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THE WORLD OF PETROLEUM AND BITUMEN

亚洲沥青生产商与消费者之间的桥梁

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EDITOR'S MESSGAE

With a decade of activity in the bitumen and petroleum derivatives industry in the field of printing and publishing specialized news and selected scientific articles from conferences, symposiums, research centers and universities, and introducing brands and companies producing petroleum and bitumen, the World of Petroleum and Bitumen Journal has been able to gain the trust of more than 6000 permanent audience in such a way that they would like to receive the print version of the journal every month.

Ali farjam

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Iran China Bitumen Exhibition

Iran China Bitumen Exhibition:

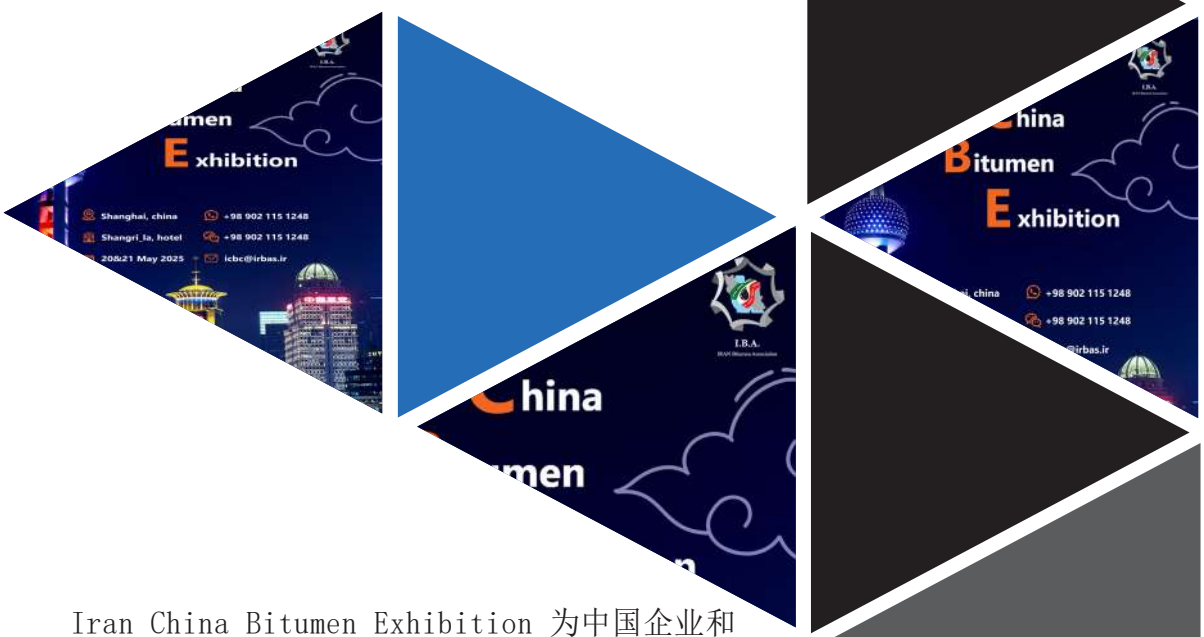
A Unique Opportunity for Direct Engagement with Iran's Bitumen Industry

伊朗–中国沥青展览会：

与伊朗沥青产业直接对接的绝佳机遇

伊朗沥青协会将于2025年5月20日至21日在上海香格里拉大酒店首次举办一场专业且大型的展览会，名为Iran China Bitumen Exhibition。WPB杂志作为此次盛会的媒体合作伙伴，将担任伊朗沥青协会的新闻传播支持机构，全面报道此次展会。

此次特别活动是首次在中国本土举行的此类盛会，汇聚了伊朗90%以上最活跃、最具影响力的沥青和沥青混合料生产企业。伊朗沥青协会，作为覆盖全国沥青供应链的200多家企业的行业组织，是本次展会的主办方。



Iran China Bitumen Exhibition 为中国企业和代表提供了一个前所未有的机会，可以面对面会见伊朗沥青市场的核心企业，直接获取来自一手渠道的价格信息和市场动态，并探索双方的商业合作潜力。

在本次展会中，中国公司和代表们将能够：

- 与伊朗顶尖沥青制造商直接交流；
- 获取关于价格、产能及出口政策的第一手资讯；
- 共同探讨发展双边合作的机会；
- 并通过参与专业论坛和会议，在行业内建立高效的联系网络。

伊朗－中国沥青展览会将成为连接亚洲两大沥青产业中心的重要桥梁。

WPB: For the first time, the Iran Bitumen Association is organizing a large-scale and specialized exhibition titled Iran China Bitumen Exhibition, set to take place on May 20–21, 2025, at the Shangri-La Hotel in Shanghai. As the official media partner of this major event, WPB Journal will support the exhibition through its media coverage and serve as the news arm of the Iran Bitumen Association.

This special event marks the first gathering of its kind on Chinese soil, featuring participation from over 90% of the most active and influential bitumen and asphalt producers from Iran. The Iran Bitumen Association, which represents more than 200 companies across the country's bitumen supply chain, will be the main host of the event.

The Iran China Bitumen Exhibition offers a unique platform for Chinese companies and representatives to meet key players in the Iranian bitumen market, receive first-hand updates on prices and market trends directly from the source, and explore potential avenues for commercial cooperation.

At this exhibition, Chinese companies and delegates will have the opportunity to:

- Engage directly with leading Iranian bitumen producers;
- Access first-hand information on pricing, production capacities, and export policies;
- Explore joint opportunities for bilateral cooperation;
- And build strong industry-level connections by attending expert panels and specialized meetings.

The Iran China Bitumen Exhibition will serve as a bridge between two major poles of the bitumen industry in Asia.

WPB BITUMEN MAGAZINE ICBE

特朗普关税引发的全球沥青市场地震：亚洲与非洲的赢家与输家

AHMAD REZA YOUSEFI – RAZIEH GILANI
INFINITY GALAXY

Ahmad Reza Yousefi 是 Infinity Galaxy 的董事总经理，同时也是国际创业学博士候选人，拥有超过十年的沥青与石化产品出口经验。他带领一支充满热情的团队，致力于通过出口业务促进国家经济发展。他始终专注于与客户建立信任并提供卓越服务。在过去四年中，他持续为客户提供行业动态、市场趋势和深度洞察，帮助他们做出明智的商业决策。

Infinity Galaxy 拥有一支专注于亚洲市场（尤其是印度）的专业团队，致力于为进口商提供量身定制的支持，协助他们及时、有效地采购。

Razieh Gilani 是 Infinity Galaxy 的出口经理，在沥青及航运行业拥有超过八年的专业经验。她在非洲、中国、印度和东亚市场的沥青和石化产品贸易与出口方面具有深厚专长。过去 200 多周，她持续发布市场分析报告，为行业参与者提供基于最新趋势的决策支持。她与一支具备商业洞察力的专业团队紧密合作，通过提供深度见解与战略建议，积极应对市场挑战。

Infinity Galaxy 是一家享有盛誉的沥青与石化产品供应商，在全球市场拥有 10 多年成功经验。我们不仅仅是一个卖家，我们的使命是为客户提供安全、盈利且无忧的采购体验。

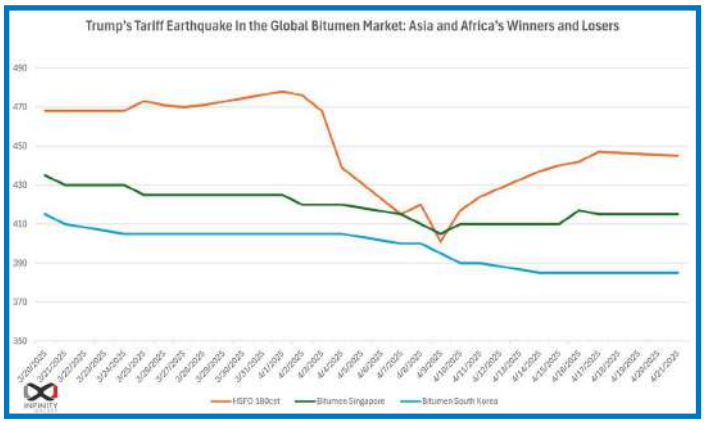
为了实现这一目标，我们每周发布市场分析报告，帮助客户在最佳时机、最优条件下做出采购决策。从下订单到货物交付的全过程，我们始终陪伴在您身边，确保整个流程高效、安全、顺畅。

近年来，许多中国公司因从不可靠的供应商处采购而遭受重大损失，反映出中国市场对价格和供应商信誉的高度敏感。Infinity Galaxy 深刻理解中国客户的特殊需求，提供种类齐全、符合标准的优质沥青产品，并根据中国市场提供极具竞争力的价格。
我们的专业支持团队全天候通过微信、阿里巴巴及电子邮件等主流中文平台，为您提供全面服务，确保您的每一笔交易安心无忧。

如果您正在寻找一个值得信赖、专业响应、了解中国市场的长期合作伙伴，Infinity Galaxy 是您明智且安全的选择。

市场分析导语：

随着唐纳德·特朗普于 2025 年 4 月 2 日起实施大范围贸易关税，全球沥青市场进入前所未有的新阶段。来自 Argus、Platts 以及 2025 年初市场趋势的数据显示，此举显著重塑了价格和出口路线。



亚洲市场：

在全球经济衰退的预期下，布伦特原油价格在 2 月至 4 月中旬从约 79 美元/桶下跌至 60 美元/桶，降幅超过 24%。与此同时，作为亚洲沥青价格主要参考指标的新加坡 CST180 燃料油价格从 450 美元/吨降至 390 美元/吨，跌幅达 13%。因此，新加坡的散装沥青价格从约 450 美元降至 400 美元以下，韩国沥青价格也从约 425 美元降至 395 美元。

东南亚地区也发生重大变化。例如，越南由于大规模基础设施和道路项目的推进，其沥青消费量增长了高达 30%，预计 2025 年将超过 120 万吨。相比之下，中国和印度的需求表现疲弱。中国因人民币贬值、建筑放缓以及与美国的贸易摩擦，国内沥青消费下降。少数报告甚至指出，中国向邻国出口沥青，进一步拉低了整个东亚地区的价格。

非洲市场：

在非洲，南非 Natref 炼油厂的关闭使该国沥青产量归零，完全依赖进口。随之而来的是中东地区向南非的沥青出口激增，3 月和 4 月间，中东对非洲的沥青出口总量增长超过 25%。

欧洲市场：

欧洲的沥青价格跌幅相对温和。地中海地区的沥青价格维持在每吨 410 至 450 美元之间波动。欧洲买家的采购成本略有下降，大多数交易价格比关税政策出台前便宜 10 至 15 美元。

国际能源署（IEA）指出：“随着 4 月初贸易紧张局势的急剧升级，全球经济前景恶化，我们下调了今年的原油需求增长预测。”这一担忧也波及至精炼油品的出口市场。

出口路线变化：

出口路线出现明显变动。韩国对越南的沥青出口在近几个月增长了约 20%，而新加坡在越南的市场份额则从去年约 55% 下降到不足 45%。

在需求方面，非洲和亚洲买家受益于供应选择增加。在部分东非港口，报价下降多达 10%，付款条件也变得更加灵活。

随着这些局势持续，预计 2025 年全球沥青市场将经历更多波动与调整。

总部位于阿联酋的 Infinity Galaxy 不仅提供产品，更提供决策支持。凭借精准数据分析、专业咨询与全方位服务，我们帮助客户把握时机、规避风险，从市场波动中获取最大收益。
查看最新价格，请访问 Infinity Galaxy 官方网站的【沥青价格】页面。

Evaluating the Safety of Recycled Asphalt: A Fresh Perspective

评估再生沥青的安全性：一种全新的视角

据WPB报道，田纳西大学的最新研究揭示了在道路建设中使用再生沥青的安全性与性能问题。在美国，超过90%的铺装道路使用的是沥青，而沥青是一种高度依赖不可再生石油资源的材料，因此寻找可持续替代方案已成为当务之急。回收沥青路面（RAP）是一种解决方案，它通过将旧路面重新加工，制成新的沥青混合料。虽然美国近95%的新沥青项目中都加入了某种比例的RAP，但其在长期安全性和性能方面与新沥青相比仍存在疑问。

什么是RAP？为什么要使用它？

传统沥青由沥青粘结剂（源自石油的黑色粘性物质）和矿质骨料（如沙子、砾石或碎石）混合而成。这些材料结合在一起形成坚固的路面，但两者均来自有限的资源。RAP通过再加工旧路面材料，提供了一种更可持续的解决方案。通过专业设备，将现有的道路层研磨，再与新沥青粘结剂以及必要的新增骨料混合，制成新的沥青混合料。这一过程有助于降低碳排放，减少对原材料的依赖，但RAP路面的耐久性和安全性尚未像传统沥青那样被充分研究。

摩擦力与骨料的作用

关于RAP的一个主要关注点是它在潮湿条件下是否能维持足够的防滑性能。防滑性是指路面对轮胎提供足够摩擦力，以防止车辆打滑或水滑，是道路安全的关键。这种摩擦力主要依赖于骨料的表面质感。虽然新骨料的摩擦性能已被广泛研究，但RAP

中的骨料因被沥青包裹，其特性难以辨别，研究较少。

由于大约75%的与天气相关的交通事故发生在湿滑道路上，RAP的摩擦性能成为道路安全评估中不可忽视的一部分。了解RAP是否能提供与新材料相当的抓地力，对工程师在追求可持续性的同时保障性能至关重要。

