

N-GEN POST OFFICE Green highways with bio-bitumen innovation

The launch of N-Gen themed Post Offices marks a significant step in redefining the identity of India Post in a rapidly evolving digital age. Long perceived as a traditional, paperwork-heavy institution, the post office is now being reimagined as a modern, citizen-centric service hub that blends trust, technology and convenience. The N-Gen (Next Generation) initiative is not merely about aesthetic upgrades; it represents a deeper transformation in how public services are delivered.

At the heart of the N-Gen Post Office concept is the idea of inclusivity with innovation. These redesigned post offices feature modern interiors, digital kiosks, improved seating, queue management systems and user-friendly signage. More importantly, they are integrated with advanced IT systems that allow customers to access a wide range of services efficiently. From postal and banking services to insurance, savings schemes and e-commerce logistics, the N-Gen model aims to make the post office a one-stop solution for diverse citizen needs.

This transformation comes at a crucial time. As private courier companies and digital payment platforms expand aggressively, traditional postal services face the risk of becoming obsolete. By embracing technology and improving customer experience, India Post is positioning itself as a competitive and relevant institution. The introduction of paperless transactions, core banking solutions and real-time tracking has already enhanced operational efficiency. N-Gen Post Offices build on this progress by ensuring that service delivery matches the expectations of a tech-savvy population.

Equally important is the social role these modernised post offices continue to play.

In rural and semi-urban areas, the post office remains a trusted institution, often serving as the primary link between citizens and the formal financial system.

The N-Gen model strengthens this role by enabling smoother Direct Benefit Transfers, pension disbursements and financial inclusion initiatives. By combining digital infrastructure with human support, it bridges the digital divide rather than widening it.

The N-Gen themed Post Office represents a thoughtful balance between legacy and modernity. It respects the institution's historical significance while preparing it for future challenges.

If implemented consistently across the country, this initiative can restore public confidence in India Post and reaffirm its relevance in the digital era. In doing so, the post office can once again emerge as a symbol of accessible, efficient and people-oriented public service.

■ MOHAMMAD HANIEF



India's road construction sector is poised for a significant transformation with the successful transfer of an indigenous bio-bitumen technology that converts agricultural residue into a sustainable alternative to conventional petroleum-based road binders. Developed jointly by the CSIR-Central Road Research Institute (CRRI), New Delhi, and the CSIR-Indian Institute of Petroleum (IIP), Dehradun, the innovation signals a decisive move towards cleaner, greener, and more self-reliant highway infrastructure.

Bio-bitumen is produced through the pyrolysis of post-harvest biomass such as rice straw, a process that enables farm residue to be repurposed as a high-value industrial input. The technology directly addresses two of India's pressing challenges: the environmental impact of fossil fuel dependence in infrastructure and the large-scale burning of crop residue after harvest. By linking agricultural waste management with road construction, the innovation establishes a circular economy model with nationwide relevance.

India's expanding highway network currently relies heavily on petroleum-derived bitumen, nearly half of which is imported. This dependence exposes the sector to volatile global prices and results in a substantial foreign exchange burden. The introduction of bio-bitumen offers a domestic alternative that can partially substitute conventional bitumen while maintaining performance standards required for high-traffic roads. Laboratory studies have shown that blending bio-bitumen at levels of 20 to 30 per cent does not compromise structural integrity or durability, making it a viable option for mainstream adoption.

The production process begins with the systematic collection of post-harvest crop residue, which is pelleted to ensure uniform feedstock quality. The pellets are then subjected to pyrolysis, a controlled thermal process conducted in the absence of oxygen. This treatment produces bio-oil, which is subsequently refined and blended with conven-



tional bitumen to create a road binder suitable for paving applications. The process has been designed to be energy-efficient and emission-free, enhancing its environmental credentials.

Extensive validation of the bio-bitumen blend has been carried out to ensure compliance with national and international road construction standards. Researchers evaluated the material through a wide range of physical, rheological, chemical, and mechanical tests. Performance assessments included resistance to rutting under high temperatures, cracking behaviour under stress, susceptibility to moisture damage, and resilient modulus measurements. The results demonstrated parity with conventional bitumen, reinforcing confidence in the material's suitability for long-term infrastructure use.

Field-level feasibility has already been established through a pilot project on the Jorabat-Shillong Expressway in Meghalaya, where a 100-metre stretch of road was laid using the bio-bitumen blend. The trial confirmed the material's workability during construction as well as its performance under real traffic and climatic conditions. The success of this demonstration has strengthened the case for scaling up the technology across national and state highway projects.

