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THE WORLD OF PETROLEUM AND BITUMEN

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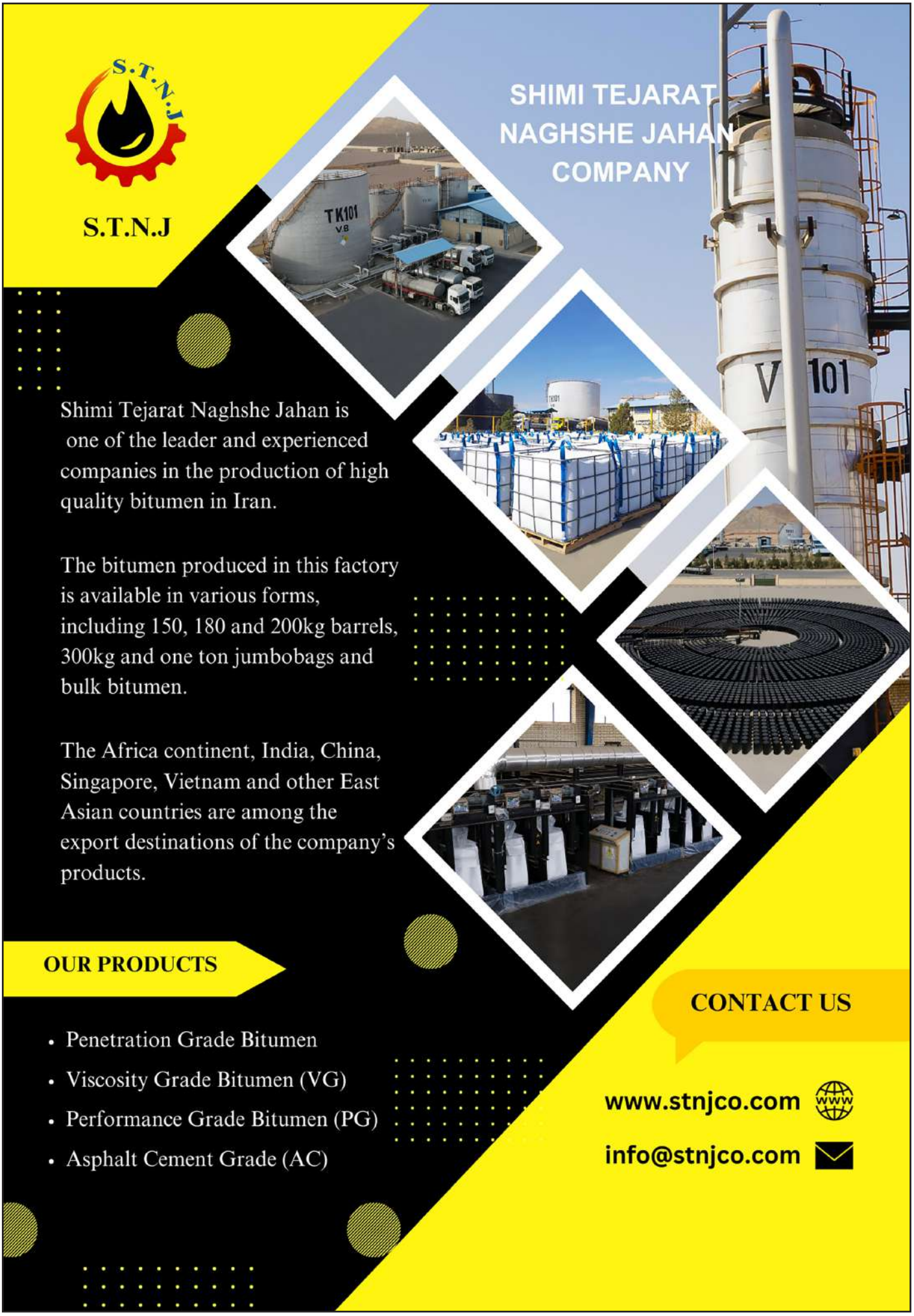
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LAF 40ft Bitumen Flexitank

LAF

اطلاعاتی در مورد فلکسی تانک قیر ۴۰ فوتی:

وزن قابل حمل: ۲۵ تن
انواع (گریدهای) قیر قابل حمل: شامل ۶۰\۷۰، ۸۵\۱۰۰، ۲۰۰\۳۰۰
مدت بارگیری: ۳۰ دقیقه
مدت تخلیه: ۲۰ تا ۴۰ دقیقه

装运重量：25 吨
装运型号：60/70, 85/100, 200/300
装货时间：30 分钟
卸货时间：20-40 分钟
配置：液袋 +2 卷瓦楞纸，无需挡板系统

Some details about 40’ Bitumen Flexitank:
Payload: 25 tons
Grades shipped: 60/70, 85/100, 200/300
Loading time: 30 minutes
Discharging time: 20–40 minutes
Kit: flexitank + 2 rolls of corrugated paper, no bulkhead system required

从 2022 年开始，LAF 联手 Black gold, Akam, Parsian Energy, Oxin, Hormozan oil, Sebco 等炼厂开创了沥青运输新模式 - 液袋运输。目前伊朗沥青运输的每 10 条液袋就有 8 条来自 LAF。感谢行业里各位朋友的帮助与支持。

现在，我们真切的了解到市面上缺少 20 尺集装箱的现实情况。历经三年，我们终于打造了一款能够满足装货和卸货的 40 尺沥青液袋。加快沥青运输速度。

Since 2022, LAF has joined forces with refineries such as Black Gold, Akam, Parsian Energy, Oxin, Hormozan Oil, Sebco, AIM, STNJ (to name just a few) to utilize a new model for bitumen transport; flexitank shipping. Today, eight out of every ten bitumen flexitanks in Iran are supplied by LAF. Many thanks to all friends in the industry for their help and support.

We now clearly see the market reality: 20-ft containers are in short supply. After three years of development, we have finally created a 40-ft bitumen flexitank which not only addresses the issue of 20’ containers shortage but also streamlines both loading and unloading process which leads to accelerating bitumen transport.

از سال ۲۰۲۲، شرکت LAF با همکاری شرکتهایی نظیر طلای سیاه، آکام، پارسیان انرژی، اکسین، نفت هرمزان، سیکو، عایق اصفهان، شیمی تجارت (تنها چند نمونه) استفاده از فلکسی تانک مخصوص قیر را توسعه داده اند و در حال حاضر ۸ فلکسی تانک از ۱۰ فلکسی تانک استفاده شده در ایران توسط LAF تامین میشود. از همه دوستان در این صنعت سپاسگزاریم.

اما اکنون بازار با چالش کمبود کانتینر ۲۰ فوتی وبروست و ما پس از ۳ سال تحقیق و توسعه، فلکسی تانک قیر ۴۰ فوتی را طراحی و ارایه کرده ایم که نه تنها پاسخگوی مشکل کمبود کانتینر ۲۰ فوتی است بلکه با ساده کردن فرایند تخلیه و بارگیری باعث افزایش سرعت حمل قیر خواهد بود.

LAF 20ft Bitumen Flexitank

Contact Information

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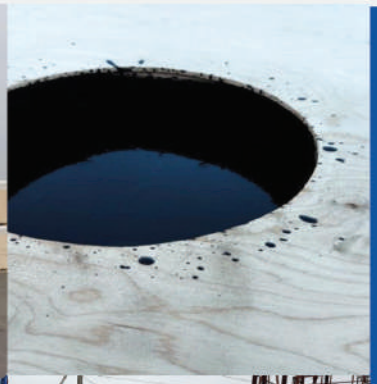
Iran agent:
Peyman Mozaffarifard +971 56 596 1010 ceo.peyman@qtransglobal.co

RUSPROMPAK
Russian Industrial Packaging

RUSPROMPAK company was established in 2012. We offer a container for filling with hot bitumen BitumBox. It is used for packing hot bitumen and further storage and transportation by any type of transport. A marine 20-foot container with a stack of 3 tiers accommodates 20 containers (20 tons of bitumen).