RAP性能的研究

为了解决这些不确定性，田纳西大学的研究团队采用了一种系统的方法来分析RAP的摩擦性能。他们首先将再生沥青中的骨料分离出来，使用两种方法：一种是用锤子敲碎材料，物理破开；另一种是用化学溶剂溶解沥青，从而提取骨料。

在获得裸露骨料后，研究人员对其进行了化学分析，以识别其组成，特别是硬质矿物如硅的含量。较硬的矿物在交通磨损下更能保持表面质感，因此长期提供更好的摩擦力。

测量摩擦特性

研究人员还使用了一种骨料图像测量系统，对骨料的形状、棱角度（即颗粒的尖锐或不规则程度）和表面质感进行详细图像分析，这些因素都会直接影响轮胎与路面的接触性能。

通过将矿物硬度和表面特征与摩擦性能进行关联，研究团队希望评估RAP骨料在高风险区域（如弯道和路口）是否具备与新骨料相当的安全性。如果RAP表现良好，这一发现将帮助交通运输部门在不牺牲安全的前提下，优化RAP的使用比例和适用范围。

结论

这项研究强调，虽然RAP为实现更环保的道路建设提供了可行路径，但其材料的细致评估必不可少。通过深入研究再生骨料的摩擦特性，工程师可以做出有数据支持的决策，在兼顾可持续发展的同时，确保道路安全。

来源：Bitumenmag

哈萨克斯坦计划在2025年将道路沥青产量提高32%，目标超过100万吨

据《Bitumenmag》报道，哈萨克斯坦的三大主要炼油厂正计划在2025年大幅提升道路沥青产量，预计总产量将达到107.6万吨，较2024年预估的81.6万吨增长32%。这一预测来自四位熟悉炼油厂发展计划的业内消息人士。

预计各厂产量如下：Caspi Bitum 将生产40.5至41万吨，Pavlodar 炼油厂预计产量为36.6万吨，Qazaq Bitum 计划贡献约30万吨。

哈萨克斯坦能源部以及相关企业尚未对上述预测作出正式评论。

在过去一年中，Caspi Bitum 的产量由上一年的358,155吨下降至242,877吨；与此同时，Pavlodar 炼油厂产量从289,440吨上升至360,278吨；Qazaq Bitum 的产量也由113,184吨提升至213,140吨。

根据哈萨克斯坦燃料与能源行业形势分析中心（SACFEC）和行业内部人士的数据，三大主要炼油厂的总产量比上一年的总产量（760,780吨）增加了55,515吨。

目前，哈萨克斯坦四大主要沥青生产企业（Caspi Bitum、Pavlodar 炼油厂、Qazaq Bitum 和 Asphaltobeton-1）的年产能约为120万吨。

Pavlodar 炼油厂通过其沥青装置中新炉的投运，使其加工能力提升了约15%，从而实现了产能扩张。

Caspi Bitum 也正在实施现代化升级项目，目标是将原油处理能力提高至每年150万吨。该升级计划将于2024年11月至2025年4月期间进行，届时该厂的沥青年产量有望提升至75万吨。

预计2025年哈萨克斯坦的道路沥青消费量将保持在约100万吨，与上一年持平。

为确保供应充足，哈萨克斯坦已批准每年最多从俄罗斯进口50万吨沥青的配额。此外，Qazaq Bitum 和 Asphaltobeton-1 正在加工真空残渣（重油焦油，俗称“古德隆”），相关年进口上限为28万吨。

价格概况

Caspi Bitum 的道路沥青批发价格已从此前的每吨190,000 – 195,000坚戈（含增值税，出厂价）下调至185,000 – 190,000坚戈。Pavlodar 炼油厂的价格保持稳定，仍为每吨125,000至140,000坚戈（含增值税，出厂价），自1月初以来未发生变化。

由于季节性需求减少，市场价格受到一定压力。一位贸易公司人士指出，道路建设季尚未开始，这是当前

订单稀少的主要原因。

建筑公司已开始在冬季储备沥青，以避免夏季施工高峰期间可能出现的短缺，尤其考虑到Caspi Bitum即将进行的设备检修与升级。

在俄哈边境，俄罗斯沥青的价格为每吨170至190美元（不含国内税）。

据市场贸易商估算，2024年12月通过铁路进口至哈萨克斯坦的俄罗斯沥青约为857吨，而进口用于国内加工的真空残渣接近17,000吨。

来源：Bitumenmag

Kazakhstan Targets 32% Growth in Road Bitumen Output in 2025, Aiming for Over 1 Million Tons

According to bitumenmag, Kazakhstan's three primary refineries are preparing to significantly expand their road bitumen production in 2025, with projected output reaching 1.076 million tons—a 32% increase compared to the estimated 816,000 tons for 2024. This forecast is based on insights from four sources closely acquainted with the refineries' development plans.

The anticipated production figures are as follows: Caspi Bitum is set to deliver between 405,000 and 410,000 tons, Pavlodar Refinery is expected to produce 366,000 tons, and Qazaq Bitum plans to contribute approximately 300,000 tons.

The Ministry of Energy and the companies involved have not provided any official comments regarding these projections.

In the past year, Caspi Bitum saw a decrease in output, dropping to 242,877 tons from 358,155 tons in the previous year. Meanwhile, Pavlodar Refinery increased its production to 360,278 tons from 289,440 tons, and Qazaq Bitum raised its output to 213,140 tons from 113,184 tons.

Combined production from the three main plants rose by 55,515 tons compared to the previous year's total of 760,780 tons, based on data from the Situation-Analytical Center for the Fuel and Energy Sector (SAC FEC) and industry insiders.

The current annual production capacity of Kazakhstan's four leading producers — Caspi Bitum, Pavlodar Refinery, Qazaq Bitum, and Asphaltobeton-1 — is estimated at around 1.2 million tons.

Pavlodar Refinery's capacity expansion was made possible through the commissioning of a new furnace in its bitumen unit, which increased processing ability by approximately 15%.

Caspi Bitum is also undertaking a modernization project to raise its crude oil processing capacity to 1.5 million tons per year. This upgrade, scheduled to take place from November 2024 through April 2025, is expected to enable the plant to increase bitumen output to 750,000 tons annually.

Kazakhstan's road bitumen consumption is forecasted to remain steady at around 1 million tons in 2025, consistent with the previous year's demand.

To ensure adequate supply, the country has authorized an annual import quota of up to 500,000 tons of Russian bitumen. In addition, Qazaq Bitum and Asphaltobeton-1 are processing vacuum residue (gudron), with a total annual import limit set at 280,000 tons.

Price Overview

Wholesale prices for road bitumen at Caspi Bitum facilities have declined to a range of 185,000–190,000 tenge per ton from the earlier level of 190,000–195,000 tenge per ton (VAT included, EXW). Prices at Pavlodar Refinery remain stable, ranging between 125,000 and 140,000 tenge per ton (VAT included, EXW), unchanged since early January.

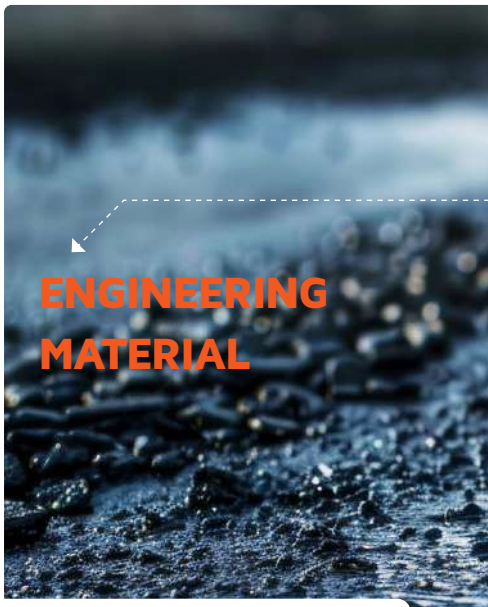
Market prices have come under pressure due to reduced seasonal demand. A source from a trading firm noted that the road construction season had not yet begun, which was contributing to the lack of orders.

Construction firms have started stockpiling bitumen during the winter months to avoid potential shortages in the summer peak season, especially in light of the scheduled shutdown at Caspi Bitum for plant modernization.

At the border between Russia and Kazakhstan, Russian bitumen is priced at $170 to $190 per ton, excluding domestic taxes.

In December, railway deliveries of Russian bitumen into Kazakhstan amounted to approximately 857 tons, while imports of vacuum residue for domestic processing reached close to 17,000 tons, based on estimates from market traders.

Analysis of Bio-Derived Additives



Advanced Physicochemical Compatibility Analysis of Bio-Derived Additives and Petroleum Bitumen Through Solubility Parameter Methodologies

WPB: As environmental imperatives grow increasingly urgent due to climate change and resource depletion, the construction industry—particularly the paving sector—is under significant pressure to reduce its reliance on petroleum-derived bitumen. Bitumen, an essential component in asphalt production, is traditionally sourced from non-renewable crude oil. However, global sustainability goals and the pursuit of carbon neutrality have catalyzed intensive research into renewable, eco-friendly alternatives. Among these, bio-based materials present a particularly promising path forward, offering the potential to serve as either partial modifiers or complete substitutes for conventional bitumen. Yet, despite their potential, the integration of such bio-additives remains a complex challenge, primarily due to the inconsistent performance outcomes arising from incompatible physicochemical interactions.

In response to this challenge, the application of solubility science, particularly the Hansen Solubility Parameters (HSP), offers a systematic and predictive framework for evaluating the molecular compatibility between bitumen and various bio-based additives. Bitumen, a chemically intricate substance, consists of a continuum of polar and nonpolar constituents, typically categorized into maltenes (a blend of saturates,

aromatics, and resins) and asphaltenes (the highly polar, complex fraction). The interaction between these constituents and bio-additives determines the resulting rheological performance, structural stability, and long-term durability of the bio-modified bituminous binder.

In this context, a comparative assessment was conducted involving two bio-sourced additives: tall oil (referred to as Bio-Additive-1), a by-product of wood pulping processes rich in rosin acids and fatty acids, and waste cooking oil (Bio-Additive-2), a common residual lipid-based feedstock. To quantitatively analyze the miscibility potential of these additives with petroleum bitumen, the HSP values—defined by the three-component system of dispersion forces (δD), polar interactions (δP), and hydrogen bonding (δH)—were determined for both additives and the bitumen fractions. The degree of compatibility was further examined through the concept of Hansen interaction radius and the geometric overlap of Hansen spheres, which provides a visual and numerical measure of solubility affinity.

Complementing this theoretical compatibility analysis, a suite of rheological evaluations was undertaken to investigate how molecular miscibility translates into macroscopic performance characteristics. Frequency sweep tests were utilized to observe the temperature-dependent viscoelastic behavior of the modified binders. The Linear Amplitude Sweep (LAS) method enabled the quantification of fatigue resistance under cyclic loading, and the Bending Beam Rheometer (BBR) provided insights into the low-temperature stiffness and relaxation properties, which are critical for assessing thermal cracking susceptibility in cold climates.

compatibility potential, thereby reducing the reliance on empirical trial-and-error methodologies.

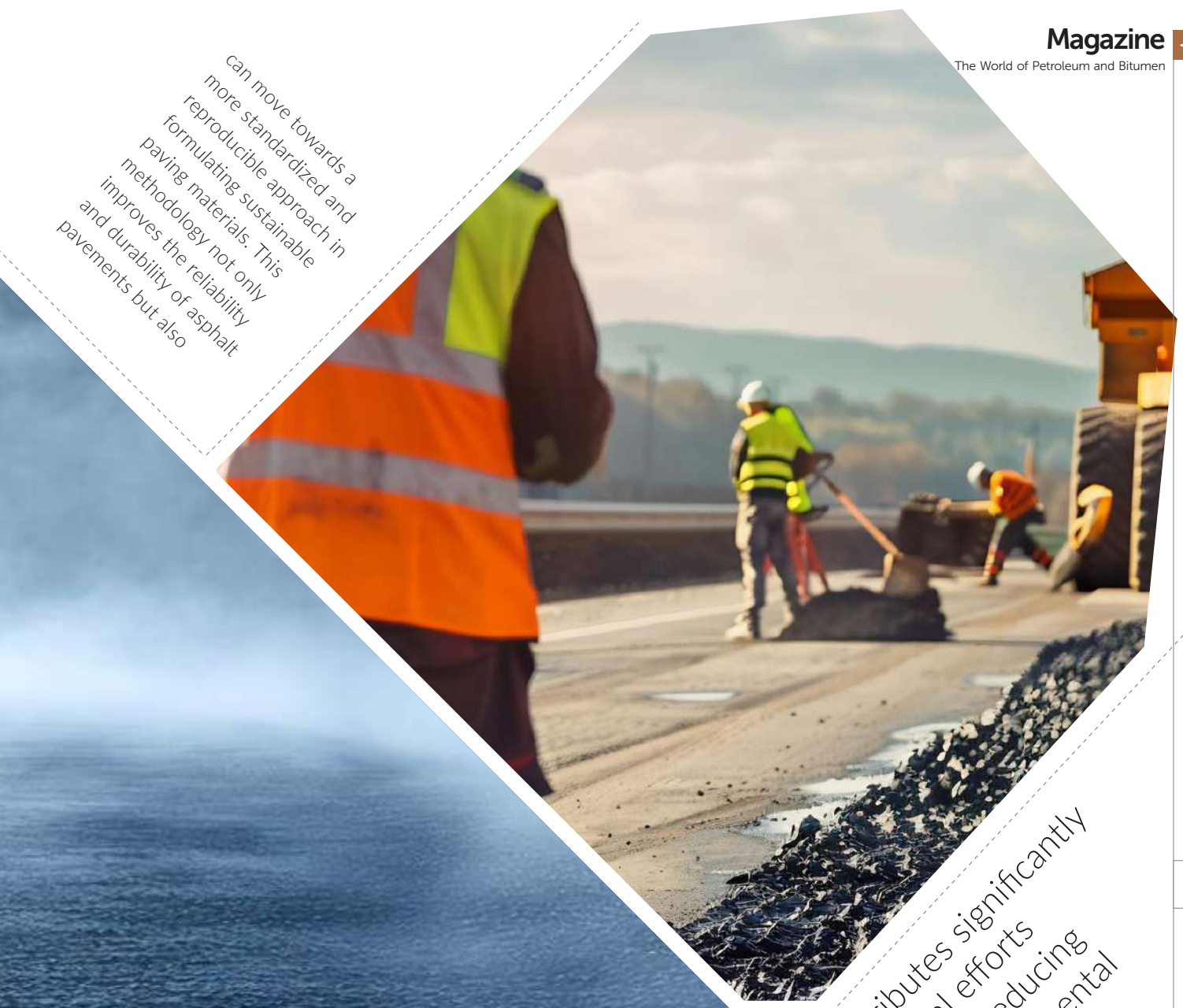
The broader implication of this work lies in the establishment of a rationalized, scientifically grounded framework for the design and evaluation of bio-bituminous binders. By coupling solubility parameter theory with mechanical performance testing, researchers and engineers

One of the promising approaches is the use of bio-based alternatives as partial or full bitumen substitutes in asphalt mixtures.