Beyond its application in road construction,

the bio-bitumen production process yields several valuable co-products that enhance its economic viability. Pyrolysis generates energy-rich gases that can be used as fuel within the system, reducing external energy requirements. It also produces bio-pesticide fractions and high-grade carbon materials with applications in batteries, water purification, and advanced manufacturing. These multiple value streams contribute to the overall sustainability and cost-effectiveness of the technology.

The development is particularly significant in the context of India's efforts to reduce import dependence. With annual bitumen imports valued at an estimated ₹25,000-30,000 crore, even partial substitution through bio-bitumen could result in substantial savings. At the same time, the technology creates new economic opportunities in rural areas by generating demand for agricultural residue that was previously treated as waste. Farmers stand to benefit from additional income streams, while local processing units can stimulate employment and regional development.

The rapid progression of bio-bitumen from laboratory research to industrial-scale technology transfer highlights the growing maturity of India's applied research ecosystem. A patent has been filed for the process,

and multiple industrial partners have been engaged to facilitate commercial production and deployment. India has emerged as the first country to move bio-bitumen technology to industrial and commercial readiness within the same year, positioning itself as a potential global leader in sustainable road materials.

The successful integration of alternative materials into infrastructure projects is not without precedent in India. Previous initiatives involving waste plastic, steel slag, and bio-fuels have demonstrated that non-conventional inputs can meet performance benchmarks while delivering environmental benefits. Bio-bitumen builds on these experiences, offering a scalable and scientifically validated solution that aligns with climate commitments and development priorities.

Policy-level integration is expected to play a crucial role in the widespread adoption of bio-bitumen. The inclusion of blended bitumen in national highway specifications would provide regulatory clarity and market confidence, encouraging contractors and state agencies to adopt the material. Region-specific implementation strategies, based on the availability of agricultural residue, could further optimise deployment and maximise impact.

As India continues to expand its road network to support economic growth and connectivity, the choice of construction materials will increasingly influence environmental outcomes. Bio-bitumen represents a shift in thinking, where infrastructure development is no longer viewed in isolation from sustainability goals. By transforming farm residue into durable highways, the technology demonstrates how indigenous innovation can simultaneously address pollution, resource efficiency, and self-reliance.

The successful transfer of bio-bitumen technology marks a critical step towards redefining how India builds its roads. It underscores the potential of science-driven solutions to reshape traditional sectors and positions the country on a path towards cleaner, greener, and more resilient infrastructure for the future.

(The author is a senior analyst)

Riding Market Cycles with Business Cycle Mutual Funds

■ PUNEET SHARMA



The Indian economy has traversed multiple business cycles over the past 25 years. It began with the mild recession that followed the dotcom bust in the early 2000s, before entering an upcycle that lasted until the Global Financial Crisis of 2008. This was followed by a stimulus-

driven rebound from 2009 to 2012, which eventually gave way to the volatility triggered by the taper tantrum in the mid-2010s. The 2016-2017 period witnessed a series of structural policy reforms - GST implementation, demonetisation, and the roll out of the Insolvency and Bankruptcy Code which was followed by associated transition pains between 2017 and 2019. The pandemic-induced contraction in 2020 was succeeded by a

strong V-shaped recovery in 2021. The years 2022-2024 marked a phase of normalization marked by elevated inflation driven by supply chain disruptions and an extended period of loose global monetary policy. Now, the economy is seeing government capex and policy-led expansion, even as it continues to navigate significant global uncertainties and geopolitical headwinds. The stock markets too, as a result, have seen ups and downs over the

years, proving to be a wild ride for equity investors. 2026 and the years ahead will bring economic cycles of their own. Equity investors have to navigate these with tact and patience to create sustainable, long-term wealth. Business Cycle Mutual Funds which are designed to ride out different business cycles in a research-backed, disciplined way can be a smart way to do that. These funds do top-down research to identify

lucrative themes and opportunities. They also move out of sectors and stocks set to underperform as a result of the cycle.

This is done continuously in a way that has potential to add to returns and reduce risk over time, making it particularly advantageous for retail investors who may not have the time, expertise, or resources to track and respond to economic cycles on their own.

ICICI Prudential Business Cycle

Fund is one such option investors can consider.

Launched in January 2021, it has stood out for its consistent performance. As of November 30, 2025, it posted a one year CAGR of 13.41% and healthy CAGR of 21.66% over three years and 21.58% since inception, outperforming its benchmark by 4-7% across these periods.

(The writer is Mutual Fund Distributor, J&K)

Netaji Subhas Chandra Bose

■ RAVI ROHMETRA

Subhas Chandra Bose was one of the most celebrated freedom fighters of India. He was a charismatic influencer of the youth and earned the epithet 'Netaji' by establishing and leading the Indian National Army (INA) during India's struggle for independence. Although initially aligned with the Indian National Congress, he was ousted from the party due to his difference in ideology. He sought assistance from Nazi leadership in Germany and Imperial forces in Japan during the World War II, to overthrow the British from India. His sudden disappearance post 1945, led to surfacing of various theories, concerning the possibilities of his survival.

