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The Chinese Bitumen Market

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“It is the new and different that is always most vulnerable to market research”

(Malcolm Gladwell in: Blink – The power of thinking without thinking, 2005)

Background:

In 2002, CICHEM Ltd.¹, a worldwide recognized chemical producer located in Asia, initiated the development of new kind of plastic foil suitable for packaging bitumen into plastic bags. Bitumen is one of the oldest mineral oil products won during the refining of crude oil. Typical application areas of Bitumen include construction of highly strained traffic surfaces (roads, air strips), mastic asphalts used e.g. for the production of insulating materials or roofing membranes.

Due to its characteristic of only being fluid at temperatures of 180 - 200° Celsius and otherwise hardening out, Bitumen is usually either transported in fuelling vehicles or barrels. Fuelling vehicles are especially suitable when large quantities are needed as for example in the case of road construction. In the case of small quantities as for example in the roofing industry Bitumen is filled into barrels where it hardens out when the temperature drops. So, for the further processing the barrel has to be reheated or even destroyed. The advantage of the new foil developed by CICHEM Ltd. is, that when heated it disintegrates without leaving chemical residues and therefore not changing the Bitumen's chemical structure.

Mr. Tanaka², the responsible product manager at CICHEM's R&D department, sees a potential for the new developed foil especially in those areas, where small quantities of Bitumen are needed. The first major advantage of packaging Bitumen into foil bags are possible cost reductions for the end-user due to minimized energy (reheating) and material costs. While for example an empty barrel with a capacity of 150 liters costs approximately 15 USD, a single foil bag containing 25 kg of Bitumen only costs 0.20 USD. Secondly, the used barrels do not have to be returned to the supplier for disposal, leading to lower logistic costs. Additional savings concerning logistics can also be achieved, since foil bags are stackable and therefore allow an optimized space usage in trucks.

¹ Name changed due to confidentiality reasons

² Name changed due to confidentiality reasons

The decision concerning the development of this new foil was heavily controversial. Mr. Tanaka knew that his career highly depended on the success of his product. But in order for the product to succeed in the market he needed a packaging machine which was capable of filling a hot liquid into a foil bag. Such a technology did not exist until then.

Due to intensive business connections, Mr. Tanaka contacted the business unit “chemicals” of a company named Haver & Boecker. Haver & Boecker is a world-leading, medium-sized German manufacturer of packaging machines and systems. Mr. Tanaka asked Haver & Boecker, if they were interested in developing such a packaging machine. Due to the uniqueness of the filling process and the limited application possibilities, this decision was not easy. Haver & Boecker’s R&D department estimated development costs of over 1 million USD. This is a comparably high investment considering the companies size, the limited potential of applying the new filling process to other areas and the machine’s market success dependence on the market success of CICHEM Ltd.’s product.

So, in order to make a founded decision Haver & Boecker decided to initiate secondary market research aiming at assessing the market potential for bitumen in foil bags and therefore for their machine. Igantius M. Müller³, a consultant specialized in industrial market research, was hired to first evaluate the Chinese bitumen market. Müller’s recent report incorporates general information regarding the product bitumen and the Chinese market for bitumen as well as special information concerning the Chinese roofing market. Looking at the characteristics of bitumen, Müller noticed that the latter proved to be very promising for packaging bitumen into foil bags.

General information regarding Bitumen

The term “bitumen” describes a category of organic, highly viscous, black and sticky liquids comparable to tar or asphalt. Obtained during the refining process of crude oil, it is one of the oldest mineral oil products. Such as oil, bitumen is found in natural deposits formed by remains of ancient, microscopic organisms, which under pressure transformed to materials such as crude oil or diamonds. Industrial production of bitumen solely occurs in refineries. In brief, the production process can be described as follows: By heating crude oil to temperatures of 350-380° Celcius and pressurizing it, the heavy (bitumen) and lighter (e.g. kerosene, gasoil, benzine) components of the crude oil are physically separated. Being the heaviest component and

³ Name changed due to confidentiality reasons

possessing the highest boiling point, the bitumen falls to the bottom of the distiller. Through further steps, as for example oxidation, different kinds of bitumen are produced, each suitable for different applications.