The dimensions of the container when assembled are 1060x1060x1095 mm. The capacity is up to 1040 kg of hot bitumen of various thicknesses. The heat resistance of the package is up to 200 degrees. The container is made only of glued material — FC plywood, glued in a checkerboard pattern. This eliminates the need to process and install the ISMP15 stamp during export. Storage is allowed in 4 tiers on a flat surface. The assembly is carried out using special keys in 3 minutes. When disassembled, the euro trolley holds 350 sets.

Own production: 2 Gagarina Street, Alexandrov, Vladimir region, Russia, The production area is 5,000 sq.m. The number of employees is 72 people. The production capacity is up to 20,000 boxes per month. At the request of the customer, we can produce packaging of any size for any product. For example, for various serial equipment, car batteries, synthetic rubber, etc.

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tel.+7 925 872 27 27

Global Bitumen Market Analysis – Mid November 2025 (November 13–15)

The mid-November trading period (13–15 November 2025) showed a continuation of the stabilizing trend observed earlier in the month across major global bitumen hubs. Despite minor daily fluctuations driven by freight adjustments and crude oil softness, price levels largely remained within their previously established ranges. The overall market sentiment during these three days was neutral, with limited upward pressures from feedstock values and modest seasonal demand shaping purchase behavior across Asia, the Middle East, and Oceania.

Across the Middle East (Iran, UAE, Iraq), FOB values were mostly steady, with exporters reporting consistent buying interest from South and East Asian importers. Iranian bulk cargoes in particular remained competitive against regional suppliers, maintaining their role as a key pricing reference for many import-reliant countries.

In Asia-Pacific hubs including Singapore, South Korea, Malaysia, and Vietnam, prices reflected mild softening near the lower band of weekly ranges due to high inventories and cautious procurement ahead of year-end budgets. Singapore's FOB bulk market specifically showed slight pressure, though trading volumes remained reasonably firm.

China's domestic bitumen market continued to exhibit a gradual cooling trend as construction activity declined in the northern provinces with the onset of colder weather. Ex-works prices saw marginal adjustments but stayed broadly aligned with early-month benchmarks.

In South Asia, India's ex-refinery rates remained unchanged during this period, following the refiners' pricing revisions earlier in November. Local suppliers reported stable demand from infrastructure segments, though export-related activity staved limited.

Australia and Japan preserved their historically stable pricing patterns, with Australia's CFR values holding firm and Japanese domestic ex-refinery prices maintaining upper-range consistency. Limited import shifts and strong refinery discipline continued to anchor their price behavior. Across the Caucasus region (Georgia), CFR/CIF import assessments showed no major deviations from early-month levels, driven more by freight variation than changes in base commodity pricing.

In summary, the bitumen market between November 13th and 15th, 2025 demonstrated price consolidation across most regions. Seasonal demand slowdown, together with restrained crude oil volatility, supported overall stability. Market participants generally anticipated that this equilibrium would hold through the second half of November unless a significant shift in feedstock fundamentals emerged.

Iran

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13, 2025	60/70	262±3 (bulk)	FOB Bandar Abbas
Nov 13, 2025	60/70	380±3 (drum)	FOB Bandar Abbas
Nov 14, 2025	60/70	≈265–270 (bulk)	FOB Bandar Abbas
Nov 14, 2025	60/70	≈370–380 (drum)	FOB Bandar Abbas
Nov 15, 2025	60/70	272±3 (bulk)	FOB Bandar Abbas
Nov 15, 2025	60/70	370±3 (drum)	FOB Bandar Abbas

Singapore

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13, 2025	60/70	390±3	FOB Singapore
Nov 14, 2025	60/70	≈395–400	FOB Singapore
Nov 15, 2025	60/70	400±3	FOB Singapore

China

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13–15, 2025	AH-70 (#70 pen)	≈415–420	Ex-works Domestic

UAE

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13–15, 2025	60/70	400±3 (bulk)	FOB Jebel Ali
Nov 13–15, 2025	60/70	≈377–383 (drum)	FOB Jebel Ali

Iraq

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13–15, 2025	60/70	322±3 (drum)	FOB Iraq

Australia

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13–15, 2025	C170	470±3	CFR Australia

South Korea

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13, 2025	60/70	355±3	FOB Korea
Nov 14–15, 2025	60/70	≈355–360	FOB Korea

India

Date	Bitumen Grade	Price (USD/MT)	Price Basis
Nov 13–15, 2025	60/70	352±3 (bulk)	Ex-refinery India
Nov 13–15, 2025	60/70	392±3 (drum)	FOB Mundra

Emirates, and Qatar remain key drivers, underpinned by massive investments in housing, transport, and smart city projects.

Market experts say that rolled or sheet bitumen has become a vital commodity in roofing and waterproofing in view of growing environmental concerns. The shift toward polymer-modified and eco-friendly bitumen sheets is enabling longer durability with reduced maintenance costs under the harsh climatic conditions of the Middle East.
Moreover, local refineries are expanding their production capacities, thereby reducing import dependency, while the opening of new trade routes through the Red Sea and the Persian Gulf improves regional distribution efficiency.

Analysts, however, caution that volatile crude oil prices and fluctuating raw material costs may impact short-run market stability.

Although these challenges exist, the overall outlook remains positive, rooted in government-backed infrastructure programs and technology innovation in the construction materials sector. Bitumen has evolved from a simple by-product of refining into a strategic building component that reflects the region's economic diversification.

Green Bitumen Challenges Global Markets and Shapes the Future of Energy

According to Bitumenmag, in late October 2025, Saskatchewan's provincial government in Canada announced an audacious $47.5 million investment in industry-led clean technology projects that will work toward the goal of cutting emissions, improving sustainability, and increasing efficiency in bitumen recovery. This strategic push is aimed at modernizing methods of extraction, reducing carbon intensity, and positioning the province as a leader in environmentally-conscious heavy oil production. Early adopters could be at an immediate competitive advantage in both North American and global markets, analysts said.
Meanwhile, prices of Chinese wholesale bitumen have not strayed out of the range of 3,267 CNY per ton on October 31st, reflecting a modest drop of 0.34%, thus belying demand under subtle pressure even for the key Asian markets. Market commentators find that buyers are increasingly scrutinizing delivery reliability, quality verification, and price-to-performance ratios before committing to contracts.

These parallel developments suggest a deeper tension within the global bitumen economy. While Saskatchewan works to reimagine the heavy oil sector through green subsidies and technological innovation, price signals from Asia indicate that coarse demand is fragile and reactive. This sets a delicate balance for governments and producers: efficiently extracting and producing the resource in an environmentally responsible way, while being agile in the face of unpredictable market fluctuations and price sensitivity.

But should Canada manage to anchor early technology adoption and attain reputational leverage as a sustainable producer, its investment gamble may pay off. The question is whether new "green bitumen" might flood markets, depressing margins or provoking competitive pushback from conventional producers. By contrast, the pricing behavior of Asian buyers shows that they are watching closely and will pull back if the performance premium does not justify the cost.

The next several months will determine whether "green bitumen" garners loyalty among a carbon-conscious world or gets shuffled to the wayside by cheaper, carbon-heavy blends. According to market strategists, success will depend on factors such as transparency, timely delivery, and credible certification, which may have wider implications for global energy markets, trade flows, and investment strategies.

VIETNAM: BALANCING SUPPLY, DEMAND, AND REGIONAL COMPETITION

AHMAD REZA YOUSEFI – RAZIEH GILANI

Ahmad Reza Yousefi is the Managing Director of Infinity Galaxy and a PhD candidate in international entrepreneurship. With over a decade of hands-on experience in bitumen and petrochemical exports, he leads a dynamic team committed to strengthening the national economy through international trade. Ahmad Reza is known for his focus on building trust-based client relationships and delivering outstanding service.

For the past four years, he has proactively kept clients informed about industry developments, emerging trends, and market opportunities- empowering them to make timely, informed business decisions. Under his leadership, Infinity Galaxy has established specialized teams in key regional markets, providing importers with tailored support and market intelligence for strategic decision-making.