The results demonstrated that Bio-Additive-1 exhibited superior rheological performance enhancements, particularly in terms of fatigue resistance, low-temperature flexibility, and overall binder durability. This favorable behavior is consistent with its closer HSP proximity to bitumen and its subcomponents, indicating a higher degree of molecular interaction and dispersion within the bituminous matrix. In contrast, Bio-Additive-2, despite its environmental benefits and ease of availability, displayed lower compatibility indices and suboptimal rheological properties, likely stemming from its divergent polarity and less cohesive integration with the bituminous structure.

Notably, a strong correlation was observed between the solubility overlap ratios and the functional performance metrics of the bio-bitumen blends. This suggests that solubility parameter analysis, particularly the use of Hansen sphere models, can serve as a predictive tool for pre-selecting bio-additives with high

Can move towards a more standardized and reproducible approach in formulating sustainable paving materials. This methodology not only improves the reliability and durability of asphalt pavements but also



contributes significantly to global efforts aimed at reducing the environmental impact of road infrastructure development.

Fracture Resistance and Performance Enhancement of Asphalt Mixtures Incorporating High RAP Content and Steel Slags via Bio-Oil Additivation and Heavy Polymer Modification

The pursuit of sustainable infrastructure development has significantly increased interest in utilizing reclaimed materials in asphalt mixtures, particularly Reclaimed Asphalt Pavement (RAP) and industrial by-products such as steel slags. These alternative materials offer substantial environmental and economic advantages, notably in reducing the demand for virgin aggregates and mitigating landfill disposal.

However, their widespread implementation is often constrained by technical specifications that limit RAP content to under 30% by weight, primarily due to concerns over the aging and brittleness of recycled binders and inconsistencies in mechanical performance.

Addressing these constraints requires a multifaceted strategy that encompasses both binder rejuvenation and mixture stabilization. The present work evaluates the feasibility of designing high-recycled-content Hot Mix Asphalt (HMA) compositions that not only meet performance criteria but also align with the European Union's 2030 recycling targets—namely, the incorporation of at least 80% recycled constituents in pavement materials.

In this context, a novel mixture design is proposed comprising 50% RAP and 30% steel slags, supplemented by 20% virgin aggregates. Two core interventions are implemented to overcome the challenges posed by such high levels of recycled materials: the application of a bio-based rejuvenator (bio-oil additive) to restore the viscoelastic properties of

aged RAP binder, and the use of a heavy polymer–modified asphalt binder to ensure adequate rutting resistance and elasticity.

Three asphalt mixtures were prepared and analyzed: (1) a control mixture (0R) composed exclusively of virgin aggregates and heavy polymer–modified binder, (2) a partially recycled mixture (50R) with 50% RAP, the same binder, and the bio-oil additive, and (3) a highly recycled composition (50R30G) containing 50% RAP, 30% steel slag aggregates, 20% virgin aggregates, the same polymer binder, and the bio-oil rejuvenator. The mixtures were subjected to mechanical testing using the Superpave Indirect Tensile Strength (IDT) procedure, with strain field monitoring facilitated by digital image correlation (DIC) techniques to precisely capture fracture behavior and strain localization patterns.

Results from the testing phase indicated that mixtures incorporating RAP and steel slags exhibited enhanced resistance to permanent deformation and favorable energy absorption characteristics under tensile loading.

Despite a general reduction in creep compliance—a phenomenon consistent with higher stiffness due to recycled content—the fracture energy of the recycled mixtures remained well above the conventional thresholds observed in standard HMAs composed of virgin materials and medium-grade polymer binders. This preservation of fracture toughness suggests that the bio-oil additive successfully reconstituted the molecular mobility and adhesive qualities of the aged binder, restoring its ability to interact with surrounding aggregate structures and dissipate stress effectively.

Furthermore, the spatial analysis of strain evolution revealed critical differences in damage distribution between the mixture types. Recycled mixtures (50R and 50R30G) exhibited more localized strain concentration zones, reflecting the presence of stiff inclusions and binder heterogeneity, while the control mixture (0R) demonstrated a more uniform strain field with diffusely distributed damage.

The incorporation of steel slags, known for their angularity and high surface roughness, likely contributed to improved mechanical interlock and aggregate skeleton stability, enhancing load transfer and delaying crack initiation.

The synergy between the bio-oil additive and the heavy polymer–modified binder proved essential in achieving both high elasticity and durability, as well as environmental sustainability. While the rejuvenator played a key role in mitigating the embrittlement of aged RAP bitumen, the polymer modification augmented the mixture's capacity to recover after deformation and resist rutting under traffic-induced stresses.

Collectively, these modifications enabled the successful design and mechanical validation of asphalt mixtures with high recycled content that do not compromise on structural integrity.

The implications of this research extend beyond laboratory optimization and into the broader framework of circular economy principles in road construction. Through the deliberate engineering of additive-enhanced recycled materials, it becomes possible to decouple pavement performance from dependency on virgin resources—contributing to both carbon footprint reduction and resource conservation.

KAZAKHSTAN

FIRST BITUMEN PRODUCED AT MODERNIZED KAZAKHSTAN PLANT LINKED TO CHINA

After completing modernization efforts, the Aktau Bitumen Plant, operated by Caspi Bitum—a joint venture where KazMunayGas (a subsidiary of Samruk-Kazyna) and China's CITIC each own 50%—has produced its first batch of bitumen. A total of 740 tons were manufactured, marking a key milestone. The plant's full relaunch at its upgraded capacity of 1.5 million tons of oil per year (up from the previous 1 million tons) is planned for May.

According to a statement, this achievement was part of a modernization project initiated on the orders of Kazakhstan's President. The first batch of road bitumen, weighing 740 tons, received a quality certificate, confirming that the updated facilities are ready for full operation.

Since November 2024, construction and installation work at the site was handled by CITIC Construction, the general contractor linked to the Chinese partner. KazMunayGas highlighted that the project finished one month ahead of schedule, thanks to continuous round-the-clock work, following an earlier request for accelerated completion. About

THE TOTAL INVESTMENT IN THE MODERNIZATION PROJECT REACHED $76 MILLION

a year ago, Kazakhstan's Ministry of Energy had announced that the plant's production capacity would grow by 1.5 times by April 2025. The total investment in the modernization project reached $76 million.

The Ministry of Energy also shared that the plant is set to produce 8,000 tons of bitumen in April. An official launch ceremony for the upgraded plant is scheduled for May 5. The overall cost of the project was reported at 36.1 billion tenge.

As a result of the upgrades, the annual output of bitumen will increase to 750,000 tons, compared to the earlier 500,000 tons. Kazakhstan, which has had to rely partly on imported road bitumen, will now be able to meet more of its domestic demand. Market players have noted that construction companies usually ramp up bitumen purchases during the warmer months when asphalt laying is active, but the modernized plant aims to ensure steady supply throughout the year.

Caspi Bitum stands as the largest producer of road bitumen in Central Asia. The plant itself was constructed between 2010 and 2013 and officially began operations on December 12, 2013.

During President Kassym-Jomart Tokayev's visit to China on October 17, 2023, KazMunayGas and CITIC Group signed an agreement to carry out the capacity expansion project throughout 2024 and 2025. The plant exclusively processes heavy oil from Karazhanbasmunay, another KazMunayGas-CITIC partnership, which is particularly suited for bitumen production.

GLOBAL EXPANSION OF THE BITUMEN MARKET DRIVEN BY INFRASTRUCTURE GROWTH AND TECHNOLOGICAL INNOVATION

How Infrastructure Developments Are Fueling Bitumen Market Growth

The increasing volume of road construction projects is expected to significantly drive the expansion of the bitumen market. Road construction comprises the planning, design, enhancement, and maintenance processes of highways and roadways. Bitumen plays an essential role in these operations, acting as a cohesive substance that enhances water resistance, provides flexibility, withstands weather fluctuations, reduces skidding, and facilitates ease of construction and repair.

To illustrate this, Global Australia Highlights—a governmental organization based in Australia—revealed in November 2022 that the national budget for 2022–23 includes a substantial investment of $12.04 billion (A$17.9 billion) over a decade, aimed at major infrastructure developments across the country, with a considerable portion allocated to road and railway projects. Furthermore, forecasts estimate that total spending on large-scale public infrastructure will exceed $146.72 billion (A$218 billion) between 2021 and 2025.

In a related update from March 2023, Global X ETF, an American asset management company, highlighted the U.S. government's commitment to infrastructure progress through the $1.2 trillion Infrastructure Investment and Jobs Act (IIJA), enacted in November 2021. Of this, $550 billion is earmarked for use over ten years to enhance transportation systems—such as roads, bridges, airports, and railways—as well as expand clean water resources, broadband connectivity, and environmental equity. Such global infrastructure efforts are intensifying the demand for bitumen, thereby propelling its market forward.

Future Growth Catalysts Expected to Shape Bitumen Market CAGR by 2034

The bitumen sector has exhibited stable growth, with market size projected to rise from $55.85 billion in 2024 to $58.12 billion in 2025, reflecting a compound annual growth rate (CAGR) of 4.1%. Several factors underpin this growth: expanding infrastructure needs, increasing applications in paving and roofing, growth in transportation demands, continuous innovation in bitumen formulations, and rising focus on sustainable and environmentally conscious practices.

Projections indicate that the market will continue its upward trajectory, reaching an estimated $71 billion by 2029 with an improved CAGR of 5.1%. Contributing factors to this growth include eco-friendly asphalt alternatives, the global rise of smart cities, development of renewable energy infrastructure, growing construction activities, and the utilization of bitumen in carbon capture applications.

Innovations anticipated during the forecast period comprise high-performance pavements, advanced roofing technologies, bitumen recycling and reusability, integration of nano and micro technologies in bitumen production, and the digitalization of manufacturing processes.

Innovative Trends Shaping the Bitumen Market's Evolution

An emerging development gaining traction within the

bitumen sector is the adoption of bio-based alternatives. As companies strive to retain a competitive edge, many are turning toward sustainable product innovation. A notable example is Tarmac, a construction solutions provider based in the UK, which introduced a novel algae-derived bitumen—also referred to as bio-bitumen—in May 2024. This product is designed to offer an eco-friendly substitute to traditional petroleum-derived bitumen used in road infrastructure. The algae-based variant leverages the carbon-absorbing properties of algae, helping to reduce greenhouse gas emissions tied to bitumen production, while preserving critical characteristics such as strength, water resistance, and recyclability.

Key Regional Markets Leading Bitumen Industry Expansion

As of 2024, the Asia-Pacific region held the leading position in the bitumen market. This region is also projected to witness the most rapid growth throughout the forecast period. The global regions analyzed in the report include

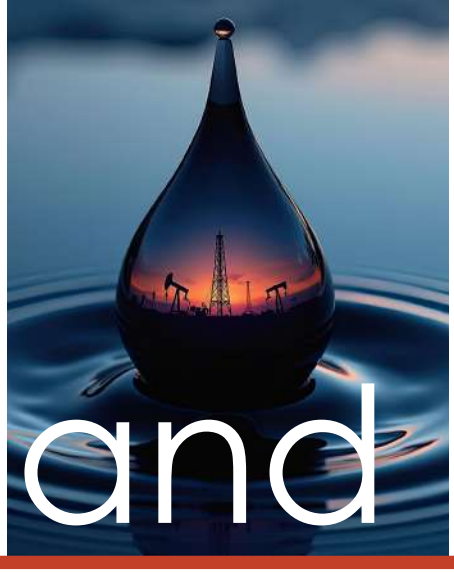
Asia-Pacific, North America, Western and Eastern Europe, South America, the Middle East, and Africa.

