Criticality of Tungsten in the USA: A Detailed Review with Focus on Government Support

- ***Introduction to Tungsten***

Tungsten, or wolfram, is recognized for its exceptional properties, such as the highest melting point among metals (3422°C), high density, and excellent electrical conductivity. These characteristics make it indispensable in various high-tech applications, including aerospace, defence, and electronics.

- ***Uses of Tungsten***

Tungsten's unique properties are critical in several sectors:

  - **Aerospace and Defense:** Its density and hardness make tungsten ideal for heavy alloys and kinetic energy penetrators, critical components in military ordnance.
  - **Energy:** Tungsten is vital in the production of wear-resistant materials and cutting tools, particularly in the oil and gas industry.
  - **Electronics:** Due to its high conductivity and thermal stability, tungsten is essential in semiconductors, light bulb filaments, and electrodes.
  - **Medical and Industrial:** It is used in radiation shielding in medical applications and in the production of superalloys and heavy machinery.

- ***Supply Chain and Import Dependency***

The U.S. lacks significant domestic tungsten production, relying heavily on imports, primarily from China, which dominates global production. This dependency on a single, geopolitically sensitive source poses substantial risks to the U.S. supply chain.

- ***Geopolitical and Economic Risks***
  - **China's Dominance:** China controls approximately 80-85% of the global tungsten supply. Any geopolitical tensions or trade restrictions with China could severely disrupt tungsten availability in the U.S.
  - **Price Volatility:** The concentrated supply chain makes tungsten prices highly volatile, impacting industries dependent on this critical mineral.
  - **Strategic Importance:** Given its role in defence and aerospace, any supply disruption could have significant national security implications.

- ***Criticality Assessment***

The U.S. Geological Survey (USGS) and the Department of Defense (DoD) classify tungsten as a critical mineral due to its essential role in economic and national security and the risks associated with its supply.

  - **Supply Risk:** Tungsten's criticality is heightened by the limited supply sources outside China. Diversification of supply or development of alternatives has proven challenging, maintaining its high criticality rating.
  - **Substitution Challenges:** Tungsten is difficult to substitute due to its unique properties, particularly in high-temperature and high-density applications where alternatives often compromise performance.

- **Government Grants and Support**

Recognising the strategic importance of tungsten, the U.S. government has implemented various grant programs and support mechanisms to encourage domestic exploration, production, and innovation in tungsten-related technologies.

  - **Critical Minerals Funding Initiative:** The U.S. government, through agencies like the Department of Energy (DOE) and the U.S. Geological Survey (USGS), offers grants and funding opportunities specifically targeted at the exploration and production of critical minerals, including tungsten. These grants aim to reduce import dependence by supporting domestic mining projects and advancing new technologies for extraction and processing.
  - **Department of Defense (DoD) Funding:** The DoD has also provided financial assistance to domestic producers and explorers of tungsten to secure a stable and reliable supply chain for defense applications. This includes funding for research into alternative sources and recycling technologies.
  - **Innovation and Technology Grants:** The U.S. government supports research and development through grants aimed at improving tungsten recycling processes and finding substitutes for tungsten in certain applications. The Department of Energy, for example, has provided grants to companies and research institutions working on innovative recycling technologies that could reclaim tungsten from industrial waste or end-of-life products.
  - **State-Level Incentives:** In addition to federal programs, several states offer incentives, including tax credits and grants, to companies engaged in the exploration and development of critical minerals. States with potential tungsten deposits may provide additional support to attract investment and development.

- ***Current U.S. Policy and Mitigation Strategies***

To mitigate the risks associated with tungsten's criticality, the U.S. has adopted several strategies:

  - **Stockpiling:** The U.S. Strategic Materials Stockpile includes tungsten to ensure availability during crises.
  - **Diversification of Supply:** Efforts are underway to establish trade agreements with alternative tungsten suppliers and to explore new mining opportunities in allied countries.
  - **Research and Development:** The U.S. continues to invest in R&D to develop alternative materials and improve recycling technologies, aiming to reduce dependency on foreign tungsten.
  - **Support for Domestic Mining:** The availability of government grants and incentives plays a crucial role in encouraging the development of domestic tungsten resources and reducing the reliance on imports.

- ***Future Outlook***

Tungsten's criticality in the U.S. is expected to remain high due to its unique properties and the concentrated nature of its supply. Continued government support through grants, funding initiatives, and strategic policies will be essential to secure a stable supply of tungsten, thereby enhancing national security and economic resilience.

Tungsten is a critical material for the U.S., vital for defence, energy, and technological applications. The country's reliance on imports, particularly from China, underscores the need for robust strategies to mitigate supply risks. Government grants and funding initiatives are pivotal in fostering domestic exploration and production, as well as advancing technologies that could reduce dependency on foreign tungsten. By prioritizing these efforts, the U.S. can ensure a secure and sustainable supply of this indispensable material.