Razieh Gilani, Infinity Galaxy's Commercial Deputy, and a PhD candidate in DBA, brings more than eight years of in-depth expertise in market analysis and consultancy across the bitumen sector. Specializing in the export, trade, and shipping of bitumen and petrochemicals, Razieh focuses on high-potential markets in Africa, China, India, and East Asia. For nearly 260 consecutive weeks, she has consistently delivered actionable market insights to help industry stakeholders navigate the complexities of the global market. Working with a dedicated team of professionals, Razieh combines commercial acumen with strategic vision to deliver deep market intelligence and practical solutions, helping clients overcome challenges and capture new opportunities.

Introduction:

While the global bitumen market faces downward pressure and oversupply in late 2025, Vietnam has managed to maintain its resilience as one of Southeast Asia's most stable markets. From May to November 2025, imported bitumen prices in Vietnam declined only about 7%, despite fluctuations in Brent crude and HSFO. The average CFR price in November stood around $408–416, compared with Thailand at $404 and Malaysia at $399. This stability highlights Vietnam's market maturity and the strong link between regional supply and government-led infrastructure policies.

Key national projects- including the North–South Expressway, expansion of Cai Mep–Thi Vai port, and increased investment in industrial road networks around Ho Chi Minh City- have sustained demand throughout the year. According to the Ministry of Transport, Vietnam's annual bitumen consumption is estimated at 1.8 million tons by the end of 2025, marking an almost 9% increase compared to 2024.

Price Trend Analysis: May to November 2025

Argus reports show that Vietnam's bitumen prices dropped moderately from $425 in May to $418 in October and then to $408 in November. This mild decline, compared to sharper falls across Asia, demonstrates effective supply management and adaptive buying behavior by local importers.

Heavy monsoon rains in Q3 caused temporary delays in road projects, yet construction activities resumed strongly in September and October. During this period, HSFO prices in Singapore fell from $410 to $380/MT, putting downward pressure on bitumen. However, Vietnam's long-term CFR contracts helped absorb the impact.

In November, limited Iranian exports and reduced Singapore production triggered tighter competition between Middle Eastern and South Korean suppliers. Meanwhile, China's reduced exports to Southeast Asia opened more space for Singapore and Bahrain to increase supply. As a result, Vietnam avoided a potential shortage and maintained stable price levels.

Supply, Demand, and Smart Procurement Strategy

Vietnam's 2025 supply sources are more diversified than ever:

- Singapore and South Korea together covered about 65% of imports.
- Middle Eastern refineries (mainly Bahrain, UAE, and Iran) supplied around 20–25%.
- Supplemental suppliers from Malaysia and Indonesia balanced short-term shortages.

Importers typically adopt a staged purchasing model- buying every 30–45 days instead of large stockpiles- to hedge against currency and freight fluctuations. Meanwhile, the government has supported smoother logistics by maintaining stable tax policies and expediting customs clearance at Hai Phong and Cat Lai ports.

On the demand side, urban construction activities in Hanoi and Da Nang grew by about 15%, boosting demand for Pen 60/70 grades. Industrial projects in northern free trade zones also pushed demand for bulk bitumen shipments.

Infinity Galaxy's Role in Vietnam's Bitumen Value Chain

Infinity Galaxy, one of the active Middle Eastern suppliers in Vietnam's bitumen trade, has demonstrated significant operational efficiency and reliability throughout 2025. Leveraging its logistics network in Bandar Abbas and Jebel Ali, the company delivers cargoes promptly- often within ten days after document confirmation- a key advantage in Southeast Asia's volatile market.

Competitive features of Infinity Galaxy include:

- On-time delivery aligned with project schedules, reducing monsoon-related delay risks.
- Partnerships with leading shipping lines active in Vietnam to minimize destination costs.
- Flexible payment options that appeal to local buyers.
- Diverse packaging: Jumbo Bag 1MT, Jumbo 300Kg, and New Steel Drum suitable for humid climates.
- Full document transparency, including UAE Certificate of Origin and loading reports.

With years of experience serving Vietnam's contractors and importers, Infinity Galaxy has earned a reputation as a trusted supplier for both government and private projects.

Vietnam within the East Asian Landscape

Vietnam's bitumen market cannot be viewed in isolation. While South Korea and Singapore faced oversupply in H2 2025, Vietnam acted as a steady absorber of regional output. Compared with Thailand, Malaysia, Cambodia, and the Philippines, Vietnam's average prices remained higher yet more stable- a sign of healthy demand and balanced trade.

Southeast Asia consumed about 18 million tons of bitumen in 2025, with Vietnam accounting for roughly 10%- a notable figure for a nation of 100 million people. Seasonal weather remains the biggest factor shaping demand. Monsoon rains in June and July reduced consumption by 25%, but activity rebounded sharply by October.

Market Outlook to Q1 2026

Based on Argus data and Vietnam's infrastructure project timeline:

- The average CFR Vietnam price is expected to stay between $400–415/MT in Q1 2026.
- If Brent crude rises above $70/bbl, prices may reach $425–435/MT.
- In a downside scenario, extended rainfall or slower budget allocations could pull prices down to $390/MT.

Nevertheless, with continuous foreign investment in infrastructure and consistent supply from exporters like Infinity Galaxy, the market is entering a phase of steady, sustainable growth.

Conclusion

Vietnam is no longer merely a consumption-driven market; it has evolved into a benchmark for stability in Southeast Asia. Its combination of steady demand, supportive policies, and reliable suppliers positions it as a model for regional development.

Infinity Galaxy, through speed, transparency, and long-term cooperation, stands not only as a supplier- but as a strategic partner in Vietnam's infrastructure growth.

Advanced Review of Emerging Technologies for Next-Generation Bitumen Transportation and Processing

According to WPB, Bitumen, one of the most technically challenging heavy hydrocarbons, continues to push researchers and industrial engineers toward developing novel transportation and processing systems capable of addressing its inherent complexity. While thermal upgrading, solvent blending, and pipeline heating have remained traditional strategies, recent academic and industrial efforts have shifted toward technologies that radically reduce viscosity, increase handling safety, and enable long-distance mobility without reliance on excessive diluents. In the landscape of 2025 innovations, three clusters of technological breakthroughs have drawn special attention: microbubble-assisted separation, hybrid polymer–infrastructure solutions for pipeline transport, and thermal partial-upgrading methods designed to reshape the internal molecular structure of bitumen before transit.

Microbubble-Assisted Phase Modification

One of the most intriguing innovations involves using micro-sized gas bubbles to manipulate how heavy fractions separate and reorganize within bitumen. Microbubbles, due to their extremely large surface-area-to-volume ratio, can attach selectively to high-density asphaltene clusters. When injected under controlled frequency and pressure, they cause these clusters to detach from the colloidal suspension temporarily, reducing short-term density and altering rheological behaviour. The resulting fluid becomes more responsive to shear forces, decreasing the energy required for movement through conduits.

Microbubble technology is not a simple dilution substitute; instead, it acts like a temporary restructuring mechanism. By destabilizing dense regions of the bitumen matrix, the

AFRICAN BITUMEN MARKET AND POLITICAL-GLOBAL IMPLICATIONS

According to WPB, Bitumen is one of the most critical raw materials in the road construction and infrastructure development sectors in Africa, and its significance goes beyond being a mere technical commodity. In recent years, the rapid growth of construction projects, urbanization, and the increasing need for road networks have significantly driven up demand for bitumen. This rising demand has, in turn, intensified African countries' reliance on imported bitumen, exposing the market to economic and political fluctuations both locally and globally. This dependency, combined with geopolitical risks and regional tensions, has made Africa's bitumen market a point of strategic interest not only for the continent but also for international suppliers and investors.

In East Africa, particularly in Kenya, Ethiopia, Tanzania, and Uganda, the expansion of infrastructure projects and efforts to improve road networks have substantially increased the need for imported bitumen. Most of these countries do not have significant domestic production and rely heavily on imports to meet demand. This dependency exposes them to global price volatility in oil and bitumen, and any disruption in international supply chains can cause significant delays in road construction projects. The Port of Mombasa in Kenya serves as a primary gateway for bitumen entering East Africa, and any logistical disruption at this port could severely impact supply. As a result, countries in the region have had to implement careful management and logistical strategies to ensure a stable supply of bitumen.

