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Security Nexus Perspectives

WATER SECURITY AS AN ESSENTIAL COMPONENT OF THE DEFENSE INDUSTRIAL BASE

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Introduction

The defense industrial base sector represents a global network that drives the research, development, production, and maintenance of military weapons systems and components. It plays a vital role in fulfilling military needs and safeguarding national security. However, both the People's Republic of China and Russia are increasingly focused on targeting U.S. critical infrastructure, aiming to disrupt societal functions and hinder Department of Defense operations during a crisis. This is particularly concerning as the defense industrial base relies heavily on water resources and infrastructure, making it vulnerable to such threats.

In the Indo-Pacific, where water scarcity is becoming increasingly prevalent due to factors such as climate change and population growth, ensuring water security for the defense industrial base is particularly challenging. The competition for water resources between industrial, agricultural, and domestic uses can impact the ability of nations to maintain and expand their defense capabilities. Without reliable access to water and improved water security, the ability to manufacture defense equipment, operate military installations, and sustain critical industries that supply the military is severely compromised. Many defense-related manufacturing processes require significant amounts of water. From cooling systems in electronics production to chemical processes in materials development, water is an essential input. Additionally, military installations themselves rely on water for various purposes, including personnel needs, equipment maintenance, and fire suppression systems.

The interdependence between water security and the defense industrial base has significant implications for national security. Insufficient water can disrupt manufacturing processes and limit the production of essential military equipment resulting in diminished operational readiness. Countries with water-stressed defense industries may become more vulnerable to external pressures

or conflicts resulting in strategic vulnerability. Water scarcity will increase production costs, potentially having an economic impact that affects a nation's ability to invest in defense capabilities.

Recognizing the critical role of water in sustaining the defense industrial base is crucial for policymakers and military planners, especially in regions facing water stress. Ensuring long-term water security is not just an environmental or economic issue, but a matter of national defense and strategic importance.

Strategic Importance

Water is a key input in many industries that underpin the defense sector. From the production of raw materials like steel and aluminum to the manufacturing of complex defense systems such as aircraft, naval vessels, and armored vehicles, water is essential at every step of the process. Here are four examples where water is essential.

1. The production of metals used in defense manufacturing—such as steel, aluminum, and titanium—requires significant amounts of water for cooling and processing. In steelmaking, water is used to cool the molten metal and control emissions, while in the production of lightweight materials for aircraft and missiles, water is essential for various refining and alloying processes.

2. The production of explosives, propellants, and chemical agents used in military applications relies heavily on water, not only as a coolant but also in many chemical reactions. Water shortages could disrupt the manufacturing of critical ammunition and explosives, creating bottlenecks in the supply chain for the military.

3. Many defense facilities, including military bases and manufacturing plants, depend on stable energy supplies, much of which is generated by power plants that require large volumes of water for cooling. Hydroelectric power, which is particularly important in countries like Bhutan (100%), Laos (95%), Nepal (99%), Myanmar (52%), Cambodia (45%), Sri Lanka and Vietnam (29%), Malaysia (17%), and Indonesia (7%), relies directly on water availability. Any disruption to energy production due to water shortages could have cascading effects on the ability to power key defense installations.

4. The construction and maintenance of naval vessels are highly water-dependent. Shipyards require vast amounts of water for both construction and testing of naval ships and submarines. In addition, naval bases rely on significant water supplies to maintain fleets, repair equipment, and support personnel. Inadequate water supplies could directly impact the readiness of naval forces and their operational capabilities.

Vulnerabilities

Ensuring a stable and predictable supply of water is thus essential for maintaining the defense industrial base, which in turn supports military readiness and strategic independence. Indo-Pacific countries that are vulnerable to water scarcity face the risk of significant disruption to their defense production capabilities if water security is not addressed. This is particularly critical as internal and global competition for water resources intensifies and the region's defense needs grow in response to shifting geopolitical dynamics.

In addition to the direct manufacturing processes, many defense-related industries, such as electronics, optics, and advanced materials manufacturing, are increasingly reliant on precision water management systems for cooling, cleaning, and material processing. Any disruptions in water supply can reduce productivity, increase operational costs, and delay the delivery of essential military hardware.

Potential water-based threats to the defense industrial base include reduced productivity, higher costs, supply chain disruption, and environmental regulation.