In general, the different types of bitumen can be classified into four groups:

- **Distillation bitumen** includes soft and semisolid types of bitumen primarily used for road construction. Therefore, this type is often called “road construction bitumen”.
- **High vacuum and solid bitumen** are primarily used for the production of mastic asphalts, needed for the production of screed, varnish, vulcanized rubber goods and insulating material.
- **Oxidation bitumen** is industrially employed in the production of roofing and sealing membranes. Another important application is the production of bonding compounds connecting roofing membranes with one another.
- **Polymer-modified bitumen** is produced by combining distillation bitumen with different kinds of polymers. It is used in the field of constructing highly strained traffic surfaces (e.g. roads or air strips) and in the production of high end roofing and sealing membranes.

While in the past bitumen was especially used to waterproof boats or to coat buildings, today it is mainly used for road construction as well as for the production of roofing and sealing membranes and as a binder in the field of building construction and underground engineering.

Industrial bitumen is usually stored, delivered and applied in a hot-liquid state of approximately 180 - 200° Celsius using railway tank wagons or fuelling vehicles. But these vehicles are only suitable where larger quantities of bitumen are needed (e.g. road construction). In other case - such as roofing – usually barrels or blocked bitumen are used.

The disposal of bitumen in the form of granulate has proved to be a failure because granulating lowers the bitumen’s softening points to around 40 – 60°C. As consequence bitumen granulates easily agglomerate. Its application in an adhesive state is technically troublesome.

For oxidation and polymer-modified bitumen a fully automated block filling process into foil already exists. Here, hot bitumen is filled into a tube and then passes a quenching bath in order for it to harden. The resulting bitumen block can then be cut into different segments. This block then has to be reheated when applying the bitumen. During the reheating process, which can take

between one and two hours, the foil disintegrates. Block bitumen is only suitable when small quantities are needed and the application site is hardly accessible for railway tank wagons or fuelling vehicles (e.g. construction sites). Exhibit 1 shows different forms of bitumen products.

The Chinese Market for Bitumen

Demand situation

One of the main application areas of bitumen (distillation, high vacuum and solid bitumen) is the road construction sector. Around 80-90% of the worldwide bitumen production is used in this area, where it serves as a binder combining different essential mineral compounds such as gravel, split and sand to form mastic asphalt. The customers are mainly stationary asphalt blending plants. The hot-liquid bitumen is directly pumped from the storage tanks into the blender. Using fuelling vehicles with in-built mastic asphalt boilers, keeping the asphalt at a temperature of approximately 200° Celsius, the mastic asphalt is then directly transported to the construction site. Here, depending on the size of the construction site, it is directly infused on the surface by hand or using so-called “mastic-asphalt-dumpers”. These steps are generally conducted by specialized firms.

The Chinese market for mastic asphalt has experienced rapid growth in the last decades, leading to a market volume of 10.8 million metric tons in 2003. For the next 5 years, recent research estimates an annual growth rate of 6.8 percent, yielding to a market size of more than 15 million metric tons in 2008 (Freedonia, 2005, p.1). This increasing demand results from the necessary investments (construction, maintenance and repair) in the Chinese infrastructure due to the still ongoing economic growth, supported by Beijing’s staging of the 2008 Summer Olympic Games (Freedonia, 2004a, p.1). Exhibit 2 gives an overview of the main indicators regarding construction enterprises in China.

Due to their characteristics, oxidation and polymer-modified bitumen are primarily delivered to producers of roofing and sealing membranes. As far as refineries do not produce membranes themselves, they deliver the bitumen directly to the end-users (e.g. roofers and insulators), who own mobile fusing machines and use the bitumen in order to connect the roofing membranes. Unfortunately, it was not possible to receive detailed information concerning the bitumen quantities sold for these applications.

But rising living standards spark both the residential and the nonresidential building construction industry, raising the use of oxidation and polymer-modified bitumen. Some industry representatives believe that there is additional demand in the rural and underdeveloped areas in the Northwest of China, since the development of these areas is an especial important goal in the central government's "Go West" campaign. Defective road networks and limited bitumen production capacities in these areas foster transportation of bitumen in a solid state.