In Southern Africa, the bitumen market has been affected by reduced refinery capacity and increased imports. Companies active in infrastructure, such as Raubex, have implemented multi-stage quality control systems for imported shipments to guarantee the bitumen quality for road construction projects. This demonstrates that reliance on imports, coupled with quality risks, is a major concern for both the economy and local infrastructure. Any decline in imported bitumen quality can affect the durability of roads and construction projects and increase maintenance costs, placing additional financial pressure on governments and contractors.

Furthermore, fluctuations in crude oil prices—the primary feedstock for bitumen—directly impact production and import costs. Any increase in oil prices can significantly raise the cost of construction projects in import-dependent countries.

GLOBAL GEOPOLITICAL DYNAMICS AND STRATEGIC IMPERATIVES OF BITUMEN

According to WPB, In the contemporary energy landscape, bitumen has emerged as a resource of strategic significance, with its influence extending beyond infrastructure and industrial applications into the realm of geopolitical negotiation. According to recent analyses, the global trade of bitumen is increasingly entwined with political contingencies, where the movement of raw and processed bitumen across borders is not only an economic matter but also a reflection of international power dynamics.

the past months have demonstrated that regions with substantial bitumen reserves or production capacity are increasingly leveraging these assets to fortify political influence. In Africa, for instance, countries rich in bitumen deposits, including Nigeria, South Africa, and Angola, have been navigating the complex interface of domestic energy policy and international trade agreements. The interplay between state-controlled corporations and private sector stakeholders has intensified scrutiny over the management of bitumen flows, highlighting the latent risk of resource-driven political conflicts.

Historical patterns indicate that disruptions in bitumen supply, whether due to regulatory interventions, labour strikes, or interstate disputes, can propagate substantial ripple effects throughout the global energy market. Analysts from the International Energy Research Council underscore that even marginal interruptions in bitumen transit routes can magnify pricing volatility in regional construction and road infrastructure sectors, though the actual commodity price is not the focus of this analysis. Instead, emphasis is placed on the strategic leverage conferred upon states controlling bitumen reserves.

The geopolitical utility of bitumen is increasingly evident when examining pipeline politics and export corridors. African corridors transporting bitumen from inland production hubs to coastal ports are often subject to competing claims over sovereignty, taxation, and security provisions. For example, the recently operationalized pipelines in West Africa illustrate the dual function of bitumen: a tangible industrial commodity and a geopolitical instrument capable of shaping regional alliances. According to WPB, nations strategically utilizing these transit routes can exert influence over neighbouring states, affecting both infrastructure development priorities and broader diplomatic alignments.

This duality underscores the emergent complexity in the global bitumen landscape, where infrastructure investments, state policies, and international diplomacy are intricately connected.

Moreover, the integration of bitumen into energy security frameworks reflects its multifaceted significance. While bitumen itself is primarily employed in road construction and industrial coatings, its trade intersects with broader energy logistics, as refining by-products, petrochemical derivatives, and ancillary transport systems often accompany bitumen exports. Consequently, countries endowed with bitumen reserves can manipulate market access and infrastructure dependencies to achieve geopolitical objectives, positioning bitumen as a tool for soft power projection.

Analysis of global trade patterns over the past decade reveals that political leverage derived from bitumen is not confined to supply-rich states alone. Import-dependent economies also engage in strategic manoeuvres to secure consistent bitumen flows, diversifying sources and negotiating long-term agreements. This duality underscores the emergent complexity in the global bitumen landscape, where infrastructure investments, state policies, and international diplomacy are intricately connected.

The implications for future strategic planning are profound. WPB notes that understanding bitumen's role within geopolitical frameworks requires careful monitoring of production sites, pipeline security, and regulatory environments. As energy consumption patterns evolve, particularly in rapidly urbanizing regions of Africa and Asia, the demand for high-quality bitumen is projected to rise, reinforcing the need for astute political and economic foresight.

Importantly, the political dimension of bitumen extends beyond conventional statecraft. Non-state actors, regional alliances, and multinational corporations increasingly influence access to and control over bitumen resources. Strategic investments in refining infrastructure, shipping logistics, and storage capacity serve not only commercial interests but also national security imperatives, highlighting the duality of economic and political objectives intertwined with bitumen production and distribution.

In conclusion, bitumen embodies more than a construction material; it represents a vector of geopolitical strategy and influence. According to WPB, nations adept at leveraging bitumen resources can enhance their diplomatic posture, influence regional stability, and exercise nuanced control over energy-dependent infrastructure projects. As the global political climate evolves, the strategic value of bitumen will likely intensify, reinforcing its position as a critical commodity that bridges industrial utility and political power. Comprehensive risk assessment, proactive policy design, and vigilant monitoring of bitumen flows are essential for stakeholders seeking to navigate the increasingly complex interplay between energy resources and international relations.

BIO–BITUMEN FROM RICE STRAW AS A SUSTAINABLE ALTERNATIVE

By WPB MAGAZINE

According to WPB, a growing number of scientific institutions have begun to explore unconventional methods for producing road-grade binders from renewable resources. Among these emerging approaches, the conversion of paddy stubble into bio-bitumen has gained significant attention due to its potential to address two long-standing challenges: large-scale agricultural residue burning and the persistent reliance on imported petroleum-based bitumen. This initiative, introduced by researchers working within a national road-materials development program, represents a shift in the way countries may view agricultural waste and its relationship to sustainable infrastructure.

The concept originates from a central problem that has burdened many farming regions for years: the accumulation of rice straw after harvest. Traditionally, the vast quantities of leftover stubble are disposed of through open burning, a low-cost method that unfortunately releases severe emissions, reduces air quality, and contributes to public-health complications. The issue becomes more acute in areas where climatic conditions trap these emissions close to the ground. By rethinking this biomass not as waste but as a source of industrial raw material, the project positions itself at the crossroads of environmental reform and technological innovation.

The research team responsible for this innovation has emphasized that their aim extends beyond producing an eco-friendly material. Their intention is to introduce a circular model of production that integrates farmers, laboratories, and the construction sector. In this model, agricultural residues are supplied in a structured manner, processed through thermochemical techniques, and transformed into a binder that can be used for paving roads. Such an arrangement could reduce the environmental burden associated with residue burning while creating a supplementary income stream for local communities.

From a technical standpoint, the transformation of paddy straw into bio-bitumen draws upon pyrolysis-based methodologies. During this process, the lignocellulosic

KS RUNTU LAUNCHES R321 WATER-BASED BITUMEN WATERPROOF COATING, SETTING NEW BENCHMARK IN ROOF MAINTENANCE

According to WPB, with a view to meeting the increasing challenge of roof leakages, especially on traditional asphalt-sheet roofs in the ageing building stock of China, 科顺民用建材有限公司, or KS Runtu, is launching its R321 water-based bitumen waterproof coating as a so-called "one-stop" solution for modern roof-repair needs.

The company says that R321 addresses three major industry pain points: compatibility with asphalt-based sheet membranes, safe application under extreme surface temperatures, and deep penetration for micro-crack repair. Unlike typical asphalt repair materials, R321 is engineered to bond seamlessly with SBS and APP modified bitumen membranes, filling overlaps, breaches and fine cracks to form welded-like continuity and eliminate delamination risk.

Furthermore, due to its special formulation, it reduces stickiness under high heat, even in direct sun, while remaining pliable in intense cold; this enhances safety and durability both at installation and during subsequent inspection.

It exhibits low surface tension and improved flow characteristics. The deep penetration into substrate micro-cracks allows it to reinforce waterproofing from inside the concrete rather than just providing a surface layer of protection.