Childhood & Early Life

Netaji Subhas Chandra Bose was born on 23 January, 1897 in Cuttack (Orissa) to Janakinath Bose and Prabhavati Devi. Subhash was the ninth child among eight brothers and six sisters. His father, Janakinath Bose, was an affluent and successful lawyer in Cuttack and received the title of "Rai Bahadur". He later became a member of the Bengal Legislative Council.

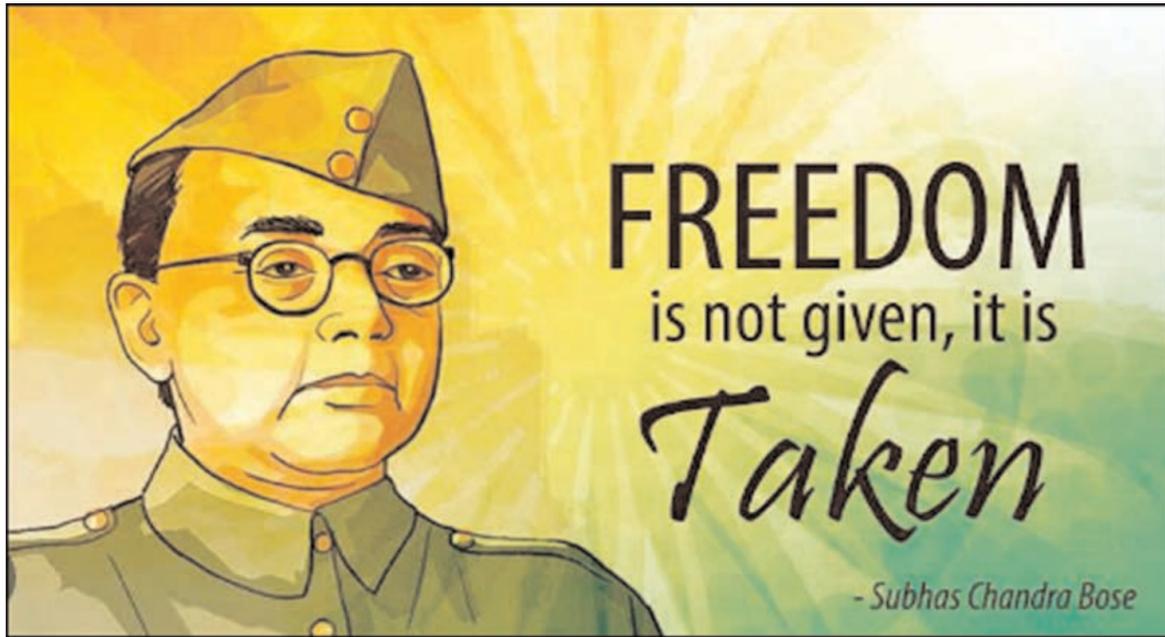
Subhas Chandra Bose was a brilliant student. He passed his B.A. in Philosophy from the Presidency College in Calcutta. He was deeply influenced by Swami Vivekananda's teachings and was known for his patriotic zeal as a student. In an incident where Bose beat up his professor (E.F. Otten) for his racist remarks, brought him notoriety as a rebel-Indian in eyes of the government. His father wanted Netaji to become a civil servant and therefore, sent him to England to appear for the Indian Civil Service Examination. Bose was placed fourth with highest marks in English. But his urge for participating in the freedom movement was intense and in April 1921, he resigned from the coveted Indian Civil Service and came back to India. In December 1921, Bose was arrested and imprisoned for organizing a boycott of the celebrations to mark the Prince of Wales' visit to India.

During his stay in Berlin, he met and fell in love with Emily Schenk, who was of Austrian origin. Bose and Emily were married in 1937 in a secret Hindu ceremony and Emily gave birth to a daughter Anita in 1942. Shortly after the birth of their daughter, Bose left Germany in 1943 to come back to India.

Political Career

Association with Indian National Congress

Initially, Subhas Chandra Bose worked under the leadership of Chittaranjan Das, an active member of the Congress in Calcutta. It was Chittaranjan Das, who along with Motilal



Nehru, left Congress and founded the Swaraj Party in 1922. Bose regarded Chittaranjan Das as his political guru. He himself started the newspaper 'Swaraj', edited Das' newspaper 'Forward' and worked as the CEO of Calcutta Municipal Corporation under Das' stint as Mayor. Subhas Chandra Bose played an important role in enlightening the students, youths and labourers of Calcutta. In his fervent wait to see India as an independent, federal and republic nation, he emerged as a charismatic and firebrand youth icon. He was admired within the congress for his great ability in organization development. He served several stints in prison for his nationalist activities during this time.