Pioneering Companies in Bitumen Innovation and Supply

Major players dominating the bitumen industry landscape include:

- Sinopec Corporation • ExxonMobil Corporation
- Royal Dutch Shell plc • TotalEnergies SE
- BP plc • ConocoPhillips Co
- PJSC Rosneft Oil Company • Cenovus Energy Inc.
- Bouygues Group • Imperial Oil Limited
- Suncor Energy Inc • MOL Group
- Nynas AB • Gazprom Neft
- Teck Resources Limited • Indian Oil Corporation Ltd.
- Syncrude Canada Ltd. • MEG Energy Corp
- Soprema Group • NuStar Energy L.P.
- Athabasca Oil Corporation • NIS Group
- CEPSA (Compañía Española de Petróleos)
- CertainTeed Corp. • Asphalt Materials Inc.
- The Richmond Group • Karnak Corp.
- Sunshine Oilsands Ltd. • GOYAL Group of Companies

These firms are actively driving innovation, sustainability, and expansion in the global bitumen market.



Oil and Gas

Sector Faces Ongoing Hurdles in Emissions Reduction Push

Efforts to reduce carbon emissions within the oil and gas industry have remained a contentious and urgent issue for years. In 2025 — a significant benchmark year for climate goals — uncertainty looms: will companies revise their targets downward, stick to current trends, or double down on decarbonization? The course and extent of action taken will ultimately decide whether these firms can meet their short-term emission goals and advance meaningfully toward long-term net-zero aspirations.

A number of oil and gas companies have earmarked 2025 as the deadline for achieving interim cuts in Scope 1, 2, and 3 emissions, making this year critical for assessing the sector's environmental performance. However, not all firms rely on consistent or independently verified methodologies when setting or measuring targets. The diverse and often complex approaches used to track and reduce emissions can undermine both the transparency and comparability of these climate commitments.

According to research from Rystad Energy, 120 major oil and gas companies each follow their own unique emission reduction roadmap. In 2024 alone, their upstream operations generated more than 630 million tonnes of greenhouse gases, accounting for roughly 58% of the industry's total emissions for the year.

Their analysis of upstream CO_2 trends between 2019 and 2023 reveals wide variation.

In response to mounting pressure, both international energy giants and smaller, regionally focused or state-owned firms have revised their business models to include decarbonization plans. Many of these players have publicly disclosed their strategies and set interim reduction targets for 2025 — with over 20 companies aiming to cut emissions, especially in Scope 1 and 2 categories, by then. Some have already hit these benchmarks ahead of schedule. For instance, BP, TotalEnergies of France, and U.S.-based Expand Energy surpassed their goals as early as 2023. BP reduced its absolute emissions by 41% — more than double its original 20% target — while Expand outperformed its own goal by 14%.

Yet, despite this earlier success, BP has seen its Scope 1 and 2 emissions rise for the second year running, with a 5% increase in 2024 compared to 2023. The company attributes the uptick to

several new or expanded projects launched during the year. This raises concerns over whether such setbacks will persist, particularly since BP no longer intends to decrease its overall hydrocarbon production.

Although setting emissions targets is a fundamental part of corporate planning, the real measure of progress lies in understanding where companies began, how they performed, and the methods they used to reach their goals. These factors should play a central role in guiding strategic decisions.

Rystad's assessment divides the 120 companies into different categories to track how emission levels have evolved over the past five years. Their analysis of upstream CO_2 trends between 2019 and 2023 reveals wide variation. Among national and international oil companies (NOC/INOC), European firms like Equinor, OMV, and MOL have notably decreased both their total emissions and emission intensity. Meanwhile, Russian companies such as Gazprom and Rosneft have seen increases in both areas since 2019. Similar patterns emerge across global independents and regional operators, suggesting that local conditions and business environments heavily shape emission outcomes.

US and European energy majors stand out for delivering the most notable improvements. Frequently under intense scrutiny regarding their environmental efforts, these firms have implemented a range of tactics, including asset sales, operational upgrades, electrification, flaring minimization, and methane leak mitigation. For example, TotalEnergies has reduced emissions through the closure of combined-cycle gas turbine plants, expanded use of electric systems, and the discontinuation of routine flaring at specific sites like Nigeria's OML 100.

The road to decarbonization in oil and gas continues to be a complex, heavily discussed journey. As 2025 draws near, it remains to be seen whether this moment becomes a turning point for intensified action, a plateau in progress, or a reality check prompting target recalibration. The path chosen will define not just near-term achievements, but the broader role these companies play in the global transition to net-zero.

POSITIONING THE TRANSPORTATION INDUSTRY IN THE SUPPLY CHAIN OF PETROLEUM AND PETROCHEMICAL PRODUCTS

(Part I: Defining the Transportation Industry and Its Role in the Supply Chain)

By Amir Rezaei from Sokan Arya Darya Company

The exchange and trade of goods among countries—and even within a single country—dates back to the very

beginning of human history. Throughout history, humans have purchased goods and sold their products to meet their own needs. A fundamental pillar of trade in every historical era has been the transportation of goods. Today, the movement of goods from origin to destination is recognized as one of the most critical links in the supply chain of goods, which holds an undeniable value. If transportation of goods is not carried out properly, both domestic and international trade will fail.

In the modern world, transportation is a core and foundational component of economy. It influences the process of economic development and forms the basis for trade exchanges. Furthermore, it acts as a driving force for national economic activity. This sector encompasses all activities related to distribution, production, consumption, and the flow of goods delivery, and it impacts every economic activity in a country. Its role cannot be denied. Transformation and development of transportation push various sections of a society toward sustainable development.

Macroeconomic studies show that investment in transportation leads to economic growth, increasing social returns and prompting further investment in transportation infrastructure. This creates a continuous cycle of advancement in both national and international transportation systems, resulting in faster and more precise distribution of goods.
Transportation plays a vital role in global trade and is one of the main pillars of the global supply and distribution chain. Some of the key ways transportation influences global trade include reducing costs, increasing competitiveness, accessing global markets, and improving supply chains.

Transportation is accepted as a means of expanding sales markets on both domestic and international scales, and it is considered a driving force that creates integration within the supply chain. Transportation is defined as a component of the supply chain process. While it is one of the less visible components, it is

essential to the global economy by supporting a wide range of goods movement between countries.

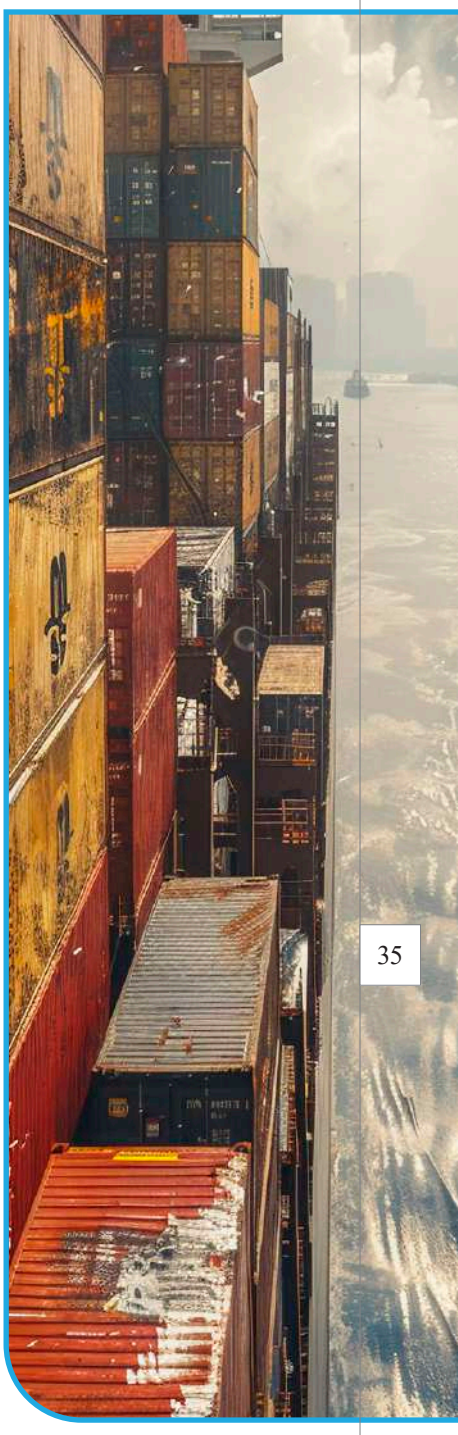
It is important to note that transportation is often referred to as an "industry." In everyday conversations, we sometimes use the terms "market" and "industry" interchangeably.

However, when discussing value creation, it is essential to distinguish between the two and use them with more care and sensitivity in their own context. Misunderstanding or overlooking this distinction has led to weak or incorrect decisions by managers in various industries and inaccurate analyses by analysts. Transportation can only be properly called an industry when its outputs, regardless of geographic location, compete on a global market scale.

For example, the outputs of steel, petrochemical, and crude oil industries are always in demand in the global market. Based on another definition, an industry can be defined as a collection of manufacturing and service-oriented organizations and companies that produces goods or services to meet market demand by using various equipment.

Based on these definitions, and considering that the transportation industry plays a central role in the supply chain and other industries, we can broadly classify it as a "parent industry" alongside other foundational industries such as steel and petrochemicals. A parent industry is one that produces goods or services used by other industries in their own production and delivery of goods and services.

The international transportation industry plays a pivotal role in the supply chain of goods and services, acting as a value-creating link within it. It functions as a turning point in the supply chain, always seeking ways to reduce shortages, create value, and maximize overall profitability.



The concept of supply chain originates from an operations management perspective, i.e., every stage of a process—including product or service creation, manufacturing, transporting it to a point of sale (marketing), and selling it—all of which are part of a company's supply chain. As mentioned earlier, the terms "market" and "industry" are often used interchangeably in casual conversation. However, a market includes all individuals, companies, and organizations that are potential or actual buyers of a specific product.

Therefore, we can conclude that the transportation industry—as a parent industry—plays a crucial role in facilitating the supply chain of goods to potential markets. It also plays an undeniable role in delivering diverse products to new target markets and is a central source of value creation in accessible and influenced markets. For this reason, it can be argued that transportation is a broader concept than "market" within the context of supply chain.

HONGKONG POST TO SUSPEND U.S.-BOUND SURFACE SHIPMENTS OVER NEW TARIFFS

WPB Hongkong Post has announced it will suspend shipping goods to the United States via surface mail in response to newly imposed U.S. tariffs. This includes sea freight parcels, which typically involve longer transit times.

The move follows Washington's decision to end a customs waiver that previously allowed small-value packages from Hong Kong to enter the U.S. without import taxes. Beginning May 2, these packages will now face a hefty 120% tariff. The revoked "de minimis" rule had exempted shipments worth under $800 from duty.

In a government-issued statement, Hongkong Post declared it will not facilitate the collection of U.S. customs duties. As a result, surface mail shipments — usually handled through maritime transport — containing goods destined for the U.S. will no longer be accepted. Air mail parcels will continue to be accepted until April 27.

Officials also warned Hong Kong residents to prepare for "excessive and unreasonable" fees triggered by what they described as the U.S. government's "bullying" and unjust policies.

Only mail containing documents will still be accepted for delivery.

Though Hong Kong remains a duty-free port, it has increasingly become entangled in the broader U.S.-China trade conflict.

Formerly a British colony and returned to Chinese sovereignty in 1997, Hong Kong has operated under a separate customs and trade regime. But after Beijing enacted a national security law in 2020, the U.S. began treating Hong Kong as part of mainland China, extending to it the same steep tariffs — up to 145% — imposed on Chinese goods.

Beijing maintains the law restored stability, but critics argue it has stifled all forms of political dissent in the territory.

“Maritime Sector to Bear Financial Responsibility for Ship-Generated CO_2 Under New International Agreement”

For the first time in history, shipping firms will be held financially accountable for the carbon dioxide emissions produced by their fleets, following a landmark decision by the world’s top maritime regulatory authority. The newly adopted framework marks a significant shift in global shipping policy, although it does not meet the expectations of less affluent nations that had lobbied for a direct carbon tax to aid in their climate change mitigation efforts.

Despite strong resistance from oil-rich nations such as Saudi Arabia, Russia, and the United Arab Emirates, a majority of countries attending the International Maritime Organization (IMO) summit in London voted in favor of a compromise plan. This agreement mandates that starting in 2028, all vessels will be required to pay for the greenhouse gases they release into the atmosphere.

Under the new system, ships will incur escalating fees based on the amount of emissions they generate. In addition, they will gain access to a carbon credit market, enabling them to trade allowances to meet their obligations. This system is designed

to push the maritime sector toward cleaner fuels and improved efficiency—such as reducing sailing speeds to lower fuel use—rather than continuing with the prevalent practice of racing to ports only to idle nearby.

Estimates suggest that the scheme will generate approximately $10 billion (or £7.6 billion) annually, a figure that falls well short of the $60 billion anticipated from a comprehensive carbon tax. Furthermore, instead of being redirected to nations facing climate-related disasters, the expected revenue will likely remain within the shipping sector to fund innovations in cleaner technologies.

The potential reduction in emissions brought about by this initiative is expected to be minimal in the near term—roughly an 8% decrease by 2030, according to Umas, a consultancy specializing in commercial shipping.

This figure is significantly below the 20% target the IMO laid out in its climate roadmap in 2023.

Emma Fenton, senior director at the advocacy group Opportunity Green, acknowledged the agreement as a turning point but criticized its lack of ambition. She noted that the move ultimately neglects the urgent needs of climate-vulnerable nations and fails to deliver on commitments made by IMO members just two years ago.