Real-world case studies reinforce its performance:
A factory roof in Shandong endured rooftop temperatures above 70 °C in summer and as low as −15 °C in winter. After application, the repaired zone remained intact through a full seasonal cycle - no de-bonding in heat, no cracking in cold.
One owner said, "R321 truly delivered 'waterproof once, waterproof for good' and solved our long-standing leak problem."
In Anhui, a self-built residential roof subject to high heat, humidity and aging saw marked improvement in wind-uplift resistance and maintenance ease thanks to the coating's "foot-safe" surface and tight adhesion to membrane joints. KS Runtu believes the R321 launch now creates a paradigm shift in asphalt-based repairs, blending traditional bitumen durability with the ease and ecological benefits of a water-based system.
Speaking about the future, the company's product leader Mr Song said the firm remains committed to resolving civil-building waterproofing challenges through high-efficiency, eco-friendly, reliable one-stop solutions.

Eco Steel Collaboration in South Korea's Asphalt and Environmental Engineering Sector

By Bitumenmag

According to WPB, in November 2025, South Korea witnessed the emergence of an unusual and forward-looking alliance between leading asphalt producers and environmental engineering firms, an alliance that quickly attracted attention across the infrastructure community. Although many collaborations in the construction-materials sector typically revolve around cost reduction or regulatory alignment, this initiative, known informally as the Eco Steel collaboration, carries broader implications. It signals a shift in how highly industrialized nations may approach the durability, sustainability, and long-term adaptability of pavement systems. Rather than treating road surfaces as mere consumable infrastructure, the new effort frames them as engineered composites whose environmental footprint and metallurgical complexity warrant the same scrutiny given to advanced building materials.

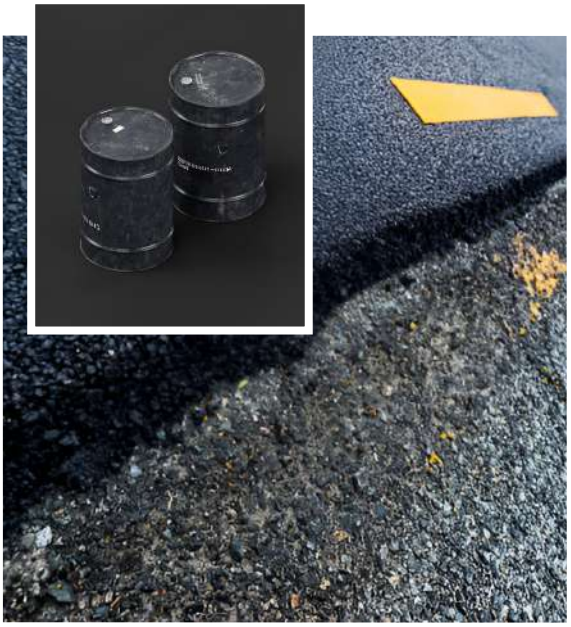
The origins of this partnership lie in several parallel pressures that converged over the past decade. South Korea's Road network, one of the most heavily used in the world

relative to land area, has faced increasing vulnerability due to high-temperature deformation in dense cities, cracking during freeze–thaw cycles, and heavy traction loads from freight movement. At the same time, rising public concern about industrial emissions has placed bitumen refining, asphalt mixing, and aggregate production under policy review. Environmental agencies have urged private companies to consider material innovation not as an optional enhancement but as an operational imperative. Meanwhile, steel mills across the country have been searching for more efficient ways to integrate their by-products into useful industrial applications rather than relegating them to long-term storage or limited-value recycling streams.

The Eco Steel collaboration forms precisely at this crossroads. It brings together asphalt manufacturers, environmental engineers, and academic laboratories specializing in composite materials, with the goal of producing an entirely new category of pavement binder. This binder would incorporate microstructured steel by-product fractions, polymer-modified bitumen, and recycled additives designed to increase mechanical stability while lowering the environmental burden of road construction. Instead of simply blending slag or dust into asphalt mixes, the project envisions a chemically interactive matrix in which bitumen, polymer chains, and micronized metallic particles mutually reinforce thermal stability and deformation resistance. The guiding principle is that steel by-products need not be passive fillers but can participate in the physical characteristics of the asphalt at the microscopic scale.

A central motivation for this research is the recognition that traditional asphalt mixtures, although effective in many climates, display limitations in environments with intense temperature gradients. South Korea's coastal and inland regions experience fluctuations that accelerate binder aging and compromise long-term flexibility. High loads in urban centers create ruts that require frequent maintenance, adding economic and environmental costs. The Eco Steel approach attempts to counter this by adjusting the viscoelastic properties of the binder through the controlled distribution of metallic microresidues. When combined with polymer modifiers, these metallic particles may restrict chain mobility within the bitumen, reducing softening under heat and increasing crack resistance during cold cycles. Early laboratory

Regional Implications of Azerbaijan's Expanding Bitumen Output for Iran, Dubai and the Middle East



According to WPB, in late 2025, the announcement of increased bitumen production and export capacity in Azerbaijan gained notable attention within regional commercial networks, particularly among suppliers, traders, and infrastructure planners across the Middle East. While Azerbaijan is not the world's largest producer of bitumen, its geographic position, logistical accessibility, and political stability give its production an influence that extends beyond its size. The rise in output must therefore be assessed not merely as a domestic industrial achievement but as a meaningful development with consequences for regional supply chains, pricing dynamics, competitive equilibria, and long-term infrastructure strategies in neighbouring countries. Iran and the United Arab Emirates, especially Dubai as a commercial hub, stand among the most exposed to shifts originating from the Caucasus. The Middle East as a whole, with its diverse but interconnected bitumen markets, will inevitably experience a ripple effect as Azerbaijan's strategic orientation evolves.

Azerbaijan's expansion reflects a broader national objective to elevate downstream petroleum products in its export portfolio. Bitumen, once a minor commodity for the country, has matured into a targeted growth sector supported by refinery modernization and efficiency improvements. These reforms enable higher volumes, more stable quality grades, and more competitive pricing in regional markets. Because the country's logistical routes through the Caspian Sea and overland corridors are increasingly integrated with Eurasian trade networks, exported bitumen from Azerbaijan can reach destinations in the Caucasus, Central Asia, Eastern Europe, and parts of the Middle East with relative ease. This emergence of Azerbaijan as a more confident bitumen supplier carries implications for trade flows traditionally dominated by Iran and, in re-export and blending form, by the UAE.

For Iran, the effect is complex. Iran has historically been one of the major bitumen exporters globally, especially in penetration-grade bitumen used widely in road construction. The country's geographic proximity to

Shifting Asphalt Economics in a Saturated Market

According to WPB, the middle weeks of November 2025 marked a subtle yet meaningful realignment in the economic landscape of asphalt and bitumen across the Middle East and parts of Asia. Although the developments emerged from different contexts—a domestic allocation program in Iran and price-driven fluctuations in East Asian trading hubs—taken together they form an interconnected narrative about how governments, refiners, and infrastructure sectors respond to a market under increasing supply-side pressure. This report synthesizes these signals into a single analytical account that reveals deeper structural transitions underway in regional bitumen economics.

Iran's decision to supply nearly ninety thousand tons of free bitumen annually to municipalities and road-building authorities was publicly framed as an urban renewal initiative. Officials emphasized the need to accelerate the rehabilitation of aging districts, particularly dense neighbourhoods where street quality had deteriorated due to years of underfunded maintenance. While the public justification centered on social priorities, the strategic implications extend well beyond urban beautification. In practice, Iran's allocation program stands at the crossroads of domestic infrastructure needs, refinery utilization strategies, and competitive positioning within the broader bitumen export market.

Domestic consumption of bitumen in Iran historically fluctuates with fiscal budgets and regional climate cycles. By guaranteeing free material to local authorities, the government effectively stabilizes a portion of annual demand that might otherwise be vulnerable to financial uncertainty at the municipal level. This stabilization serves a secondary industrial function: it protects refineries from sudden swings in domestic offtake, allowing them to optimize production cycles for both internal needs and export opportunities. Bitumen production is sensitive to refinery configurations, heavy-crude availability, and seasonal storage capacities.

When domestic demand softens unexpectedly, refiners face the choice of slowing output—inefficient and costly—or redirecting excess material into export channels, which can saturate regional markets and depress prices. The state-led distribution program mitigates this volatility.

