatment plants, forcing the Ghana Water Company Limited (GWCL) to shut some down (Bawa et al., 2022; Mensah & Tuokuu, 2023). In the Black Volta Basin, increased siltation and deforestation as a result of small scale mining negatively impacts the reservoir capacity and long term operation of the Bui Dam.

This white paper assesses the impact of galamsey on Ghana's hydropower infrastructure and recommends improvements to national policy and regulation. It recommends protecting river basins that feed hydropower facilities as critical infrastructure protection zones, integrating water and energy sectors of the government, installing early warning systems to measure sediment, increasing enforcement in hydropower catchments, and implementing a national program to restore damaged catchments.

Introduction

"Critical infrastructure are those infrastructure systems and assets that are so vital that their incapacitation or destruction would have a debilitating effect on security, the economy, public health, public safety, or any combination thereof" (Cybersecurity and Infrastructure Security Agency [CISA], n.d., para. 1). Hydropower remains a significant part of Ghana's energy supply, therefore the hydroelectric power plants are also critical infrastructure. The generation of hydropower depends largely on the supply of water, and in Ghana the Volta River contributes significantly to this. As such, the Volta River and other rivers that feed the country's hydroelectric plants must remain free of pollution and silt.

Galamsey has predominantly been discussed as an environmental degradation and public health threat. However, the unregulated mining activities lead to pollution and siltation of waterways, including rivers and reservoirs used for power generation. This paper assesses galamsey as a critical infrastructure threat. It considers the impact of illegal mining on water resources of Ghana, the implications this has on the country's electricity and energy security, and the threat this poses to the Bui Dam on the Black Volta River using official energy statistics and the available literature. The paper concludes with policy recommendations to address the issue.

Problems Facing Ghana

Threats to Water Resources

Water resources are essential for various aspects of Ghana's development including providing drinking water, irrigating farmland and generating electricity. 'Galamsey' activities have been detrimental to the environment across Ghana and negative impacts on water bodies have been the most pervasive. Mercury and cyanide are two of many wastes discharged into various rivers by illegal miners. River systems including the Pra, Ankobra, Birim, Densu and Tano have been highly polluted by these wastes and others. Unsafe levels of these wastes have also been observed in surface water resources that serve many industries. Pollution of water bodies is creating an uninhabitable environment and threatening the lives of the people in the mining communities as well as the general population downstream (Adjei et al., 2022; Anokye & Darko, 2025; Nunoo et al., 2022). It is estimated that approximately 60% of Ghana's water bodies have already been polluted by mining wastes and if the trend continues this percentage is expected to increase (Gyasi & Ametepe, 2026; Nti et al., 2023).

Pollution has also impacted water treatment. Due to high levels of contamination, some treatment plants have been shut down by GWCL (Bawa et al., 2022; Mensah & Tuokuu, 2023). The deterioration of water quality has also decreased the amount of water available to the country. Ghana may have to import water for domestic and industrial use by 2030 (WaterAid, 2024, as cited in Lawal, 2025). Water resources in Ghana are further compromised by land and forest degradation resulting from galamsey activities. Artisanal and small-scale mining has degraded 78,000 hectares of forest and land over the past 20 years (Bansah et al., 2024). Illegal mining activities in Ghana's river basins accelerate the rate of deforestation and result in the siltation of water bodies (Amproche et al., 2020). Deforestation and soil erosion lead to a reduction in the ability of river basins to retain water and alter the natural flow of

water through the basin. Disruption of the water cycle in a river basin also alters the balance of the entire basin and disturbs other essential services the environment provides, including energy. In the case of Ghana, degradation of river basins could negatively affect the nation's electricity supply, both in the short term and in the long term (Adom et al., 2019).

Direct Effects on Hydropower Generation

Hydropower is a renewable energy source with low costs and high reliability (Sarpong & Agyei, 2022). As of 2025, hydropower accounted for about 32.4% of Ghana's electricity generation (Energy Commission, 2026), with thermal plants accounting for about 66.8% (Energy Commission, 2026). Hydropower decreased by 11.5% in the same year, due to low inflow to the reservoirs (Energy Commission, 2026). As hydropower provides about one-third of the total generation in Ghana, the loss of hydropower is replaced by thermal generation. Thus, any negative impact on hydropower has a direct effect on Ghana's energy sector.