While some ship operators might

consider switching to liquefied natural gas (LNG) as a cleaner option than conventional bunker fuels, the upcoming regulations in the 2030s are expected to introduce harsher penalties for LNG use, reducing its appeal. However, Tristan Smith, an associate professor of energy and transport at University College London, pointed out that the current rules are likely to boost the adoption of biofuels—despite their own environmental risks—as they offer the cheapest compliance route for around 85% of vessels over the first five years. He predicted a sharp increase in demand for these fuels, amounting to tens of millions of tonnes.

Smith emphasized that negotiations

between now and the scheduled adoption of the rules in October will be essential to avoid unintended negative consequences.

Jonas Moberg, CEO of the Green Hydrogen Organisation, which promotes hydrogen-based solutions, welcomed the IMO's decision. He argued that it sends a positive message to companies involved in low-emission fuels, particularly green ammonia, which is likely to become increasingly important in maritime transportation.

Despite the progress, several small island nations abstained during the final vote, voicing their dissatisfaction with the outcome. Simon Kofe, Tuvalu's transport and energy minister, expressed frustration that wealthier nations offered weak substitutes instead of endorsing a carbon levy—a solution that vulnerable countries had championed. He stressed that these alternatives fail to align with the goal of limiting global temperature rise to 1.5°C above pre-industrial levels, and that those bearing the brunt of climate change were once again being asked to settle for less.

Leaders from the most affected regions vowed to keep pushing for more robust climate measures. The current framework still requires refinement and may undergo significant modifications before being officially adopted during the IMO's meeting in October. Albon Ishoda, the Marshall Islands' envoy for maritime decarbonisation, stated that the battle is far from over. He affirmed that nations from the Caribbean, Pacific, Africa, Central America, and even the UK remain united in their commitment to stronger climate action.

The United States, although initially involved in the talks, withdrew from negotiations after conveying that Donald Trump opposed the proposed carbon tax. Whether the US will ultimately support the carbon trading scheme remains uncertain, but many nations believe they can proceed with implementation regardless of American participation.

A representative from one developed nation said, considering the geopolitical dynamics, the compromise reached was likely the best possible outcome. The European Union, previously a staunch supporter of a direct carbon fee, shifted its stance before the conference and chose to back the carbon trading approach instead.

Countries such as China, Brazil, and other rising economies initially rejected the idea of a tax but lent their support to the trading model.

Ralph Regenvanu, Vanuatu's environment minister, placed blame on Saudi Arabia, the United States, and other fossil fuel-dependent nations for derailing efforts to keep the shipping industry aligned with the 1.5°C climate goal, as set out in the 2015 Paris Agreement. He condemned their role in lowering expectations and obstructing progress at every stage. Regenvanu criticized these countries for dismissing a proposal that could have provided a dependable financial stream to support climate resilience in nations facing severe environmental impacts.

VIENNA TESTS NEW ASPHALT MIXTURES TO COMBAT SUMMER HEAT

VIENNA

WPB: Vienna is increasingly preparing for the fight against so-called heat islands—urban areas where asphalt surfaces heat up quickly. A pilot project in the 23rd district is now expected to provide innovative solutions: Four different asphalt mixtures, including water-permeable "cool pavements," are being tested on an 80-meter section of the Liesingbach bike path. The goal is to reduce temperature development while also making asphalt more environmentally friendly.

In collaboration with the Vienna University of Technology, one conventional type of asphalt and three special mixtures have been developed, according to ORF reports. The most important criterion is the water permeability of the surface. The new asphalt is intended to allow rainwater to seep into the ground much more effectively than before, preventing soil sealing. At the same time, the new mixtures aim to reduce the high surface temperatures caused by sunlight.

As part of the research project, which will run for three years, temperature and humidity sensors will provide precise data. Wolfgang Ablinger from the Roads Administration (MA 28) emphasizes that the project is intended to help cool the city in the long term. If the tested mixtures produce good results, they could soon be used in other parts of Vienna, making a significant contribution to climate protection.

INDONESIA PROPOSES $10 BILLION IN EXTRA U.S. ENERGY IMPORTS AMID TARIFF TALKS

In a bid to persuade Washington to ease a proposed 32% tariff on its exports, Indonesia—the largest economy in Southeast Asia—is preparing to offer the United States a deal involving an additional $10 billion in purchases of American crude oil and liquefied petroleum gas (LPG).

This tariff, among the steepest introduced during President Donald Trump's "liberation day" trade measures, was temporarily halted for a 90-day period. During this window, the Trump administration expects affected nations to come forward with pledges to ramp up imports of U.S. goods, aiming to avoid the heavy tariffs altogether.

Indonesia's Energy Minister, Bahlil Lahadalia, shared with national outlets that the Energy Ministry has advised boosting the import limits on American LPG and ramping up crude oil purchases from the U.S.

By adding $10 billion in energy imports, Indonesia intends to raise its total purchase value of U.S. products to somewhere between $18 billion and $19 billion. This move is aimed at balancing its trade surplus with the United States, hoping that such a commitment will convince Washington to withdraw the proposed duties. A delegation of Indonesian officials is set to travel to the U.S. to hold discussions on the tariff issue and negotiate potential energy-based solutions.

According to Kpler's statistics, Indonesia's crude oil imports from the U.S. averaged only about 13,000 barrels per day last year—just a small fraction of the country's total daily crude imports of 306,000 barrels.

Indonesia isn't alone in seeking tariff relief through energy deals. Other nations are also exploring similar strategies. Pakistan, for example, is considering bringing in American crude oil for the first time as a step toward reducing its own trade imbalance with the U.S.

Meanwhile, South Korea is reportedly evaluating a rise in LNG imports to prompt a rollback of the U.S. tariffs, and India is contemplating the elimination of its import tax on U.S. liquefied natural gas as a way to enhance American LNG imports and address its trade surplus with Washington.

GERMANY'S BAUMA 2025 SHOWCASES CO_2-FREE ASPHALT PRODUCTION USING 100% GREEN HYDROGEN

WPB: At the recently concluded bauma 2025 trade fair in Germany, Benninghoven introduced a groundbreaking solution for sustainable asphalt production. Unveiled in Munich, the new MULTI JET burner generation and the associated MULTI JET Control system represent a leap forward in fuel flexibility and emissions reduction. This innovative burner series is capable of operating with four fuel types simultaneously, regardless of whether they are solid, liquid, or gaseous. Importantly, this technology is not limited to newly constructed plants—it can also be retrofitted to existing facilities, irrespective of the original equipment manufacturer.

A standout characteristic of the MULTI JET system is its ability to handle mixed fuel operations. For instance, hydrogen, liquefied petroleum gas (LPG), hydrotreated vegetable oil (HVO), biogas, and natural gas can all be used at the same time via individually separated nozzles. Switching between fuels can occur during operation without any need for halting production, ensuring a steady energy supply. This adaptability offers plant operators the flexibility to opt for the most cost-effective and readily available fuel options, which contributes to significant savings, especially considering the future trajectory of CO_2 pricing.

Further enhancing its appeal, the new burner system reduces acoustic emissions by 5 decibels (dB(A)), effectively cutting the perceived sound level in half. Simultaneously, electrical power usage has been cut by 20%, all while maintaining consistent material throughput.

Efficient Dust Extraction Enhances Sustainability in Asphalt Plants

In addition to burner innovations, Benninghoven also presented a newly engineered dust collection system that plays a critical role in boosting sustainability and operational efficiency. Effective dust control is essential in asphalt production, as it helps extract and filter out particulates like stone dust and bitumen fumes, both of which are generated during the mixing process.

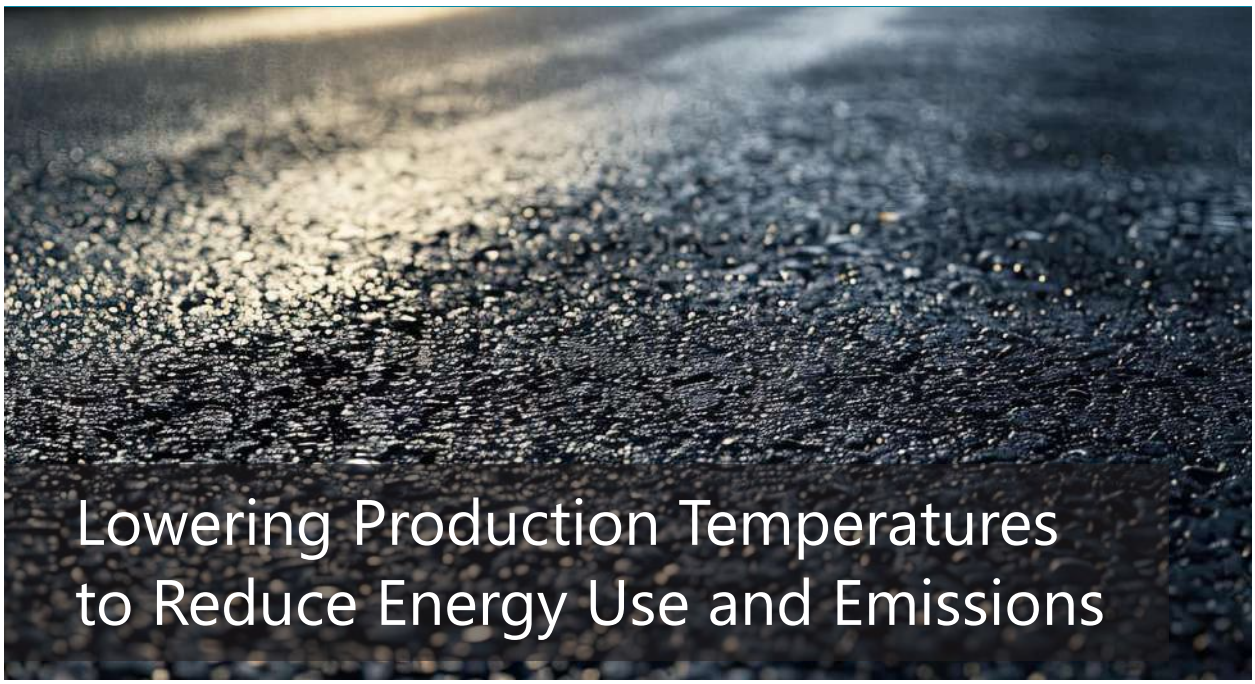
Beyond process optimization, these emissions are increasingly subject to stringent environmental regulations in many regions, making reliable dust collection systems essential.

The new dust collection technology stands out due to its aerodynamic design, strong energy efficiency, minimal residual dust levels, high operational reliability, expansive filter surface, and straightforward maintenance access.

Optimizing Recycling: Benninghoven's Recipe Generator Boosts Profits and Cuts Emissions

Benninghoven's commitment to resource-efficient asphalt production continues with a focus on maximizing recycling. The goal is to reuse premium materials in a way that preserves—or even enhances—the original quality. Increased recycling rates also result in significant CO_2 reductions, with studies indicating that incorporating up to 60% reclaimed asphalt pavement (RAP) can lead to a 20% drop in emissions.

The recipe generator, a software extension for the Benninghoven BLS 4 control system, is central to achieving this objective. This



Lowering Production Temperatures to Reduce Energy Use and Emissions

digital tool supports plant operators in managing optimal recycling content by adjusting plant parameters based on the final product specification, operational constraints, and equipment setup. It allows for the blending of various RAP grades to closely match the desired aggregate gradation of the target asphalt type.

Additionally, the software facilitates automatic switching between bitumen types—from hard binders to softer alternatives—as RAP content increases, ensuring compliance with softening point specifications. These adjustments occur in 1% increments and are executed in real time, without interrupting production or requiring recipe changes, thereby streamlining operations and enhancing flexibility.

Lowering Production Temperatures to Reduce Energy Use and Emissions

Asphalt production's most energy-intensive stages—heating and drying both raw and recycled materials—present opportunities for major energy savings. One solution gaining traction is the production of reduced-temperature asphalt, where the mixture is processed at approximately 120°C instead of the conventional 160°C. This 30% decrease translates into significant benefits: for instance, producing 2,000 tonnes of asphalt per day in this manner can save around 18,000 kilowatt-hours of energy and reduce carbon dioxide output by 6,000 kilograms.

Benninghoven offers three key methods for producing this lower-temperature asphalt: incorporating solid or liquid additives, or simply using water. These solutions can be easily integrated into both new and existing asphalt plants via the company's Plug & Work system. One particularly promising technique is the use of foamed bitumen, which requires only water—already available at any plant—to activate. This approach enhances the binder's ability to coat aggregates effectively at lower temperatures, achieving handling characteristics similar to hot asphalt. Importantly, this method also curbs the re-

ASPHALT, BITUMEN, INNOVATION

lease of harmful PAHs (polycyclic aromatic hydrocarbons) during paving.

Mobile and Continuous Mixing Technologies from Ciber Also on Display

Visitors to Benninghoven's area at bauma 2025 were also introduced to the latest developments from Ciber, a specialist in continuous asphalt production. At the event in Munich, Ciber showcased equipment designed to enable mobile and efficient continuous mixing processes, further expanding the Wirtgen Group's portfolio of environmentally conscious and cost-effective asphalt production technologies.

Through innovations in burner technology, dust collection, recycling optimization, and low-temperature mixing, Benninghoven—alongside its partner Ciber—demonstrated a comprehensive commitment to the future of sustainable road construction. The bauma 2025 exhibition in Germany offered a fitting stage for these developments, underscoring the industry's steady shift toward greener, more efficient practices.
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TURKEY PURSUES ENERGY VENTURES IN BULGARIA, IRAQ, AND LIBYA AMID BROADER REGIONAL ASPIRATIONS

WPB Turkey is actively engaging in discussions to initiate oil and gas exploration in Bulgaria, with parallel efforts underway for similar projects in Iraq and Libya, as revealed by Energy Minister Alparslan Bayraktar. The minister indicated that Turkiye Petrolleri AO (TPAO), the nation's state-owned energy company, is set to enter into a partnership with a foreign company soon to explore hydrocarbon resources in Bulgaria's portion of the Black Sea.