At the same time, the regional and global marketplace for bitumen is experiencing an unusual imbalance. Several East Asian hubs, including Singapore and South Korea, have reported downward price momentum caused by a combination of weak construction demand and elevated supply from producers seeking to clear inventories accumulated during refinery maintenance cycles. Weak maritime construction, slowed government spending on highway projects, and colder-than-expected weather patterns reduced consumption in key markets. In these conditions, even modest oversupply translates into sharper price drops because bitumen lacks the fungibility of crude oil and requires dedicated logistical pathways for storage and transport.

These global price conditions inevitably interact with Iran's domestic allocation strategy. In a saturated export market, selling additional cargoes at competitive margins

becomes difficult. A government program that internalizes more of the national production effectively shields excess volumes from entering an already weakened price environment. In other words, providing free material to domestic districts is not simply a welfare-oriented gesture—it functions as an indirect price-stabilization mechanism for exporters. With less surplus flowing outward, Iranian cargoes face reduced downward pressure in international bidding cycles, preserving margins for refiners who continue to participate in regional trade.

Dubai's position as a logistics and re-export hub adds another layer to this evolving ecosystem. Shipping agents and procurement managers in the UAE have observed increased inquiries from producers outside the Gulf, including Central Asian suppliers seeking access to maritime corridors.

This diversification of supply has amplified competitive tensions in some sub-grades of bitumen, particularly those linked to viscosity-sensitive highway applications. The presence of additional suppliers theoretically provides contractors with more negotiating power. However, in a landscape where Asian benchmark prices are softening, the relative advantage depends less on absolute cost and more on reliability, grade consistency, and lead time. Iran's domestic reconfiguration—reducing unnecessary export pressure—actually positions it favourably within this matrix by allowing exporters to be selective rather than opportunistic in their outbound sales.

The interplay between domestic subsidization and global supply dynamics raises deeper questions about the future of state-supported infrastructure materials. Although Iran's bitumen allocation is framed as an internal program, similar strategies have emerged internationally in moments of market disequilibrium. When prices fall, governments often attempt to absorb excess material into public-works pipelines, partly to maintain refinery throughput and partly to stimulate construction employment. But the Iranian program carries a distinguishing characteristic: it is not merely a temporary buffer but a structurally integrated policy positioned within an ongoing urban regeneration agenda. This distinction signals that the program may persist even after global markets rebalance.

Asphalt economics are also shaped by technological expectations. While global innovation cycles appear distant from Iran's immediate distribution strategy, developments in modified binders, warm-mix technologies, and performance-graded formulations inevitably influence future competitive standards. If East Asian markets continue advancing composite binders incorporating recycled or industrial by-products, export-oriented producers in the Middle East will face rising expectations for quality differentiation. Under these circumstances, Iran's decision to guarantee domestic offtake may allow refiners greater flexibility to upgrade infrastructure without the immediate pressure of maximizing export volume. With steady domestic consumption secured, investment into polymer-modification units or enhanced QA/QC facilities becomes more feasible.

The cascading effect also extends to municipal outcomes. Receiving free bitumen alters budgeting structures for local authorities, enabling them

Advanced Review of Emerging Technologies for Next-Generation Bitumen Transportation and Processing

According to WPB, Bitumen, one of the most technically challenging heavy hydrocarbons, continues to push researchers and industrial engineers toward developing novel transportation and processing systems capable of addressing its inherent complexity. While thermal upgrading, solvent blending, and pipeline heating have remained traditional strategies, recent academic and industrial efforts have shifted toward technologies that radically reduce viscosity, increase handling safety, and enable long-distance mobility without reliance on excessive diluents. In the landscape of 2025 innovations, three clusters of technological breakthroughs have drawn special attention: microbubble-assisted separation, hybrid polymer–infrastructure solutions for pipeline transport, and thermal partial-upgrading methods designed to reshape the internal molecular structure of bitumen before transit.

Microbubble-Assisted Phase Modification

One of the most intriguing innovations involves using micro-sized gas bubbles to manipulate how heavy fractions separate and reorganize within bitumen. Microbubbles, due to their extremely large surface-area-to-volume ratio, can attach selectively to high-density asphaltene clusters. When injected under controlled frequency and pressure, they cause these clusters to detach from the colloidal suspension temporarily, reducing short-term density and altering rheological behaviour. The resulting fluid becomes more responsive to shear forces, decreasing the energy required for movement through conduits.

Microbubble technology is not a simple dilution substitute; instead, it acts like a temporary restructuring mechanism. By destabilizing dense regions of the bitumen matrix, the technique allows pipelines to transport material that would otherwise be impractically viscous at standard conditions. Laboratory demonstrations have highlighted up to 20–30% reductions in energy demand for pumping, and researchers anticipate that scaled-up versions could replace portions of the solvent volumes used today.

Hybrid Polymer Conduits for Bitumen Flow

Alongside chemical manipulation technologies, infrastructure-level innovations are gaining traction. A new generation of pipeline materials—engineered polymer--reinforced conduits—has been developed to specifically interact with high-viscosity fluids. These conduits incorporate layered composite structures: an outer structural shell, a mid-layer with thermo-responsive polymers, and an inner surface designed to minimize boundary friction.

These pipes do more than resist corrosion; their internal surfaces exhibit micro-patterned textures that reduce turbulent adhesion zones. Additionally, the thermo-responsive layer enables the pipeline to maintain a narrow heat band, distributing thermal energy efficiently across long sections. This approach mitigates the need for external heating grids and reduces the thermal gradients that traditionally caused wax and asphaltene precipitation.

Such pipelines offer increased longevity and reduced maintenance by preventing cold-spot accumulation and minimizing shutdown-related solidification. Their controlled heat-transfer environment also allows the bitumen to remain in a semi-mobile phase without reaching temperatures that degrade molecular integrity.

Partial Thermal Upgrading for Transport Optimization

Among processing innovations, partial upgrading remains one of the most revolutionary concepts for the 2025 generation. Instead of fully refining bitumen prior to transport, partial upgrading alters only certain molecular segments, decreasing viscosity while keeping the energy expenditure manageable.

This method typically involves elevating temperatures

to a moderate range that triggers molecular cracking of only the heaviest fractions. The process releases trapped volatiles, gently increases the hydrogen-to-carbon ratio, and produces a semi-upgraded product capable of flowing without significant diluent addition.

Advancements in catalytic micro-reactors have allowed this upgrading to occur with unprecedented precision. These reactors isolate heavy clusters and expose them to localized thermal pulses, avoiding the bulk-heating inefficiencies of earlier technologies. Because the upgrading is limited rather than exhaustive, fuel consumption and greenhouse gas emissions drop substantially.

Integration of Chemical, Physical, and Infrastructural Innovations

The true leap forward in 2025 lies not in any single method but in the convergence of multiple technologies. In experimental pilot systems, microbubble injection units are being integrated with partial-upgrader modules, allowing molecular restructuring and density management to occur simultaneously. Paired with polymer-engineered pipelines, these technologies form a cohesive ecosystem that could redefine bitumen logistics over the next decade.

This integrated system reduces the reliance on diluent shipping—a major economic and environmental burden—while also improving transport safety. By maintaining more stable flow characteristics, the risk of pipeline blockage and pressure spikes drops dramatically. Furthermore, the reduced thermal and chemical stress helps preserve bitumen quality for downstream refining processes.

Environmental and Operational Implications

Beyond transport efficiency, these innovations aim to support sustainability mandates. Reduced heating requirements contribute to lower operational emissions, and microbubble-based separation minimizes the use of chemical additives and washing agents. Polymer pipelines require fewer repairs, extending infrastructure lifetimes and reducing waste.

Partial upgrading also promotes cleaner refining. By delivering a more uniform feedstock, refineries consume less hydrogen during hydro processing and generate fewer contaminants. These improvements collectively position next-generation bitumen technologies not only as economically superior but as environmentally aligned with future regulatory landscapes.

Future Prospects and Research Directions

Research efforts now concentrate on automation and digital integration: real-time viscosity monitoring, adaptive microbubble dosing, and machine-learning-guided thermal control. These systems could autonomously adjust transport conditions based on feedback from sensors embedded inside pipelines and reactors.

