



# Chengdu economical and technological development zone

## Development of an industrial symbiosis network

*Synthesis note: Accomplishment and main findings*

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**GIZ**

**Energy Policy and Energy Efficiency (EPEE) Programme**

Efficient utilization of energy resources and their by-products

# 1 INTRODUCTION AND PROJECT ORGANIZATION

## 1.1 Objectives of the study

With this project, the GIZ targeted the following achievements:

- Assisting pilot business parks in management capacities;
- Developing a consulting service platform providing specific information on energy efficiency and industrial symbiosis;
- Designing and implementing an energy efficiency and industrial symbiosis network;
- Building capacities of parks tenants and local workers to develop and use the energy efficiency and industrial symbiosis network.

Sofies SA propose procedures and tools for the development of an industrial symbiosis where adapted to the CDETDZ needs. Before the beginning of the project, all partners agreed on the following specific objectives:

1. To build-up a material flow database for the park to centralize and disseminate useful information about material and energy flow, and in particular in relation with industrial symbiosis;
2. To assist the park management in order to identify, assess, coordinate and moderate an industrial symbiosis network.

Three field missions took place between June and October 2013. Their objectives, structure and main outputs are summarized in the following sections.

## 1.2 Field missions activities

### 1.2.1 Mission 1: training on awareness raising and IS procedures

The first main task is to assist engineers from the park administration to **gather, upgrade, structure and manage data on material and energy flows**. The development of a suitable knowledge management structure implies to carry out systematically the following tasks:

1. Identification and analysis of already available data to develop the knowledge management structure;
2. Preliminary analysis of the territory to identify additional data to be collected;
3. Companies interviews and audits to upgrade information and collect new data;
4. Development and operation of the material and energy flow database.

These four steps are necessary to build an accurate database on material and energy flows facilitating identification of industrial symbiosis and eco-efficiency opportunities. To develop the capacities, a three days training was delivered by Dr. Massard on:

- Introduction to industrial symbiosis
- Definition of objectives for CDETDZ
- IS international return of experience
- Project management approaches
- Material and energy database development
- Interaction and communication to companies

In addition, all details regarding the organization of an industrial symbiosis launching conference to be organized during mission 2 were settled.

## 1.2.2 Mission 2: IS network launching conference and company visits

Mission 2 included the following activities:

- 1 day IS conference and workshop involving companies from the park
- 2 days of interviews and production line visits to collect data on material and energy flows for 6 companies
- Steering committee meeting to identify next steps

The IS launching conference gather together around 25 companies active in the park:

1. Integrated Environmental Technology Co., Ltd. Chengdu FAW
2. Chengdu Zhongpin Environmental Protection Equipment Co., Ltd.
3. **KBC Metal (Chengdu) Co., Ltd.**
4. Sichuan Aerospace Industrial Group Co., Ltd.
5. Chengdu Carbon LLC
6. **Chengdu Jingu Wheel Co., Ltd.**
7. Sichuan Hailing Electric Manufacturing Co., Ltd.
8. Chengdu ThyssenKrupp Fawer Co., Ltd.
9. **Chengdu Behr Automotive Thermal Systems Co., Ltd.**
10. Longquanyi district waste recycling company
11. Chengdu West Petroleum Equipment Co., Ltd.
12. Chengdu Jiacheng Auto Parts Manufacturing Co., Ltd.
13. **Chengdu Huaqi Houpu Mechanical and Electrical Equipment Co., Ltd.**
14. CNPC Jichai Power Equipment Company Chengdu Compressor Plant
15. Chengdu Hongbo Industrial Co., Ltd.
16. Chengdu Yunnei Power Co., Ltd.
17. Chengdu Fusheng Swell Auto Parts Co., Ltd.
18. Chengdu Canya Wood Co., Ltd.
19. Zigong Cemented Carbide Co.,Ltd,Chengdu Branch
20. Chengdu KBE Automotive Electronics Technology Co., Ltd.
21. Chengdu Longquan Anti-corrosion Materials Co., Ltd.
22. Chengdu Jiuding Technology Co., Ltd. (Group)
23. Sichuan Aerospace Tuoxin Basalt Industrial Co., Ltd
24. Chengdu Longquan High-tech Natural Pharmaceutical Co., Ltd.
25. **Chengdu Faway-Johnson Controls Automotive Systems Co., Ltd.**

Five companies (in bold) expressed motivation for interviews. The company **Kobelco** even though they did not take part to the workshop was also interviewed. The information collected was added to the excel database develop by the park with the technical support of Sofies SA.

The IS opportunities identified during the workshop and the interviews are detailed in Section 2.

## 1.2.3 Mission 3: Feasibility analysis and implementation

Mission 3 included the following activities:

- 2 days of companies visit on specific IS potentials to support implementation and mobilize company managers
- ½ day training by Dr. Massard on feasibility analysis and project management for industrial symbiosis
- Steering committee meeting to analyze results and close the project

In between mission 2 and 3, Dr. Gavin Liu performed more interviews to fulfill the material and energy flow database. All information has been introduced into the database developed by the park based on the template supplied by Sofies SA during mission 1.

## 2 MAIN OPPORTUNITIES FOR INDUSTRIAL SYMBIOSIS IMPLEMENTATION

This section summaries the industrial symbioses opportunities detected during the preliminary workshop (mission 1), the launching conference (mission 2) and the company interviews perform by the park administration (during and after mission 2). All information has been introduced into the database developed by the park based on the template supplied by Sofies SA during mission 1.