This move aligns with Ankara's broader objectives to not only expand its domestic energy production but also to position itself as a crucial conduit between energy-producing nations to the east and south and consumer markets in the west. Turkey's strategic geography and robust infrastructure are key enablers of this vision, a goal President Recep Tayyip Erdoğan has long championed.

A previous agreement between Turkey and Bulgaria paved the way for Bulgargaz, Bulgaria's state-owned gas supplier, to access 1.85 billion cubic meters of natural gas annually via the Strandzha-Malkoclar interconnection—covering nearly 60% of Bulgaria's yearly consumption. Under this deal, Bulgargaz must pay €2 billion over 13 years to Turkey's Botaş, regardless of the gas volume utilized. Bayraktar emphasized that the current export capacity stands at around 3.5 billion cubic meters, though there is potential for growth. He underlined the need to enhance the interconnection's capacity, which currently falls short of the seven billion cubic meters Turkey is technically able to supply.

Libya, however, presents a more complex and politically sensitive opportunity. Despite years of conflict and a fragile political landscape, the country is gradually increasing its oil production. Chairman of Libya's National Oil Corporation, Masoud Sulaiman, stated that the country aims to raise output from the present 1.4 million barrels per day to 2 million by 2028. Achieving this milestone demands significant investment—estimated at $3 to $4 billion—to reach an interim target of 1.6 million barrels per day. A new licensing round is expected to be approved soon. Given that oil constitutes more than 95%

of Libya's economic output, these developments carry significant implications for the country's financial stability.

In an effort to reduce Europe's reliance on Russian gas, Ankara had previously expressed readiness to scale up gas exports to the EU. The most feasible strategy involves re-exporting Azerbaijani gas via Turkish territory. However, this would necessitate an increased intake of Russian gas to balance domestic supply, creating a complex dynamic. Turkey is looking to secure firm purchase commitments from the EU before committing to infrastructure investments needed to support such exports. With access to the Southern Gas Corridor, five LNG terminals, seven pipelines, floating storage units, and underground storage facilities, Turkey has the assets required to serve as a major trading hub.

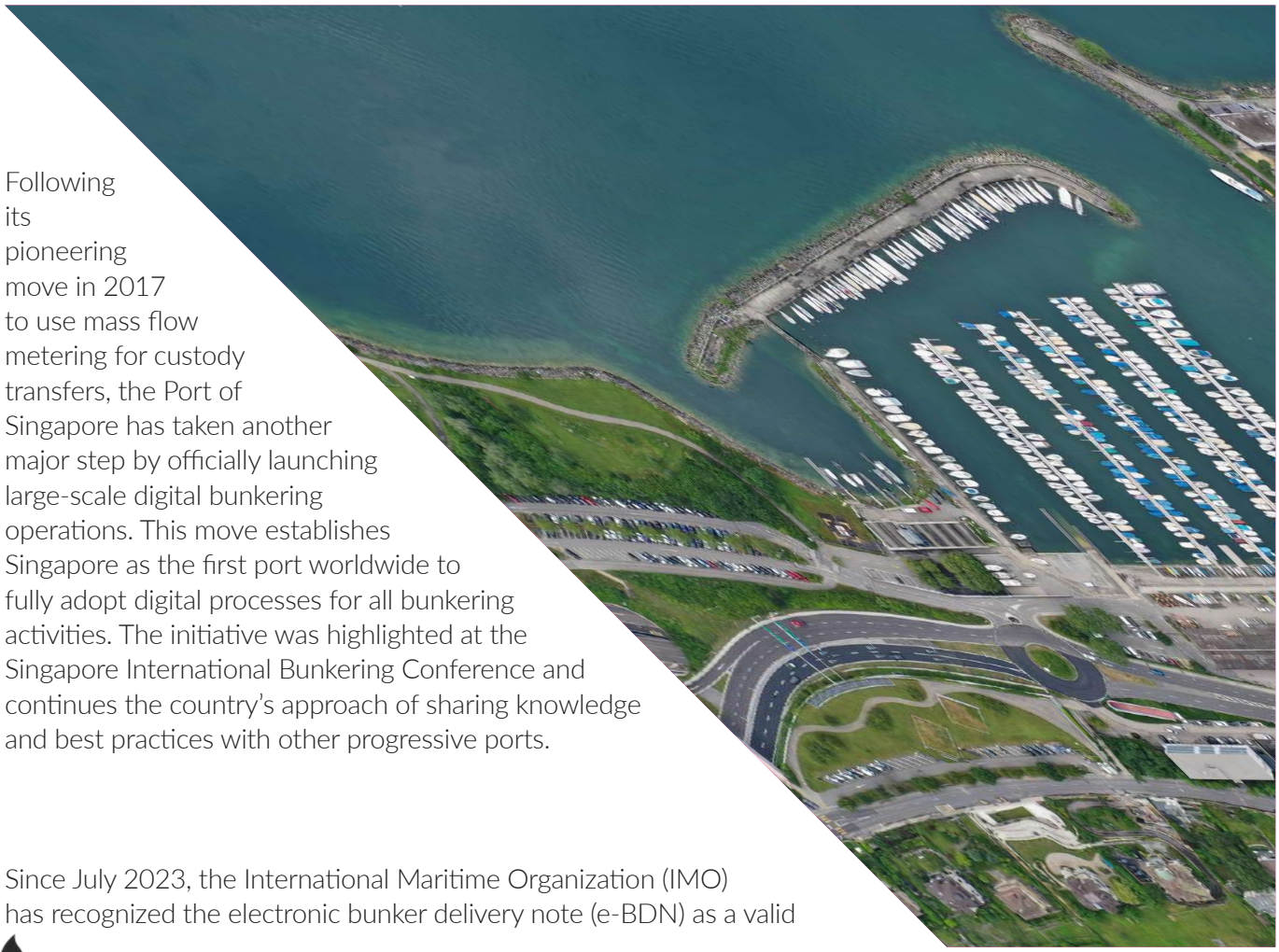
Meanwhile, European efforts to diversify energy sources have intensified, especially after the expiry of a long-term gas transit agreement through Ukraine. As a result, Russian gas no longer flows to most EU nations via that route. Ukrainian leadership emphasized the decision as a stand against Russian aggression. However, Russia still supplies gas to Hungary, Serbia, and Turkey through the TurkStream pipeline.

Azeri gas reaching Turkey could, in theory, be transported onward to the EU through Bulgaria, though such a plan entails significant logistical and financial challenges. Bayraktar, in an interview, reiterated the importance of increasing the volume of gas transported to Europe—potentially reaching 10 billion cubic meters annually—but insisted that this expansion hinges on guarantees from Brussels.

Turkey's energy ambitions have gained additional traction following political upheaval in Syria. With the fall of the Assad regime, Turkish firms may find opportunities to secure lucrative reconstruction contracts. Should Syria transition to a more open economy, Turkey could construct a pipeline linking Syria to the Arab Gas Pipeline, which runs through Jordan and Egypt. This would create an attractive, cost-effective export route for regional producers such as Egypt and Israel, offering a viable alternative to liquefied natural gas exports.

Through a blend of strategic partnerships, infrastructure development, and geopolitical positioning, Turkey is steadily advancing its goal of becoming a central energy hub for the region and beyond.

Singapore launched digital bunkering starting April 1, 2025



Following its pioneering move in 2017 to use mass flow metering for custody transfers, the Port of Singapore has taken another major step by officially launching large-scale digital bunkering operations. This move establishes Singapore as the first port worldwide to fully adopt digital processes for all bunkering activities. The initiative was highlighted at the Singapore International Bunkering Conference and continues the country's approach of sharing knowledge and best practices with other progressive ports.

Since July 2023, the International Maritime Organization (IMO) has recognized the electronic bunker delivery note (e-BDN) as a valid

alternative to traditional formats. During the event, Dr. Amy Khor confirmed that starting April 1, 2025, it became mandatory for all licensed bunker suppliers in Singapore to offer digital bunkering services and issue e-BDNs by default. This requirement follows a series of successful trials that had been running since November 2023, involving major industry participants, including the top ten bunker providers operating in the region.

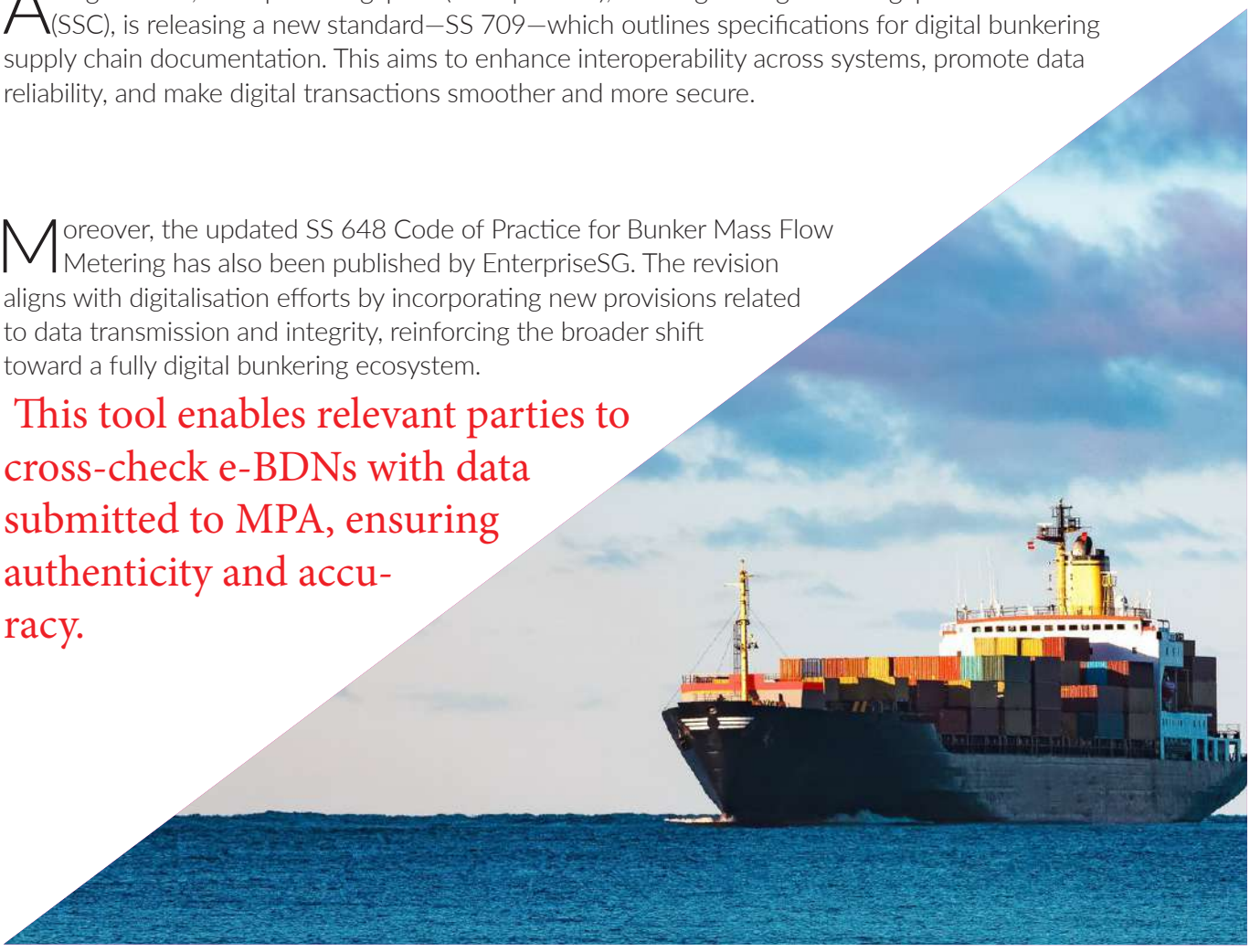
Digital bunkering is designed to simplify the exchange of information between suppliers and buyers. The new system accelerates administrative workflows, strengthens regulatory compliance, enhances accountability, and lowers the risk of human error. Additionally, it helps to detect potential fraudulent activity at an early stage. The system also supports a more secure, efficient, and eco-conscious bunkering environment, and is projected to save the industry approximately 40,000 man-days each year.

In a bid to further improve transparency and trust in transactions, the Maritime and Port Authority of Singapore (MPA) is introducing a centralised platform to verify e-BDNs. This tool enables relevant parties to cross-check e-BDNs with data submitted to MPA, ensuring authenticity and accuracy.

Alongside this, Enterprise Singapore (EnterpriseSG), working through the Singapore Standards Council (SSC), is releasing a new standard—SS 709—which outlines specifications for digital bunkering supply chain documentation. This aims to enhance interoperability across systems, promote data reliability, and make digital transactions smoother and more secure.

Moreover, the updated SS 648 Code of Practice for Bunker Mass Flow Metering has also been published by EnterpriseSG. The revision aligns with digitalisation efforts by incorporating new provisions related to data transmission and integrity, reinforcing the broader shift toward a fully digital bunkering ecosystem.

This tool enables relevant parties to cross-check e-BDNs with data submitted to MPA, ensuring authenticity and accuracy.