Supply situation

Despite exhaustive attempts, Igantius M. Müller's research did not reveal any findings regarding the suppliers of block bitumen in China. But in order to gain insight into the industry's structure, his research focused on suppliers of block bitumen in Germany. His research revealed that the average price per kilogram block bitumen is 1.05 USD. Furthermore, he found out that there are mainly three suppliers active in this market: CASG, GUSSASPHALT REMSCHEID GmbH & Co. KG and the PMA AG.

CASG offers bitumen in small trade units. The company employs around 290 people at its production and sales sites in Germany and around 60 employees abroad. Its sales activities are concentrated on the European market. CASG possesses a tube filling plant in Bamberg, which supplies foil-coated bitumen blocks containing 30kg each. Its consumers mainly include roofers and insulators only demanding small quantities and fusing the bitumen using small boilers.

The GUSSASPHALT REMSCHEID GmbH & Co. KG (GRe) is a supplier of small trade units of mastic asphalt. The GRe offers mastic asphalt on a granulate basis, packed in bags that dissolve in the course of heating. However, mastic asphalt is basically needed in large amounts and is therefore mostly transported in fuelling vehicles.

The PMA AG offers foil-coated roofing and sealing adhesive in bitumen blocks of 30kg each. According to the company's sales representative, PMA AG is a small size supplier of block bitumen with a sales volume of about merely 1.000 metric tons in 2004. The company anticipates the block bitumen market to decline rapidly in the coming years, because application areas for block bitumen are gradually substituted through other technologies, especially self adhered cold roofing products.

Similarly, an expert in the field of building materials commented in June 2005:

„Even worldwide, there is no market potential for shrink-wrapped bituminous products“

The Chinese Roofing Market

The overall roofing market in China has experienced tremendous growth in the last decade. In 2003, the demand for roofing material exceeded 1.8 billion square meters. According to the Freedonia Group, this demand will continuously increase at an annual rate of 4.6 percent, leading to a market volume of 2.2 billion square meters in 2008 (Freedonia, 2004b, p.1).⁴ This increase results from the high residential and nonresidential building activity in China.

Although these numbers seem very promising, it has to be taken into account that the Chinese roofing market is very complex. The different climates and the different levels of urbanization require a wide range of roofing materials. These include concrete tiles, bituminous roofing as well as plastic or metal roofing.

Therefore Igantius M. Müller's research focused on those types of roofing materials, which may need to be applied to the buildings using (block) bitumen. These include asphalt-coated roofing felts, asphalt roll roofings, APP (Atactic Polypropylene) and SBS (Styrene Butadiene Styrene) (see exhibit 3):

- Asphalt-coated roofing felts are mostly used for houses with flat or nearly-flat roofs. Their durability last from 10 to 20 years, depending on the severity of the weather.
- Asphalt roll roofing is similar to asphalt-coated roofing felts and consists of a single layer of asphalt-impregnated material. They are often applied in case of garages and outbuildings, because of their relatively short life span (5 to 15 years). It is generally the least expensive roofing material available.
- APP and SBS are modified bitumen waterproof membranes. While SBS is used as a waterproof material in cold areas, APP is especially suitable for areas of high temperature and heavy sun-shine.

Despite the in the last decade steadily increasing demand for built-up and asphalt roll roofing, its market share declined by more than seven percentage points. This development is assumed to continue until 2015. In contrast, APP and SBS membranes will experience vast growth with rates of over 15% p.a. between 2005 and 2015 (See Exhibit 4a and 4b).

⁴ The Freedonia Group is a leading international business research company, founded in 1985, that publishes more than 100 industry research studies annually (further information: <http://www.freedoniagroup.com>).

The complexity of the Chinese roofing market is further increased since different technologies for attaching the different roofing products to the buildings exist. These include the welding technology, the slip-casting process and silicone-coated bitumen membranes:

- In case of the welding technology, the roof membranes are superficially fused and attached to the building using slight pressure. Typical applications involve flat roofing constructions and underground engineering (especially waterproofing). According to expert opinion, the welding technology forms with a market share of over 80% the standard attachment procedure for roofing products in China.
- In case of the slip-casting process, liquefied bitumen is infused onto the surface upon which the roofing material is laid. Usually, the bitumen is liquefied on site by fusing block bitumen directly on the roof. In average, approximately 1.5 kg of bitumen is needed for the attachment of one square meter of roofing material. The utilization of block bitumen is advantageous for the construction company, because there is no need for the costly transportation of bitumen in fuelling vehicles. But this technology also has some disadvantages: First of all, its usage is limited to intermediate climates, because in cold climates bitumen easily becomes viscous. On the other hand, hot climates constrict the bitumen's hardening. Second of all, the application of the slip-casting process in steep-slope construction is fraught with risk of burns. When the block bitumen is fused and liquefied in a steep slope, roofers can easily be exposed to the hot liquid bitumen compound. As a consequence, its application is nearly limited to (nearly-) flat roofs, parking lots or underground engineering (waterproofing). Experts assess that between 3 and 10% of all roofing membranes and roll roofing products are attached using the slip-casting process.
- Silicone-coated bitumen membranes are a promising new technique. These membranes are self-adhered and can be directly applied to the surface without the use of heat. Another innovative development in roofing materials is the attachment of bitumen stripes beneath the membranes that, when heated, dissolve. Due to its easiness of usage and cost-benefit ratio, experts assume that this technique will play an increasingly important role in the future. In order to ensure water density, bitumen membranes are always attached in two layers.

Despite which technology is used, overlap is produced during the attachment of the roofing felt or membranes. The overlap constitutes 13% of the total roofing material.

Exhibit 5 shows snapshots of these different attachment techniques.

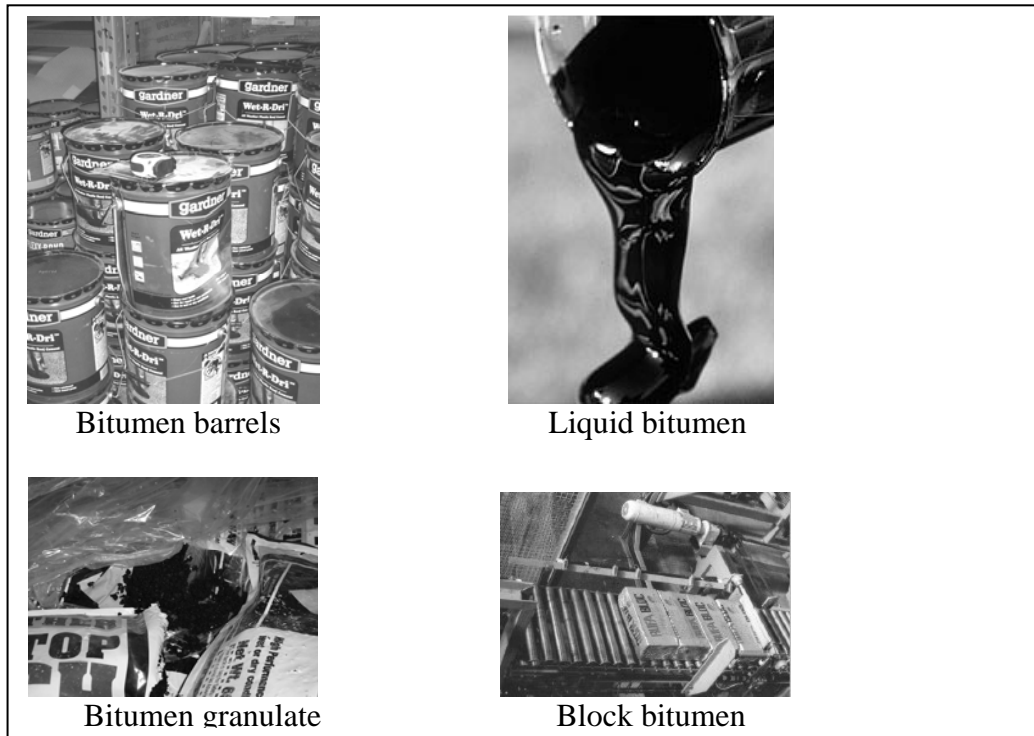
The Decision

One industry participant commented on the market opportunities of block bitumen in China:

“Personally, I see only very limited market potential for this form of bitumen. There’s no need to transport bitumen in such a way, because even in the rural areas, bitumen plants spring up like mushrooms. Utilization in the roofing business may prove useful, but not in the long run.”

