Case 75

# Porous Asphalt

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*This article introduces recycling systems of asphalt as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.*

## The Market for Asphalt

The global asphalt/bitumen market is expected to reach 124 million metric tons in 2011 representing an estimated turnover of $74.4 billion. Prices were as low as $115 per metric ton delivered at the refinery in 1999, topping $200 in 2005 rising to more than $600 in the summer of 2011. Demand is forecast to rise 2.1 percent annually through 2013. There is a deceleration from the previous years mostly due to the slower growth in China which nevertheless remains the key growth market in the world. The best growth segment in the developing world is bitumen not for roads, but rather for roofing, now already representing ten percent of the total output compared to 84 percent for road pavement. A small remaining part is used to waterproof boats. Demand for asphalt in roofing products currently accounts for a relatively small portion of total roofing demand thus offering opportunities for growth in Asia (except Japan) and Latin America. China will become the world's second largest national market for asphalt roofing after the USA.

One ton of asphalt 18 inches deep covers one square yard. Asphalt emulsions and polymer modified asphalts are posting gains while the traditional asphalt cement lags behind on the market. One of the key shifts is the replacement of non-porous asphalt, which causes aquaplaning with porous asphalt which offers higher safety to road transportation. Apart from the traditional leading refineries in the world belonging to established multinational corporations like Exxon Mobil, BP, Chevron and Shell, the Latin American company Petroleos de Venezuela (PDVSA) has taken a dominant position internationally since Venezuela has some of the world's largest deposits of bitumen in Orinoco oil sands good for an estimated 300 billion barrels, only matched by the Canadian reserves in Alberta with 310 billion barrels. If these reserves were used at today's rate of consumption of 4.4 million barrels per day, then these countries could supply the world for approximately 400 years.

## Innovations

Whereas bitumen was used to waterproof boats and buildings in the cities of Babylon and Carthage millennia ago, its properties were also used in early photography since bitumen on pewter plates exposed to light made black and white images. Later it was also applied as sound insulation in computers and home appliances such as white goods. Whereas most of asphalt is mined, it could also be produced from renewable sources such as sugar, molasses, and from starch provided by rice, corn and potatoes. However, today the bulk of bitumen is made from left-over petroleum after refining and from used motor oil. The main

challenge with asphalt remains its massive waste generation since roads need to be repaved regularly due to wear and tear. Asphalt in Europe is today 80% recycled, twice the amount of recycled paper, glass, plastic and aluminum combined. The US Federal Highway Administration estimates that 91 million tons of asphalt are scraped or milled off roads during resurfacing and widening. Of that massive volume 73 million tons are reclaimed. However, this huge volume requires hauling and shipping from the road to reconditioning centers causing additional traffic jams due to the fact recycling and blending of 10 to 25 percent of old asphalt into a new mix is done off site.

Mr. Hisashi Hosokawa pursued a remarkable career as a career service man of the Japanese Ministry of International Trade and Industry (now Economy, Trade and Industry), including the posts as Director General of the International Trade Policy Bureau, and concluding his time with the Government as Vice-Minister for International Affairs. After the mandatory retirement, Mr. Hosokawa took the exceptional step not to be parachuted into a comfortable post within industry or a government agency (known as amakudari), he decided to become an entrepreneur. Since he also held major responsibilities for environment, he reflected on the key industries where he felt that specific innovations could steer the industry towards sustainability. In view of the sheer volume of asphalt, and the challenges the industry faces to upgrade the waste material from regular asphalt to higher grade and better value porous variety he assembled a consortium of Japanese industries and a core group of experts. Starting from an existing technology, he perfected a system that not only is able to recycle asphalt on site, it can even convert the old paving material into the higher quality porous asphalt thus going beyond the mixing 10-25 percent of old material. His proven technology and process only requires blending maximum 30 percent, depending on the asphalt mixture to be repaved, of new material in order to recondition highway cover. He went on to create the Tokyo-based company GreenARM Co. Ltd. to commercialize these solutions. Mr. Hosokawa labelled his approach to asphalt recycling and other industrial designs he is developing as "ecofacturing", differentiating this methodology from manufacturing.

## The First Cash Flow

Mr. Hosokawa and his team at GreenARM including Prof. Atsushi Kasahara, a prominent academic of civil engineering who had initiated the idea advanced rapidly in the design and the manufacturing of a train of equipment and successfully proved the efficacy of the technology with a government project after initial tests in Japan. With an earlier technology a series of probes had been undertaken with porous asphalt in Italy in advance of the Winter Olympics in Torino (Italy) in 2006. GreenARM was also involved in a major first contract with the Public Works Department of Delhi State Government (India) through a local joint-venture in preparation of the Common Wealth Games 2010 recovering 820,000 square meters of resurfacing of city roads. The earlier technology of in situ recycling also demonstrated its superior performance in timing and surface quality, totally rehabilitating the old asphalt.

The NHAI (National Highway Authority of India) has introduced mandatory recycling for road rehabilitation accordingly emphasizing in situ recycling. The train of equipment preheats the surface asphalt mixture, easily scarifying it on the road, reconditions it into the desired mix on site, re-using 100 percent of the reconditioned asphalt and mixing it with a minor portion of new material. The porous asphalt making technology has an additional unit of separating asphalt coated particle by particle size after scarifying and before mixing, and a double paver that lays both porous asphalt and the mortar under-layer in tandem. Using what you have is one of the core principles of the Blue Economy, avoiding transport and securing on-site recycling thus reducing costs and material use. In this case, it is a reduction of material by factor 9. This provides sufficient financial incentives to justify the investments.

## The Opportunity

Road construction imposes a heavy toll on the environment. Converting roads to porous ones secures that storm water follows the natural drainage. Aquaplaning is not only dangerous for the drivers, it also impedes the cleaning of water leading through a natural filtration process which leads to the accumulation of waste and toxins on and around the road. Whereas the producers of asphalt/bitumen are a few major multinationals, the road builders are universally local companies that are strongly embedded in the regional business tissue. The shift in equipment required to apply the business model described above implies a fast depreciation of the existing capital investments. Since the equipment typically has a long operational life, this leads to a resistance to change, especially when the machinery is not amortized in full. This creates a window of opportunity for the entrepreneur to make a difference. However, the porous asphalt produced from existing road cover plus a minor addition of fresh material reduces mining and shipping, and helps reestablish the water table. It is a change of the rules of the game that anyone with a sense of risk is prepared to take.

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… Further information on the 100 innovations at wwww.theblueeconomy.org



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