Iran and Russia Strengthen Their Energy Ties

WPB: Energy collaboration between Iran and Russia has expanded, with Russian firms signing agreements to develop Iranian oilfields and both sides engaging in discussions to establish a natural gas hub within the Islamic Republic.

Iran's Oil Minister, Mohsen Paknejad, traveled to Moscow, where the two nations — both subject to U.S. sanctions — reaffirmed their commitment to deepening cooperation.

Earlier, Tehran and Moscow concluded a Comprehensive Strategic Partnership Agreement, which outlines various areas of collaboration, including a focus on energy supply and swap operations.

Energy relations between Iran and Russia have been steadily growing, a trend that accelerated after Russia's traditional oil and gas markets were disrupted due to the conflict in Ukraine.

During the visit, four agreements were finalized with Russian companies for the development of seven oilfields in Iran, representing a total investment of around $4 billion, according to Iranian media citing Paknejad.

Several memorandums of understanding (MoUs) in the oil and gas sector were also signed, with negotiations ongoing to convert them into formal contracts.

In parallel, the two sides are discussing the potential import of natural gas from Russia, which could pave the way for gas swap deals and transit operations to third countries.

Iran and Russia are also pursuing efforts to double their annual bilateral trade volume to $10 billion. Paknejad noted that the trade potential between the two countries far exceeds the current $5 billion level.

SINOPEC AND SAUDI ARAMCO UNIT FORM $4 BILLION JOINT VENTURE

WPB: China's state-owned energy giant Sinopec has entered into an agreement with a subsidiary of Saudi Aramco to establish a new joint venture, with a registered capital amounting to 28.80 billion yuan (approximately $3.95 billion).

The partnership involves Sinopec, its affiliate Fujian Petroleum Chemical Industry Co., and Aramco Asia Singapore Pte. (AAS), the Singapore-based unit of Saudi Aramco. Under the terms of the deal, Sinopec and its unit will contribute 7.20 billion yuan and 14.40 billion yuan in cash, respectively, while AAS will provide the remaining 25% of the joint venture's registered capital.

The newly formed company, Fujian Sinopec Aramco Refining and Petrochemical Co., is set to focus on port operations, crude oil logistics, and various activities related to refining and petrochemical production at a complex located in the Gulei Port Economic Development Zone in Zhangzhou, Fujian province.

Construction of the complex began in the past, marking a significant step in Saudi Aramco's strategy to expand its downstream operations internationally and to supply one million barrels of crude oil per day to China for oil-to-chemicals projects.

Separately, Sinopec announced a 27.6% decline in net profit for the first quarter, based on the China Accounting Standards.

Cameroon

GOVERNMENT-BACKED KRIBI BITUMEN PROJECT TO LAUNCH CONSTRUCTION PHASE IN 2025

According to WPB, construction of a new bitumen production facility in Kribi, Cameroon is scheduled to commence in 2025, with strong backing from the national government.

During a site inspection on April 29, 2025, the acting Minister of Mines, Industry, and Technological Development visited the designated location within Kribi's industrial-port zone, situated in the South region. The visit highlighted the government's commitment to the development, which is being spearheaded by the local firm All Bitumen Plc.

Ahmadou Oumarou, the company's CEO, confirmed that Minister Fuh Calistus Gentry—who also leads the interministerial body responsible for supervising the initiative—reiterated unwavering governmental support.

Oumarou noted that the minister emphasized his readiness to assist investors, particularly those behind well-developed and high-impact ventures.

At the site, Minister Gentry reviewed initial preparations conducted by China Harbour Engineering Company (CHEC), which began clearing the 60-hectare area on March 20, 2025. CHEC was contracted by All Bitumen Plc to carry out preliminary work, with broader earthmoving and construction activities scheduled to begin in the latter part of the year.

The project's total cost is projected at CFA161 billion. Financing will be partially secured through the African Export-Import

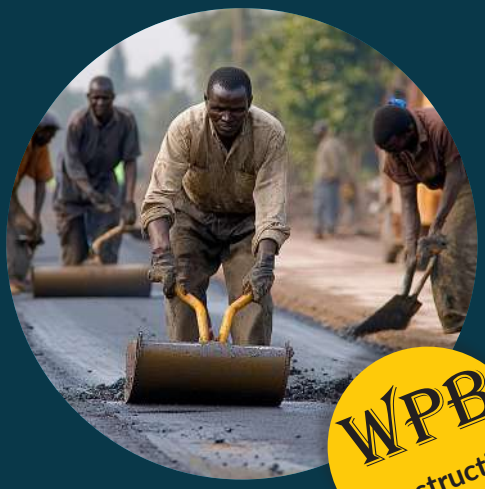
Bank (Afreximbank), which entered into a mandate agreement with All Bitumen Plc in late 2024. As lead arranger, the bank will not only provide funding but also coordinate additional investment partners.

The upcoming facility will feature a mini refinery with a daily processing capacity of 10,000 barrels of crude oil, supplying the necessary input for annual production of 250,000 tons of bitumen.

Experts in infrastructure anticipate that the project will lower road construction expenses in Cameroon by as much as 30%. Furthermore, it is expected to generate 300–400 direct employment opportunities, alongside approximately 1,500 indirect jobs.

On the ground, the minister observed early work carried out by the Chinese firm CHEC, which began clearing the 60-hectare site on March 20, 2025. CHEC was hired by All Bitumen Plc to prepare the land.

General earthworks will follow, with construction expected to begin in the fourth quarter of 2025



General earthworks will follow, with construction expected to begin in the fourth quarter of 2025.

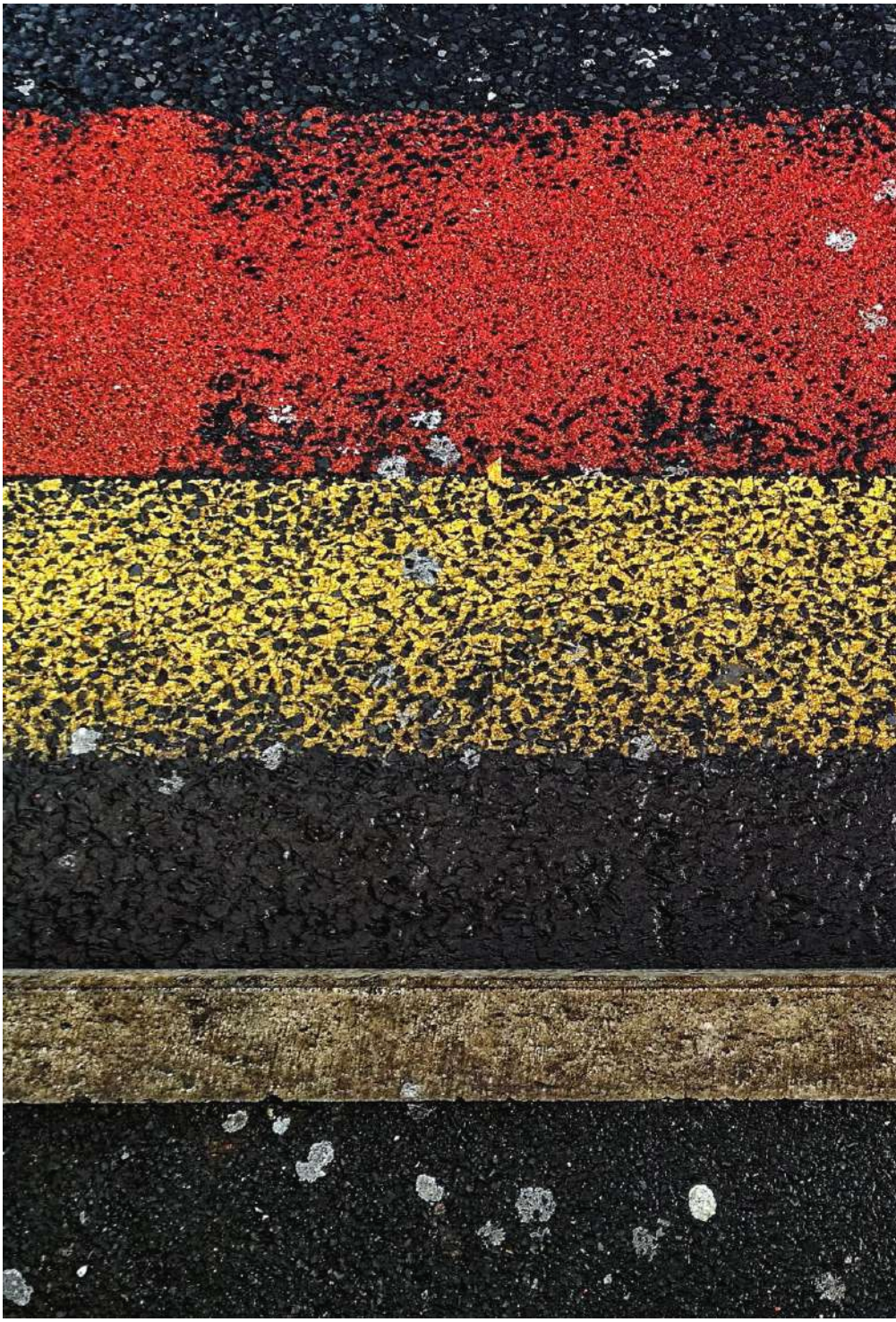
WPB Construction

WPB BITUMEN MAGAZINE

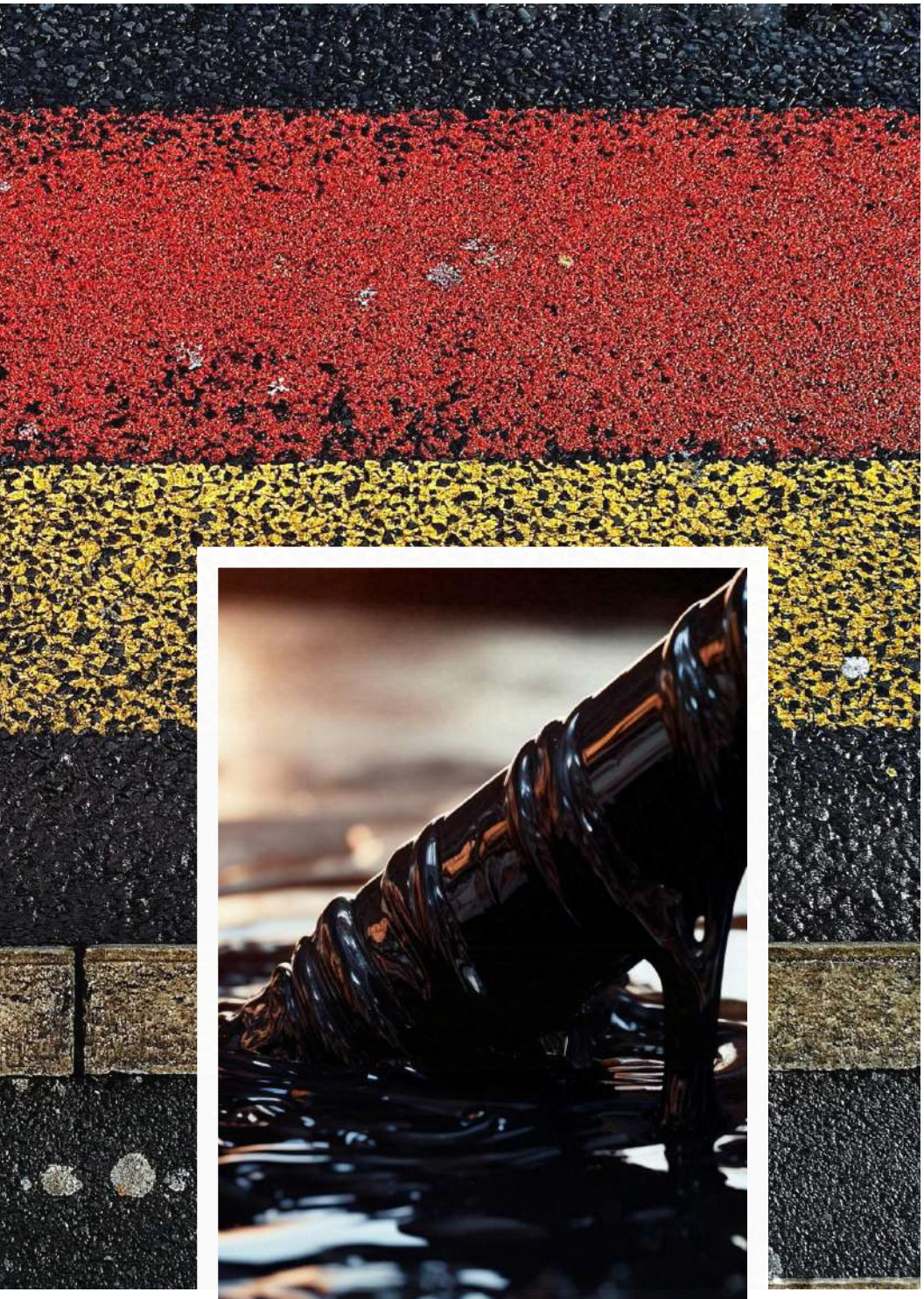
Cameroon

Germany Updates Its Technical Standards for Road Bitumen in 2025

According to WPB, the German Road and Transportation Research Association (FGSV) has published a new 2025 edition of its Technical Delivery Conditions for Road Bitumen and Ready-to-Use Polymer-Modified Bitumen. A key highlight of this update is the introduction of very soft types of road bitumen into the official specifications for the first time.