After this report, Haver & Boecker was still contemplating whether or not to develop the new packing machine for CICEM Ltd.

Exhibit 1 Selected forms of bitumen products



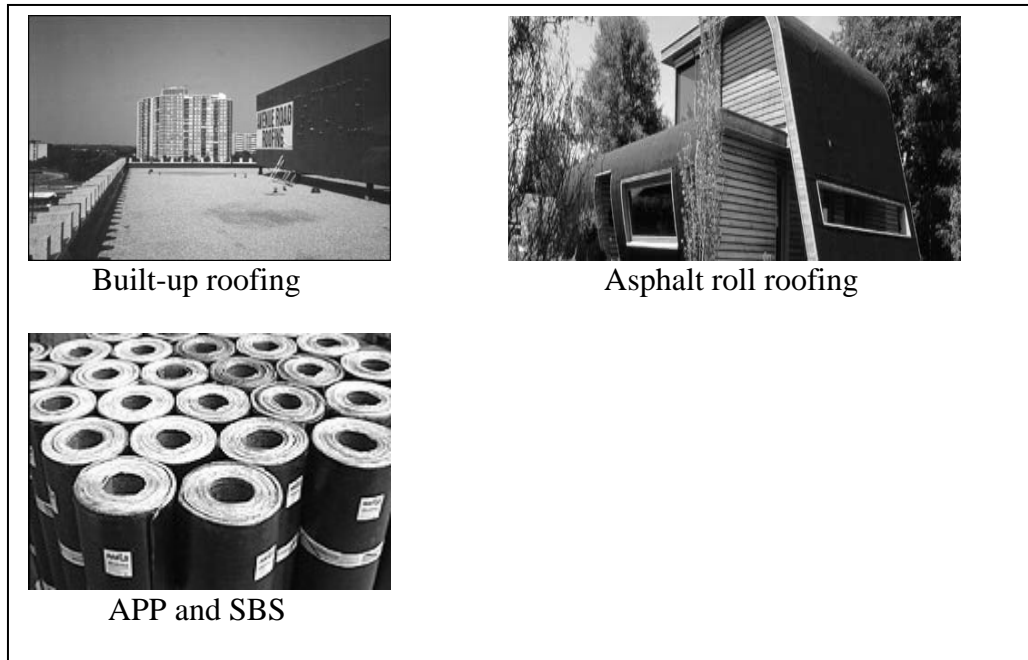
Sources: Own images, Syncrude Canada Ltd. (www.syncrude.com)

Exhibit 2 Main indicators on construction enterprises in China

Year	Number of enterprises	Number of employees (in m.)	Gross output value (in billion US\$)
1990	13327	1,01	\$16,80
1995	24133	1,50	\$72,35
2000	47518	1,99	\$156,07
2001	45893	2,11	\$191,84
2002	47820	2,25	\$231,37
2003	48688	2,41	\$288,27

Source: China Statistical Press: China Statistical Yearbook (<http://www.statsgov.cn/english>)