Effect of Illegal Mining on Dam Operations

Illegal mining within river catchment areas increases sedimentation rates (Dethier et al., 2023). One of the major impacts of mining in the Black Volta Basin is siltation of water bodies (Amproche et al., 2020). Reservoirs are usually designed to store a certain volume of water to generate power. As sediment loads increase, reservoir storage capacity is reduced, and turbines become clogged and damaged (Kondolf et al., 2014; Padhy & Saini, 2008). Other implications of increased sedimentation on hydropower systems include decreased turbine efficiency and shorter facility service life.

Increased turbidity, iron content and color in water are consequences of galamsey, which make the water difficult and costly to treat (Afriyie-Gyawu et al., 2017; Nunoo et al., 2022). The treatment cost at the Sekyere-Heman Water Treatment Plant, which draws water from the Pra River, was about four times higher than that at a nearby plant, which draws water from a river unaffected by galamsey (Afriyie-Gyawu et al., 2017). Hence, the treatment cost of water extracted from mining-affected rivers is largely borne by the Ghana Water Company Limited (GWCL) and its customers as well as industries that make use of raw water.

Bui Dam Project

The Bui Dam is another example of the impact galamsey has on infrastructure. Following the construction of the dam on the Black Volta River, small scale gold mining also took place in the riverbed downstream (Owusu et al., 2019). This activity negatively affected the livelihood of local inhabitants, including their means of fishing and farming (Owusu et al., 2019). Negative impacts of such activities include increasing pollution of the environment and decreasing ecological health.

The potential risks to the dam are primarily from activities within the catchment area upstream from the reservoir. Increase in bare land and decreased vegetation cover in the Black Volta basin between 2015 and 2018 has been attributed to small-scale mining (Amproche et al., 2020). More siltation will occur as deforestation and mining within the basin increases. Asante-Sasu (2016) estimated the gross annual sediment yield to the Bui reservoir at 1.37 million tons, which is 41.5% higher than the annual design quantity of 968,000 tons. Eventual sediment buildup will diminish storage capacity and adversely impact operation of the Bui Dam.

Implications for National Energy Security

Adom et al. (2019) state that a positive water-energy equilibrium is vital for sustainable economic development. Galamsey negatively impacts river basins and increases the dependence of the electricity system on thermal generation and further increases the vulnerability of the system to fuel supply risks and disruptions. Since reliable and stable electricity is vital for economic development, the adverse impacts of galamsey on the environment negatively impacts the overall development of the country. The Galamsey activities within the river basins impairs the hydroelectric power plants and further increases the country's dependence on fossil fuels to generate electricity.

The Solution

Policy Recommendations

The interventions to address the impact of galamsey on the water resources of Ghana's energy sector should be primarily implemented by various government ministries, regulatory agencies and security services. The following recommendations have been formulated to protect the water resources used for generating hydropower.

Declare Hydropower Catchments as Critical Infrastructure

Laws should be enacted to set aside some river basins as protected infrastructure in order to shield them from mining activities. Since the electricity generation facilities are often located close to river basins, these zones should also be protected from mining activities.

Establish a Water-Energy Integration Framework

The ministries and agencies with responsibilities over the electricity and water sectors in the country should establish a frame-work to enhance integration of these two critical sectors.

Use Early Warning Systems

Major hydropower catchment areas should be equipped with early warning systems to monitor and report sediment levels to the electricity generation authorities to enable them take the necessary actions before the sediment levels affect the operations of the hydropower plants.

Strengthen Enforcement

Surveillance and enforcement to protect water catchments should be intensified and penalties increased. This should be specifically implemented in the catchment areas of key hydropower plants.

Implement National Catchment Restoration Programs

Intensive reforestation and other restoration activities should be undertaken in large scale degraded catchments. Restoring forest cover and stabilizing river banks would go a long way to reestablish the natural balance and enable sustainable hydro-electric power generation.

Conclusion

Galamsey is a serious and growing threat to Ghana's energy sector. Its negative impact on Ghana's major river systems has resulted in increased siltation and degraded forests around the Bui Dam, thus decreasing the country's generation capacity of hydroelectric power. Illegal mining also prevents Ghana from meeting its hydroelectric power potential and increases the country's dependence on thermal energy, thus further increasing the strain on the national power grid. Failure to adequately control illegal mining in Ghana will negatively impact the country's ability to meet its energy needs and further compromise the national economy. The information in this paper justifies treating galamsey as a threat to national infrastructure.

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