- In times of water scarcity, industries that rely on large volumes of water may face production slowdowns or stoppages, leading to delays in the manufacturing and delivery of critical defense equipment. This could affect everything from the availability of basic materials like steel and concrete to more advanced technologies used in modern warfare.

- As water becomes scarcer, the cost of obtaining and purifying water for industrial use increases. Defense industries will face higher operational costs as they compete with civilian industries and urban centers for limited water supplies.

- The defense industrial base is increasingly integrated into global supply chains. Many components are sourced internationally so water shortages in key production areas could create supply chain vulnerabilities or delay production across the region, reducing the operational readiness of security forces.

- As water scarcity worsens, governments may impose stricter regulations on industrial water use to prioritize agriculture and human consumption. Such regulations would reduce the amount of water available for all industries, forcing them to adopt costly new water-saving technologies or reduce production output.

Artificial Intelligence

The defense industrial base is increasingly reliant on artificial intelligence (AI) to enhance its capabilities in research, development, and production of military systems. AI plays a crucial role in optimizing supply chains, improving operational efficiencies, and enabling advanced weapons systems. However, the effective use of AI itself depends heavily on secure and stable access to water

resources. Large-scale AI systems, particularly those used in defense, require significant amounts of water for data centers, cooling systems, and power generation. As AI becomes more deeply integrated into defense operations, ensuring water security becomes vital for maintaining the functionality and resilience of these critical AI systems.

This growing reliance on AI introduces new vulnerabilities. Adversaries such as the People's Republic of China and Russia, recognizing the importance of AI to defense operations, may target U.S. water infrastructure to undermine AI capabilities and disrupt defense capacity. Water security, once a background concern, now becomes a frontline issue in the protection of AI-driven defense technologies. Without secure water resources, AI systems critical to national security could falter, leading to broader disruptions in the defense industrial base. Thus, safeguarding water infrastructure is not only about ensuring industrial continuity but also about protecting the AI frameworks that increasingly underpin military and defense capabilities.

Resilience

To mitigate the risks posed by water insecurity, governments and military planners must ensure that water security is integrated into long-term plans for the defense industrial base. To achieve this, defense manufacturers, including the private sector, should invest in water-efficient production technologies to reduce their reliance on water. This includes advanced cooling systems, water recycling, and closed-loop manufacturing processes that minimize water waste. By reducing the water footprint of defense production, industries can insulate themselves from the impacts of water shortages.

Secondly, governments should work with industries to diversify the sources of water used in defense production. This may include the use of non-traditional water sources such as desalination plants, treated wastewater, and rainwater harvesting systems to ensure a stable water supply for critical industries. This is particularly important in countries like India and Pakistan, where large portions of the population already face significant water stress and water disputes between the nations are deepening.

Thirdly, military planners must ensure that defense facilities and industrial zones are built with water resilience in mind. This includes locating critical facilities near reliable water sources, integrating water storage infrastructure into military installations, and planning for emergency water supplies in the event of shortages.

Lastly, water is a shared resource in many parts of the world with key rivers crossing multiple national borders. International cooperation on water management is therefore essential for ensuring that defense industries in all countries have access to the water they need to operate effectively. By engaging in water diplomacy and strengthening legal frameworks like the Indus Water Treaty, countries can reduce the risk of water-related disruptions to the defense industrial base.

Readiness

Water security is vital to ensuring defense readiness, as the defense industrial base depends heavily on reliable water resources to support its operations. The defense industry underpins national security by producing, maintaining, and upgrading the military systems and components that are essential for defense capabilities. Water is integral to these processes, from industrial manufacturing and cooling systems to energy production, all of which sustain the defense sector's ability to function at peak efficiency. Without secure and stable access to water, the industry's capacity to support military readiness will be severely compromised.

This reliance on water becomes even more critical in the face of emerging threats, both natural and adversarial. Climate change poses a growing challenge, with increasing droughts, extreme weather events, and shifting water availability putting pressure on water-dependent infrastructure. Simultaneously, adversaries such as the People's Republic of China and Russia have recognized the importance of water resources and may target U.S. infrastructure to undermine defense readiness. Protecting water security is, therefore, not just an environmental concern—it is a strategic imperative for maintaining defense readiness. Safeguarding water resources ensures that the defense industry can continue to support military operations effectively, preserving national security in the face of both environmental and geopolitical challenges.

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