Exhibit 3 Selected types of roofing materials in the Chinese market



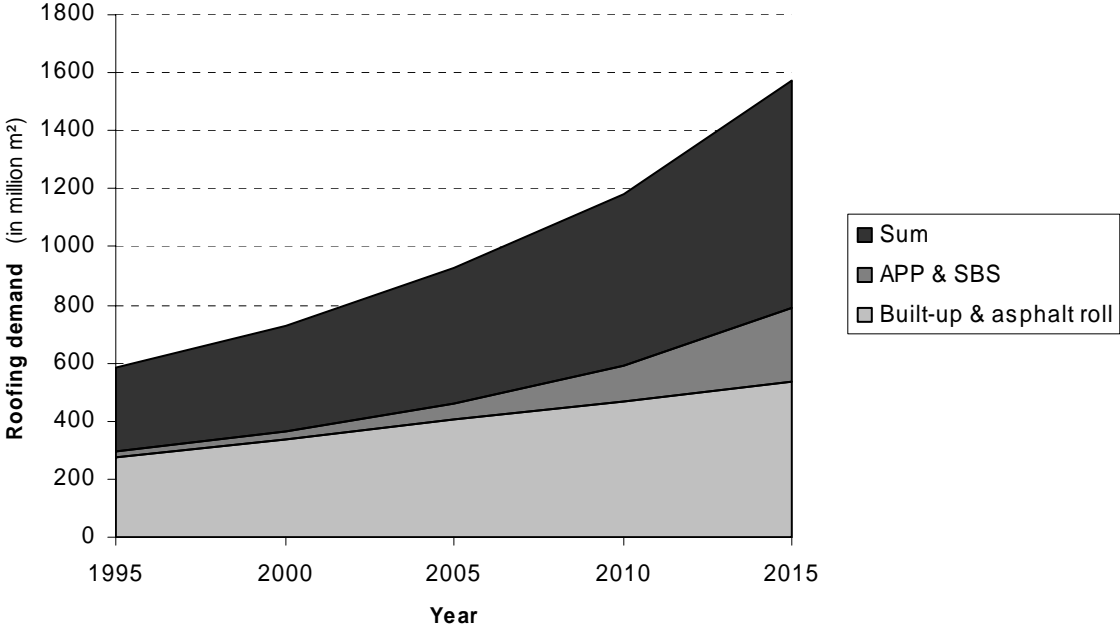
Source: vdd - Industrieverband Bitumen-Dach- und Dichtungsbahnen e.V.
 (<http://www.derdichtebau.de/>)

Exhibit 4a Demand of selected roofing products in China 1995 – 2015 (in million m²)

	1995	2000	2005	2010	2015
Built-up & asphalt roll	278 (95,20%)	339 (92,90%)	408 (88,10%)	466 (78,80%)	535 (67,90%)
APP & SBS	14 (4,80%)	26 (7,10%)	55 (11,90%)	126 (21,20%)	253 (32,10%)
Sum	292	365	463	592	788

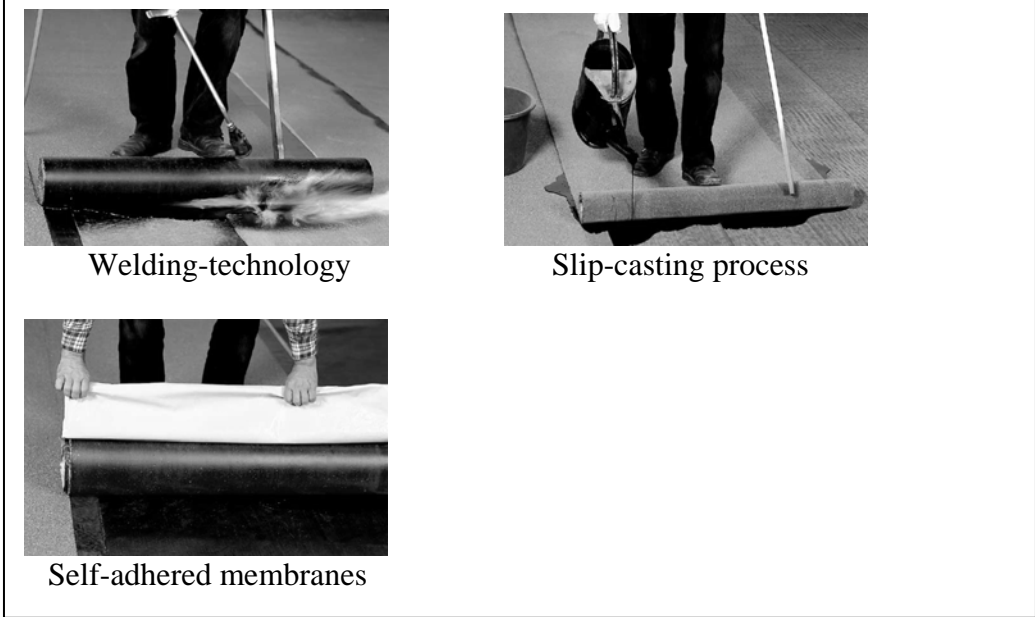
Source: Case writer estimates based on interviews

Exhibit 4b Demand of selected roofing products in China 1995 – 2015 (in million m²)



Source: Case writer estimates based on interviews

Exhibit 5 Techniques for the attachment of different roofing products



Source: vdd - Industrieverband Bitumen-Dach- und Dichtungsbahnen e.V.
 (<http://www.vdd-technische-regeln.de/>)

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