Another frontier involves exploring non-gas micro-structures—such as nano-capsules and responsive emulsions—to interact with bitumen micelles under varying pressure regimes. These innovations could eventually replace mechanical heating altogether.

As global demand for sustainable heavy-oil handling continues, the fusion of microfluidics, advanced materials science, and precision thermal engineering is set to transform the bitumen industry. The technologies emerging from 2025 research initiatives illustrate a clear trend: mobility and efficiency no longer rely on brute-force heating or high-volume solvents, but on intelligent, structurally informed manipulation of bitumen's internal architecture.

Global Consequences of the Red Sea Disruptions: How Houthi Maritime Attacks Reshaped Energy Logistics and the Bitumen Supply Chain

According to WPB, the escalating instability in the Red Sea throughout late 2025, driven by the renewed maritime aggression of Yemen's Houthi movement, has evolved into far more than a localized security issue. What began as a series of targeted attacks on commercial vessels near the Bab el-Mandeb strait has transformed into a larger geopolitical disturbance affecting global trade, energy flows, and specialized downstream markets—including the heavily transport-dependent bitumen sector. Although conflicts in this region are not new, the nature of the disruption in 2025 introduced patterns that shook global shipping corridors in unprecedented ways.

At the center of the crisis lies the strategically indispensable Red Sea route, a maritime channel through which a significant portion of global oil and refined products traditionally pass. When the Houthi forces intensified their operations, claiming political motives tied to regional rivalries, commercial shipping companies were forced to reconsider their long-established reliance on the passage. While the broader oil market had experienced disruptions in earlier years, the 2025 incidents were marked by their timing, scale, and deliberate targeting of vessels associated with specific states or flagged under certain jurisdictions.

The consequences of these attacks extended immediately to the global oil supply chain, raising not only security concerns but also inflating logistical risks. Insurance premiums for vessels transiting through the Red Sea soared. Maritime risk assessors categorized the region as "high--volatility," sending ripples across freight cost indexes. Vessel operators began diverting tankers around the Cape of Good Hope—a detour adding thousands of kilometers to typical voyages. This diversion significantly altered delivery schedules, increased fuel consumption, and strained fleet availability during an already tight global shipping cycle.

Within this broader turbulence, the bitumen industry—often overshadowed by crude oil and fuels—faced its own extraordinary complications. Unlike crude oil, bitumen is typically shipped in specialized heated tankers or in containerized drums, both of which rely heavily on predictable maritime logistics. Any unexpected rerouting or delay threatens the stability of supply, especially for countries engaged in seasonal road-building cycles. As a result, the disruptions of 2025 forced refiners, suppliers, and import-dependent governments to confront new vulnerabilities that had rarely been assessed in earlier supply-chain modelling.

The direct impact on bitumen exports from the Middle East became immediately visible. Producers located near the Gulf relied on Red Sea access to reach African, Mediterranean, and some European markets within competitive

Global Implications of Namibia's Sands-Retreatment Initiative: A Deep-Dive into Its Potential Effects on the International Bitumen Market

According to WPB, in November 2025, Namib Minerals' announcement of its operational collaboration with Bitumen World Mining (BW Mining) marked an unexpected but strategically relevant development for the global bitumen sector. Although the company is primarily known for mineral and gold-related operations, its decision to engage in large-scale sands retreatment introduces a technological pathway that could, under the right conditions, influence heavy-oil, bitumen-feedstock, and asphalt supply dynamics worldwide. This report examines the nature of sands--retreatment technology, the mechanisms through which such projects may generate bituminous materials, and the economic, geopolitical, and environmental implications for global bitumen markets.

1. Understanding the Sands-Retreatment Process and Its Link to Bitumen Production

"Sands retreatment" refers to the reprocessing of previously exploited or partially processed sandy ore bodies—materials often discarded in tailings facilities. In many geological environments, such sands contain hydrocarbon-bearing fractions, including semi-solid bituminous matter, which older extraction technologies either could not process effectively or dismissed as uneconomical.

Modern retreatment leverages breakthroughs in:

1. Surfactant-assisted liberation – chemical formulations that detach hydrocarbon residues from mineral grains and significantly increase recovery efficiency.
2. CO_2-boosted solvent extraction – a hybrid system using compressed CO_2 to reduce viscosity and accelerate component separation.
3. Ultrasonic agitation technologies – high-frequency sonication that destabilizes the bond between sand particles and hydrocarbon films.
4. Thermal-hydraulic hybrid systems – controlled heating combined with mechanical shear to mobilize heavy-bitumen remnants.

These methods allow operators to treat massive, previously untouched sand volumes with high recovery rates at materially reduced costs compared to older oil-sands technology. As a result, sands retreatment is evolving from a niche procedure into a potential alternative source of bitumen feedstock.

2. Why Namibia's Project Matters More Than Its Scale Suggests

Although Namib Minerals' project is not initially expected to rival Canadian or Venezuelan heavy-oil assets in raw volume, its significance lies in four strategic dimensions:

2.1 Proof-of-Concept in a New Geological Region

Sub-Saharan Africa has rarely been associated with commercial-scale bitumen-sands extraction. A successful retreatment project would signal the existence of underexplored heavy-oil resources across similar geological belts, prompting upstream investments in regions previously ignored by hydrocarbon developers.

2.2 Technology Deployment Outside Traditional Oil-Sands Hubs

Most advanced bitumen extraction technologies were concentrated in Canada and select Asian facilities. Namibia's involvement broadens the geographical spread of these technologies, diversifying bitumen supply chains and reducing regional concentration risks.

2.3 Lower Entry Barriers Compared to Raw Oil-Sands Mining

Classic oil-sands mining demands massive investments in overburden removal, crushing, upgrading, and waste management. In contrast, sands retreatment focuses on pre--existing materials already excavated—meaning:

lower CAPEX, minimal geological uncertainty, reduced permitting and environmental resistance.

This lower threshold could accelerate replication of the

model elsewhere.

2.4 The Potential to Convert Waste into Marketable Bitumen Feedstock

Tailings and residual sands are typically environmental liabilities. If they become economically valuable through retreatment, companies globally may reassess the revenue potential of untapped tailings. This shift could bring thousands of megatons of "waste" back into the productive economic cycle.

3. Technical Pathways for Bitumen Output from Retreated Sands

Not all sands contain the same hydrocarbon profile. The resulting product may vary along a spectrum:

1. Bitumen-like heavy hydrocarbons suitable for asphalt production.
2. Intermediate residues requiring upgrading or hydrotreatment.
3. Viscous hydrocarbons appropriate as feedstock for refineries equipped with coking or residue-conversion units.

The viability of Namib's output depends on:

viscosity index, sulfur and metal content, saturates-to-asphaltenes ratios, microcarbon residue,

and energy-correction factors.

If results fall within industry thresholds, Namibia could quickly become a regional supplier of heavy feedstock for asphalt plants in Africa, the Middle East, and South Asia.

4. Potential Impacts on Global Bitumen Markets

4.1 Pricing Dynamics

Bitumen pricing is heavily influenced by regional imbalances in supply and demand. Even modest new sources can affect pricing in interconnected markets:

An incremental rise in heavy-feedstock availability can reduce premiums in deficit regions.

Asphalt producers may benefit from cheaper inputs, especially in Africa and South Asia, where infrastructure spending is accelerating.

Traders may use Namibian volumes as leverage in contract negotiations with traditional suppliers.

NOVEMBER 2025

GLOBAL BITUMEN RENAISSANCE: HOW INFRASTRUCTURE BOOMS, TECHNOLOGICAL SHIFTS, AND MARKET FORECASTS ARE RESHAPING THE ASPHALT INDUSTRY TOWARD 2035

According to WPB, the global bitumen market is entering a transformative decade, shaped by unprecedented infrastructure expansion, evolving material science, and a steady shift toward specialized performance-grade binders. Recent analyses paint a consistent picture: the bitumen sector—long considered a traditional, slow-moving commodity market—is now experiencing structural renewal across Asia, Europe, the Middle East, Africa, and the Americas. This renewed momentum is driven by government-funded megaprojects, the demand for highly durable asphalt mixes, a surge in urbanization, and the emergence of bio-based alternatives that could complement or partially disrupt conventional petroleum-derived bitumen.