Dispute with the Congress

In 1928, during the Guwahati Session of the Congress, a difference of opinion surfaced between the old and new members of the Congress. The young leaders wanted a "complete self-rule and without any compromise" while the senior leaders were in favour of the "dominion status for India within the British rule".

The differences between moderate Gandhi and aggressive Subhas Chandra Bose swelled to irreconcilable proportions and Bose decided to resign from the party in 1939. He went on

to form the Forward Bloc the same year. Although he voiced his dislike for the British often in his correspondences, he also expressed his admiration for their structured way of life. He met with the leaders of the British Labor Party and political thinkers including Clement Attlee, Harold Laski, J.B.S. Haldane, Arthur Greenwood, G.D.H. Cole, and Sir Stafford Cripps and discussed the possibilities that an independent India might hold.

Formation of the INA

Bose vehemently opposed the Congress decision to support the British during the Second World War. With the aim to initiate a mass movement, Bose called out to Indians for their whole-hearted participation. There was tremendous response to his call "Give me blood and I will give you freedom" and the British promptly imprisoned him. In jail, he declared a hunger-strike. When his health deteriorated, the authorities, fearing violent reactions, released him but put him under house-arrest.

In January, 1941, Subhas made a planned escape and reached Berlin, Germany via a detour through Peshawar. Germans assured him their full support in his endeavours and he gained allegiance of Japan as well. He took a perilous journey back east and reached Japan where he assumed command over 40,000 sol-

diers recruited from Singapore and other south East Asian regions. He called his army the 'Indian National Army' (INA) and led the same to capture the Andaman and Nicobar islands from the British and rechristened it as Shaheed and Swaraj Islands. A provisional "Azad Hind Government" started functioning in the captured territories. The INA or the Azad Hind Fauj stared for India and crossed Burma Border, and stood on Indian soil on March 18, 1944. Unfortunately, the tide of the World War turned and the Japanese and German forces surrendered which forced him to call off further advancement.

Death

Netaji disappeared mysteriously soon after the retreat. It is said that he went back to Singapore and met Field Marshal Hisaichi Terauchi, head of all military operations in South East Asia who arranged for him a flight to Tokyo. He boarded a Mitsubishi Ki-21 heavy bomber from Saigon Airport on August 17, 1945. The following day the bomber crashed shortly after take-off after a night halt in Taiwan. Witnesses report that Bose sustained intense third degree burns in the process. He succumbed to his injuries on Aug 18, 1945. He was cremated on August 20 in Taihoku Crematorium and his ashes were laid

to rest at the Renkji Temple of Nichiren Buddhism in Tokyo.

Bose's comrades who were stranded in Saigon waiting to be transported never saw his body. Nor did they see any photographs of his injuries. They refused to believe that their hero was dead and hoped that he evaded detection by the British-American forces. They believed whole heartedly that it was just a matter of time that Netaji will gather up his army and conduct a march towards Delhi. Soon people began to report sighting of the hero and even Gandhi expressed his scepticism about death of Bose. Post-independence, people started to believe that Netaji had adopted an acetic life and became a Sadhu. The mysteries surrounding Bose's death took upon mythic proportions and perhaps symbolized the hope of the nation.

The government of India set up a number of committees to investigate the case. First the Figgess Report in 1946 and then the Shah Nawaz Committee in 1956, concluded that Bose had indeed died in the crash in Taiwan.

Later, the Khosla Commission (1970) concurred with the earlier reports, the reports of Justice Mukherjee Commission (2006) said, "Bose did not die in the plane crash and the ashes at Renkoji temple are not his". However, the findings were rejected by the Government of India.

In 2016, following the declassification of a report handed over by the Japanese government to the Indian Embassy in Tokyo in 1956, titled "Investigation on the cause of death and other matters of the late Subhas Chandra Bose" confirmed the Indian National Hero's death in Taiwan on August 18, 1945.

Ideology

Bose's correspondences prove his faith in democracy in Independent India. Bose's primary ideology was always the freedom of his motherland even if meant taking help from fascists like Mussolini or Hitler.

Legacy

Netaji Subhas Chandra Bose has left deep impact on the psyche of his countrymen. His slogan, 'Jai Hind' is still used in reverence to the country. The International airport in Kolkata has been named Netaji Subhas Chandra Bose International Airport to commemorate the charismatic leader.

In Popular Media

Many documentaries, TV series and films have been made on the life of netaji. In 2004, revered director Shyam Benegal made a biopic 'Netaji Subhas Chandra Bose: The Forgotten Hero' that received immense critical acclaim in India as well as in international film festivals

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