The revised document, known as TL Bitumen-StB 25, sets the criteria for the supply and use of bitumen in hot-mix asphalt for constructing roads, footpaths, and other paved traffic surfaces. It replaces the earlier standards released in 2007 and revised in 2013.



This edition incorporates Germany's national requirements based on two important European norms:

- DIN EN 12591: Standards for paving-grade bitumen, which is the type of bitumen used in standard road construction.
- DIN EN 14023: A framework for defining the properties of polymer-modified bitumen (PmB)—a type of bitumen enhanced with polymers to improve flexibility and resistance to deformation.

The update also includes key amendments from the General Circular for Road Construction (ARS 8/2019) issued by the Federal Ministry of Transport. In addition, it reflects outcomes from the research project FE 29.0459/2020, which evaluated how bituminous binders (bitumen mixed with additives) change under artificial aging in the lab. As a result, new requirements have been added regarding the rheological properties of the material—that is, how it flows and behaves under stress or temperature changes. These are especially important for ensuring long-lasting and safe road surfaces.

The document, titled TL Bitumen-StB 25 and listed under reference number 794, has been published by the FGSV and is available to researchers, engineers, and relevant institutions. Further information about accessing the document can be obtained through FGSV's official channels.

GLOBAL SELF-HEALING ASPHALT MARKET EXPECTED TO GROW FROM $3.9 BILLION IN 2024 TO $7.5 BILLION BY 2034

The self-healing asphalt industry is on track to witness substantial expansion, with market value projected to nearly double from $3.9 billion in 2024 to an estimated $7.5 billion by 2034. This steady rise, driven by a compound annual growth rate (CAGR) of approximately 6.5%, reflects a growing demand for smarter, longer-lasting, and eco-friendly infrastructure solutions.

At the core of this sector lies the development and deployment of asphalt mixtures designed to repair surface damage autonomously. Utilizing advanced methods such as embedded microcapsules and induction heating systems, these materials are crafted to extend the service life of roadways while minimizing the frequency and cost of repairs. The market's progression supports global initiatives aimed at building more resilient and sustainable transport networks.

Momentum Driven by Infrastructure Durability Needs

Market momentum is largely fueled by increasing global investments in infrastructure durability and cost-effective maintenance strategies. Among the emerging technologies, self-healing asphalt with microcapsule additives currently leads the market due to its proven effectiveness in delaying pavement deterioration. Close behind is the induction heating-based variant, which is gaining popularity, particularly in metropolitan areas where quick and efficient maintenance is crucial.

From a geographical perspective, Europe maintains a leading position, owing to its strong commitment to green infrastructure and strict environmental standards. Countries such as the Netherlands and Germany are pioneering advancements, backed by robust R&D efforts. North

DRIVERS AND EMERGING TRENDS

America also plays a prominent role, with the U.S. embracing innovative materials and construction methods to modernize its roadways. The push toward reducing the carbon footprint in urban development further accelerates adoption rates worldwide.

Market Composition and Projections

In terms of volume, the market stood at approximately 300 million metric tons in 2023 and is expected to rise to 500 million metric tons by 2033. The road construction sector commands the largest share—around 45%—followed by highway upkeep at 30%, and urban infrastructure projects accounting for 25%. The surge in demand for new roads, fueled by rapid urban expansion, is a key contributor to the dominance of the road-building segment.

Notable players shaping the competitive landscape include BASF SE, Shell Bitumen, and LafargeHolcim. These companies are actively broadening their offerings through innovation, strategic alliances, and the adoption of cutting-edge technologies to maintain a competitive edge.

Regulatory Environment and Technological Landscape

The evolving regulatory framework—particularly within the European Union—significantly impacts market dynamics. Compliance with stringent sustainability regulations drives the adoption of greener solutions while also affecting production and operational costs. Meanwhile, technological progress is accelerating, with an anticipated 10% annual increase in R&D expenditure directed toward more efficient and environmentally friendly formulations.

Emerging technologies like artificial intelligence (AI) and the Internet of Things (IoT) are set to revolutionize infrastructure monitoring and predictive maintenance, opening new frontiers for smart and adaptive road

Catalytic Bed Reactors: To break down volatile organic compounds (VOCs) or other resistant pollutants, catalytic beds such as metal-based catalysts are used.

systems. These innovations are expected to create additional avenues for market growth, especially in the context of smart city initiatives.

Pricing Trends and Recent Developments

Pricing for self-healing asphalt fluctuates based on the complexity of polymer enhancements used in formulations, ranging from $70 to $150 per ton. Variability in raw material supply and regional production capabilities also influence these costs. Recent breakthroughs in polymer science have significantly improved the material's healing performance, encouraging more construction companies to adopt it as a long-term solution.

Governments worldwide are increasing support for sustainable building practices, with several infrastructure stimulus packages promoting self-repairing materials. Such policies are projected to contribute to a market CAGR of over 10% in the next five years. Additionally, partnerships between research institutions and private enterprises are accelerating the development of bio-based polymers and nanomaterial-enhanced asphalt, improving the environmental footprint and mechanical resilience of these materials.

Drivers and Emerging Trends

The growing urgency to build resilient urban infrastructure is a major driver behind the market's expansion. Self-healing asphalt, with its capacity to automatically close surface cracks, fits seamlessly into strategies aimed at lowering maintenance frequency and reducing environmental degradation.

Technological advancements remain at the heart of this transformation. New formulations are increasingly equipped with capsules or fibers that discharge healing agents when damage occurs, helping extend the surface's lifespan. This innovation not only aligns with sustainable development goals but also provides a cost-effective alternative to conventional road materials.

Smart city planning and the integration of intelligent infrastructure are also playing a crucial role in market growth. As urban centers evolve, the demand for long-lasting and low-maintenance roadways continues to climb—making self-healing asphalt a critical component of future urban ecosystems.

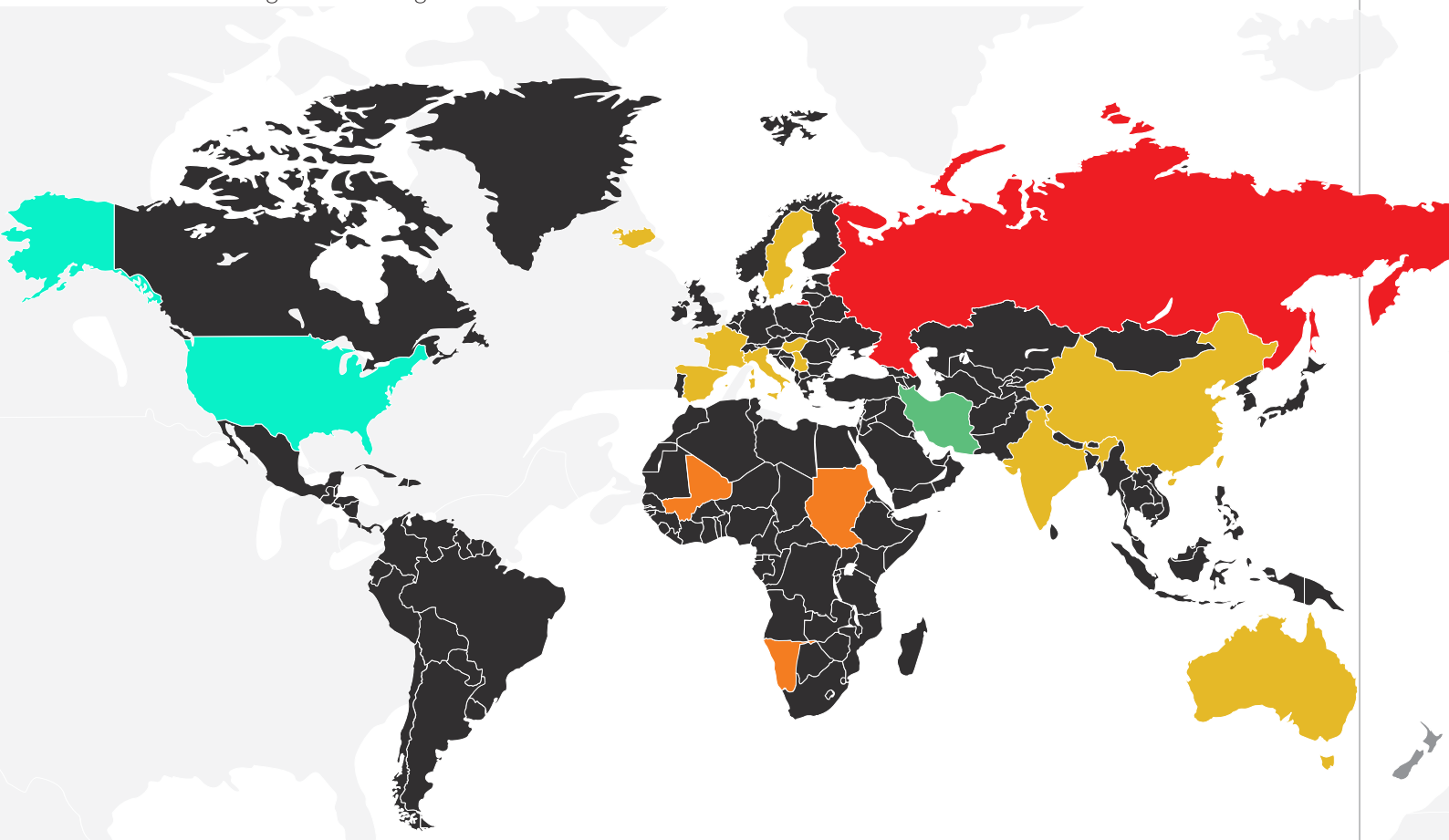
Barriers to Widespread Adoption

Despite its potential, the self-healing asphalt market faces several hurdles. High initial production costs remain a deterrent, especially for municipalities and contractors working with limited budgets. Moreover, the novelty of the technology presents an educational barrier, with many stakeholders lacking the knowledge or confidence to transition away from traditional asphalt solutions.

Installation of these materials also requires specialized expertise, which is not yet widely available. Additionally, region-specific environmental conditions affect the performance of self-healing asphalt, making universal application challenging without localized adaptation. Regulatory approval processes can be lengthy and complex, further slowing market penetration.

Future Outlook

Overall, the future of the self-healing asphalt market appears bright, with strong support from environmental policies, technological evolution, and the global shift toward sustainable infrastructure. Continued investment in R&D, coupled with increasing awareness of the long-term economic and environmental benefits, is likely to accelerate adoption and transform the way modern roads are built and maintained.

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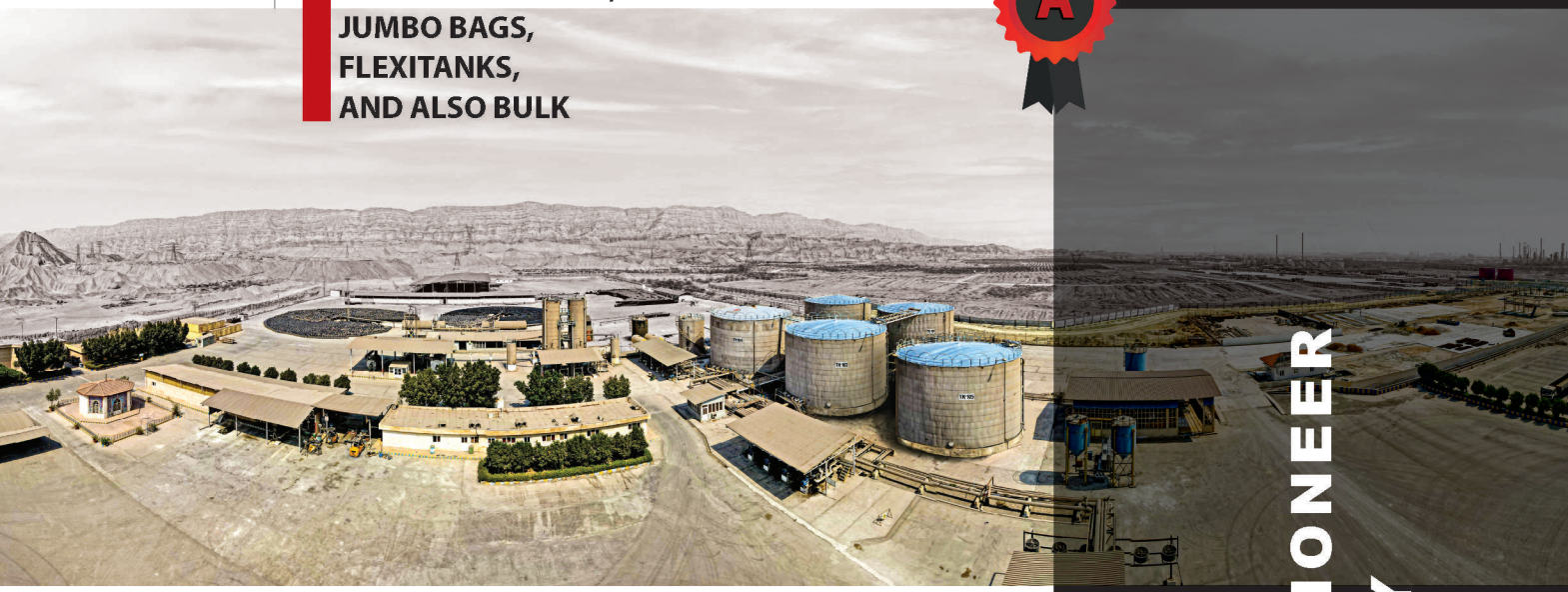

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