Global demand for bitumen is projected to expand significantly toward 2034 and beyond, potentially reaching USD 128.3 billion by 2034, supported by a compound annual growth rate ranging from 3.9% to 5.6%. While demand is strongest for paving applications—still representing nearly 85% of global consumption—the roofing sector, high-performance polymer-modified binders, and sustainable alternatives such as bio-bitumen are rapidly gaining market share.

Mega-infrastructure projects are emerging as the primary growth engine. Developing and transition economies are intensifying infrastructure investment. India, China, Indonesia, Saudi Arabia, Türkiye, and several African nations have adopted ambitious national development roadmaps requiring massive asphalt output. Projects like India's Bharatmala and Gati Shakti, China's expressway expansion, and Saudi Arabia's Vision 2030 initiative collectively create a surge in bitumen demand.

This surge pushes the global market into a new phase of demand elasticity, where supply chains must adapt to more complex logistics and higher performance requirements. The durability of asphalt has become critical, particularly in regions facing extreme temperatures, heavy vehicle loads, or accelerated urban traffic growth. Polymer-modified bitumen (PMB) is gaining central importance, as governments shift from traditional penetration-grade specifications to performance-based criteria. High-grade pavements are required for new expressways, airports, and intercity corridors, particularly in China, the United States, and the Gulf countries.

Urbanization continues to dominate bitumen consumption patterns. Currently, over 56% of the world's population lives in urban environments, expected to reach 68% by 2050. Urban expan-

Advanced Strategies for Bitumen Storage and Management

According to WPB, the storage and management of bitumen represent one of the most technically and energetically demanding aspects of the asphalt binder supply chain. As the global demand for high-quality asphalt and road infrastructure grows, refining and construction industries face increasing pressure to maintain binder integrity while reducing operational costs and minimizing environmental impact. Recent research in 2025 emphasizes that choosing the appropriate storage method—be it continuous high-temperature heating, dynamic temperature regimes, or insulated/ambient storage—significantly influences bitumen quality, operational efficiency, and sustainability outcomes.

Bitumen, a viscous semi-solid hydrocarbon material, exhibits temperature-dependent rheological properties that necessitate careful handling during storage and transport. Improper storage can lead to thermal degradation, phase separation, oxidative ageing, and contamination, all of which compromise performance characteristics such as penetration, softening point, and adhesion in asphalt mixtures. This review explores three primary storage methodologies, evaluates their benefits and drawbacks, and provides insights for infrastructure planners, asphalt producers, and sustainability strategists.

Method A: Conventional High-Temperature Storage

Conventional high-temperature tank storage remains the most widespread method. In this approach, bitumen is maintained at elevated temperatures, typically between 140°C and 160°C, to preserve low viscosity and ensure continuous pumpability. The 2025 UK study "Techno-economic assessment of decarbonizing bitumen storage heating" highlighted that maintaining tanks at approximately 150°C allows for immediate off-take and reduces logistical delays.

Advantages:

Immediate availability and pumpability without need for preheating prior to dispatch.

Established operational protocols widely known across global asphalt terminals.

Minimal risk of solidification or viscosity-related flow issues.

Limitations:

Energy-intensive operation leading to high costs and substantial carbon emissions.

Continuous high-temperature exposure accelerates thermal oxidative ageing, potentially reducing binder lifespan.

Environmental sustainability goals are challenged due to high energy consumption and greenhouse gas emissions.

This approach, while operationally reliable, increasingly faces scrutiny due to escalating energy costs and stricter carbon reduction mandates. Studies suggest that integrating complementary strategies, such as improved insulation and optimized heating cycles, can mitigate some of these concerns.

Method B: Dynamic/Reduced-Temperature Regimes

A more adaptive strategy involves implementing dynamic storage regimes. In this model, the temperature within storage tanks fluctuates according to operational demand: for instance, maintaining 140–160°C during peak handling periods and lowering temperatures during inactive phases. The 2025 study "Thermal Behavior Investigation of Bitumen Embedding Straight-Run Distillation Bitumen" demonstrated that controlled temperature fluctuations minimally affect binder rheology while significantly reducing thermal energy consumption.

Advantages:

Moderate reduction in energy consumption and associated emissions.

Lower cumulative thermal stress reduces the risk of oxidative ageing, maintaining long-term binder performance.

Flexibility in operational planning and potential cost savings.

Limitations:

Requires precise monitoring and control systems to avoid viscosity exceeding pumpable thresholds.

Risk of thermal gradients or stratification in large tanks, potential ly leading to uneven binder properties.

Higher operational complexity necessitates staff training and potential automation investments.

Dynamic temperature regimes strike a balance between operational readiness and sustainability objectives, positioning them as a preferred compromise for many mid-sized refineries and asphalt storage facilities.

Method C: Insulated or Ambient/Low-Temperature Storage

Insulated or ambient storage represents a forward-looking alternative. Here, bitumen is maintained at significantly lower temperatures through high-grade insulation, phase-change materials,

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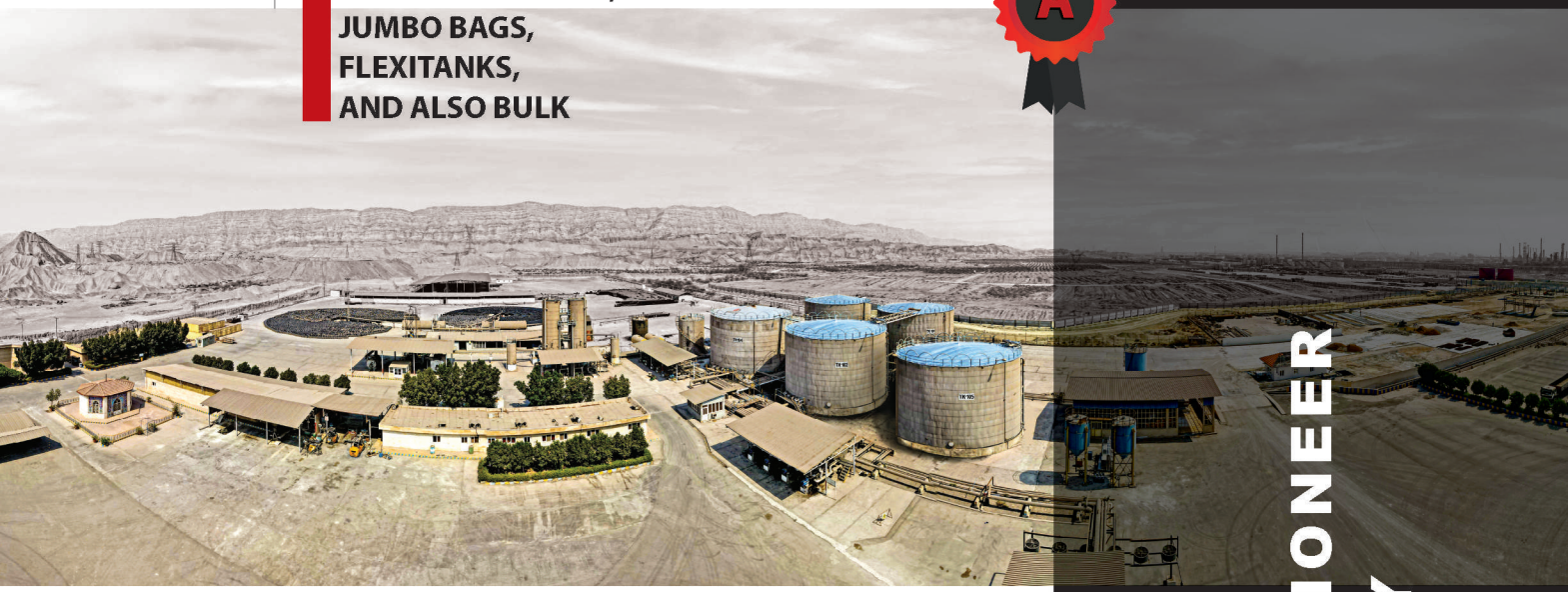

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