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Next Life for Cement Kilns

By Gunter Pauli

This article introduces a creative approach to rotary cement kilns 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

By 2013 the world market for cement will gross $246 billion annually, good for a total volume of 3.5 billion tons of construction material. Cement is the most widely used building material in the world. China produces approximately 50 percent of the world's output, while India is the second largest manufacturer, characterized by a higher growth - even compared to China. The European and American markets are slowly recovering from a deep dip during 2008-2009 with the American sales dropping some 17 percent in one year.

The cement industry is highly concentrated in few hands. The five largest producers in the world control over half of the world's production capacity. Lafarge (France) is the world market leader with sales of $16.1 billion just ahead of Holcim (Switzerland) in 2009. Lafarge purchased an unprecedented 17 cement factories in China last year. CEMEX (Mexico), the world's number three in cement, but number one in building materials offers a rare leadership from Latin America in this global industry. Employment has dropped considerably within the US employment in this sector by dropping 23 percent over the past 20 years. This is mainly because of the search for economies of scale through an ever increasing dimension of the rotary kilns. FL Smith, the Danish world leader with more than 1,000 units installed, built the largest kiln in Tongling, China, with a spectacular capacity of 12,000 tons of cement per day.

One of the major challenges of the cement industry is greenhouse gas (GHG) emissions. Each ton of portland cement requires 1.3 tons of limestone which is heated up to 1450 degrees thus releasing CO_2 while using 0.2 tons of coal and 100 kWh of electricity. The industry emitted in 2010 an estimated 2.9 billion tons of CO_2 making it one of the major contributors to climate change and representing 5 percent of the global man-made GHG emissions. The most climate neutral cement kilns still produce 0.66 kilograms of CO_2 for every kilogram of cement with 90 percent released at the point of production, and only five percent through transportation and another five percent by the on-site generation of electricity.

The Innovation

The European Union subsidized companies that buy outmoded cement plants and refit them with clean technologies. However, the greenest technologies can only reduce CO_2 emissions by 20 percent. The chemical reaction that creates this building material simply releases carbon dioxide. Since the amount of cement produced in the world goes up, so does the total

pollution generated. This has been described as the rebound effect: overall pollution increases while unit production decreases. The industry has shifted to the inclusion of waste that would otherwise generate worse environmental challenges such as the creation of methane gas (21 times worse for climate than CO_2) or the elimination of the risk of carbon black to the atmosphere by burning refuse and tyres during its production process. On the other hand, one of the main costs of the cement industry is its closure, with high profile cases of asbestos causing near bankruptcy of companies, it is instructive to note that during the 50's and 60's asbestos was a standard material used by the cement industry.

When Anders Byström observed the mechanical wonders of a rotary kiln that has processed cement for decades at high temperatures, he could not help being impressed. He admired this heavy equipment that stood rusting in Stora Vika, at a defunct cement plant just South of Stockholm. How could such a masterpiece of engineering be solely valued for its scrap value? Cement companies face high closure costs, but for Anders the facilities could be converted into a solid municipal waste (SMW) processing plant. Instead of burning coal and processing limestone, he imagined how the complete facility could receive SMW, removing all metals first, and then retaining up to 900 tons at a rate of 300 tons per day, subjecting the blend of organic and inorganic materials to a combined aerobic and anaerobic digestion. All waste could be separated and recycled, and the left over being a clean compost.

The First Cash Flow

The innovative process, from plant reconversion to waste separation went from a pilot unit of one ton per day to a full-fledged operation. However, it caught the attention of Masatsugu Taniguchi, a top executive with Taiheiyo Cement, the largest Japanese cement group. He realized that this could represent a breakthrough for an infrastructure that faces a decrease in demand for cement, while at the same time there is an increase in demand for waste management. Based on the pilot studies in Sweden with Japanese waste, Taiheiyo Cement engineers concluded that the total calorific value of SMW could reach a surprising 50 percent of that of coal, the traditional fuel inside the kilns, if processed in these defunct rotary kilns.

An investment of $40 million permitted the creation in Hidaka City, Saitama Prefecture, Japan the first industrial scale facility. One defunct kiln receives all SMW from the local waste management company. This permitted the city to scrap a pending investment in an incineration facility, nor seek the expansion of its landfill. This decreased the tax burden for the local citizens, and at the same time improved the air quality. The Swedish technology converted a low calorific waste into a high one, while at the same time eliminating the risk of methane gas generation from landfills, a noxious greenhouse gas. This process saved 20 tons of coal a day, further contributing to the reduction of the negative impact generated by a a traditional waste management system at lower cost, thanks to the use of available materials. This approach looks at industry like an interconnected system, a key characteristic of the Blue Economy. After two years of tests, the Japanese Ministry of Economics, Trade and Industry (METI) offered a license to operate.

The Opportunity

One of the under-used capital structures of the world are the writing-off of manufacturing facilities. Since these facilities are often valued at next to nothing in the balance sheet, since it has been fully amortized, these still face the risk of high closure and dismantling costs since companies are prohibited from selling these old facilities for a symbolic price, what used to be the practice. If the cement companies stick to the core business of cement, then it will remain a risk. If on the other hand, the cement companies are prepared to think out of the box, and create a consortium with complementary partners, then they could reduce their own liabilities, reduce their negative impact on climate, generate jobs, improve the return on investment and even alleviate the tax burden due to costly waste management.

Using what you have, reduce government deficits, while responding to basic needs for energy represent a basis for business development. Entrepreneurs, like Anders Byström demonstrated that this business can take off with very limited private financial resources. As the capital outlay of cement industries will continue to write off smaller ovens in favor of those that have three to four times capacity, more rotary kilns will become available. Selling these off for the value of its scrap does not match the opportunity to offer a fundamental new option for SMW management, at lower cost without getting sandwiched between the landfill or incineration option. It is up to the entrepreneurs to make the difference.

GUNTER PAULI