

## Uncovering Industrial Symbiosis in Tianjin Region, China

The team worked on our existing project in the Tianjin Economic Development Area (TEDA) and broadened the industrial inventory to examine material and energy flows and inter-firm synergies in the Tianjin Binhai New Area (TBNA) that surrounds TEDA (see Figure 1). They worked with partners at Nankai University and the TEDA Environmental Protection Board to meet and interview representatives from manufacturing companies in the electronics, automotive, chemical (including pharmaceutical and petrochemical facilities), and food processing sectors, as well as from resource recovery companies.



Figure 1: Tianjin's Industrial Districts

The team found numerous byproduct synergies among firms in the chemical, automotive, metals and food processing industries. Chemical companies, especially large operations, are finding uses for most of their byproducts and even co-locating factories that can support this symbiosis. The metals sector has a number of examples of waste

material reuse within individual companies as well as synergies with others in the sector and in other sectors as well (see Figure 2).

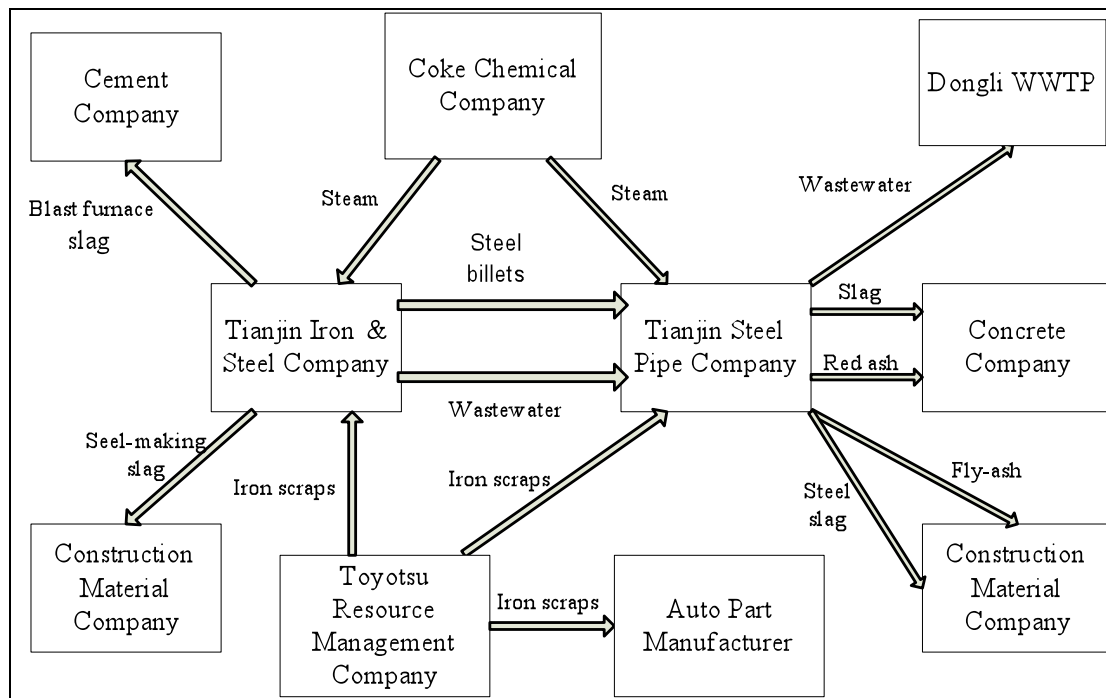


Figure 2: Industrial Symbiosis within the Metals Industry

Of the 24 companies that the team visited and interviewed, twenty were engaged in some form industrial symbiosis. The majority of these symbiotic companies were Chinese-owned and the four that were not engaged in symbiosis were subsidiaries of multinational firms. The multinationals that were not engaged in industrial symbiosis produced little waste, which reflected the stage of the production process that the facilities fulfilled. For example, some of the biotechnology and pharmaceutical companies that the team visited only mixed raw materials into the final products and packaged them. The team observed that chemical and metallurgical companies intensively reused byproducts in their internal processes. While, the chemical companies that the team interviewed were able to capture their byproducts and find economical means to convert them into marketable products or they were used in another step of the production process.

The team found that local resource scarcities and economics encouraged these symbiotic practices. TBNA is located in an arid region and much of the land itself is backfill, used to fill in the original wetland area. Thus there are limited supplies of water, raising costs. Companies are therefore encouraged, simply because of economic reasons, to develop innovative ways to reduce their water consumption. In addition, companies that generated high volumes of waste could either pay to have the waste hauled off and deposited, or could find ways to reuse or reduce its generation. Utilizing internal byproducts reduces the costs of inputs. External product exchange provides companies with additional revenue streams, as does co-products (i.e. products made from byproducts of the primary production line). They also found that company reputation and state environmental policies were motivations for industrial symbiosis and cleaner production. For example, a government policy for subsidize energy efficient technologies helped to reduce the capital cost of these investments to companies.

The team offered the following recommendations for the Tianjin Binhai New Area to increase the realization of resource efficiency savings through industrial symbiosis:

1. Promotion and enforcement of environmental standards
2. Learning and transfer of environmentally superior technologies
3. Promotion of communication among firms
4. Establishing of a database of byproducts
5. Co-location of complementary manufacturing entities in the region's pending relocation of industries