1. Wood pallet network
2. Steel scrap exchange network
3. Waste heat reuse from glass production
4. Waste painting reuse for co-processing
5. Used sand from metal processing
6. Effluents containing oil residues

For mission 3, the park administration decided to focus on opportunities one and two, involving the following companies:

1. **Steel scrap exchange network involves** KBC Metal (Chengdu) Co. Ltd., Chengdu Jingu Wheel Co. Ltd., Chengdu Yunnei Power Co. Ltd. And West Petroleum for the local recycling of steel and iron scraps for the production of diesel engines.
2. **Wood pallet network involves** Chengdu Jingu Wheel Co. Ltd., Chengdu Behr Automotive Thermal Systems Co. Ltd., West Petroleum and Chengdu Fusheng Swell Automotive Parts Co. Ltd. For the local reuse of wood pallets for packaging activities.

The following paragraphs provide detailed data for the main IS opportunities classified by topic.

### 2.1 Energy

- *Sources :*
  - 1) Sichuan Aerospace Tuoxin Basalt Industrial Co. Ltd (10) → exhaust air at 600 ° (melting rocks implies heat at more than 1'200°)
  - 2) Changchun FAW Faway Johnson Controls Automotive Metal Components Co., Ltd (44) → Exhaust air from their processes (output quality to be confirmed) Use of more than 30'000 Nm<sup>3</sup> CH<sub>4</sub>/month to produce heat at around 1'000°. Exhaust air from the 380 kW air compressor capacity can also be reused, but only internally, not with an external exchange.
- *Needs :*
  - 1) Chengdu Canya Wood Co., Ltd (41) → Company located at around 4 to 5 kms. Needs of steam (2'000-3'000 m<sup>3</sup>/month at 100°T and 0.7 MPa).
  - 2) Chengdu Jiuding Technology Co. Ltd. (15) → Idea of evaporating wastewater polluted with chromium to purify water and reuse it. But the feasibility has to be confirmed because of the difficulties to handle these wastewater with chromium.

### 2.2 Wood

- *Sources :*
  - 1) Chengdu Canya Wood Co., Ltd (41) → 20 – 30 tons/month of waste wood. Potential to reuse internally to substitute coal with it.

- 2) Chengdu Behr Automotive Thermal Systems Co. Ltd (24) → 8- 10 tons/month of wood waste that are sold to a low price. The good quality of these wood packaging would allow to reuse it as packaging material in other companies.
- 3) Chengdu Kobelco Construction Machinery (Group) Co. Ltd (2) → Old bits sold at low price with nails already separated. 5 tons/day during high season, and 10 tons/week during low seasons.
- *Needs :*
  - 1) Chengdu Canya Wood Co., Ltd (41) → Production of steam (2'000-3'000 m<sup>3</sup>/month at 100°T and 0.7 MPa) with coal that could be substituted with wood. Currently using around 30 – 40 tons of coal / month.
  - 2) Chengdu FAW Environmental Protection Technology Co. Ltd. (13) and recycler → Production of alternative solid fuel for cement industry with wood and painting waste.

## 2.3 Cardboard

- *Sources :*
  - 1) Changchun FAW Faway Johnson Controls Automotive Metal Components Co., Ltd (44) → Big cardboard produced as waste.
  - 2) Chengdu Behr Automotive Thermal Systems Co. Ltd (24) → Wood packaging mixed with cardboard, exact quantity to be defined.
- *Needs :*
  - 1) Chengdu Huaqi Houpo Holding Ltd (48) → Needs of cardboard of small size. Consumed quantity could be important but has to be precised. Interested to reuse good quality of cardboard.

## 2.4 Plastic

- *Sources :*
  - 1) Changchun FAW Faway Johnson Controls Automotive Metal Components Co., Ltd (44) → ABS production, small part are reused in the production and small part sold as waste. Production of 50 kg /month.
  - 2) Chengdu Fusheng Swell Auto Parts Co., Ltd. (26) → ABS production, low quantity around 50 kg/month.
- *Needs :* No needs identified.

## 2.5 Steel and metals

- *Sources :*
  - 1) Chengdu Jingu Wheel Co. Ltd. (4) → Outputs of steel waste of around 60 t/month, but the size (3-6 mm) does not match with Yunnei needs, but KBC has the cutting machine.
  - 2) KBC Metal Chengdu Co. Ltd (18) → Good quality of steel waste production, quantity around 15 tons/month in metal sheet hole. They have the cutting machine allowing them to produce small piece of metal for Yunnei.
- *Needs :*
  - 1) Chengdu Yunnei Power Co., Ltd (6) → They consume around 1'000 tons/year (to be confirmed), but they have specific requirements in the raw material that they use : x < 400 mm, type number 35 -45, and no contamination with chemicals such as chromium, sulfur, silicon.

## 2.6 Painting waste

- *Sources :*
  - 1) Chengdu Kobelco Construction Machinery (Group) Co. Ltd (2) → Waste of the paint shop, around 100 tons/year.
  - 2) Chengdu Jiunding Technology Co. Ltd (15) → Waste quantity around 10 tons/year, but they are considered as hazardous waste and collected by a recycler.
- *Needs :*

- 1) Chengdu Yunnei Power Co., Ltd (6) → They consume around 1'000 tons/year (to be confirmed), but they have specific requirements in the raw material that they use :  $x < 400$  mm, type number 35 -45, and no contamination with chemicals such as chromium, sulfur, silicon.
- 2) Chengdu FAW Environmental Protection Technology Co. Ltd. (13) and recyclers (located in Chengdu industrial zone) to identify and support in getting the license → Production of alternative solid fuel for cement industry with wood and painting waste.

## 2.7 Urea (formaldehyde)

- *Sources :*
  - 1) Chengdu Canya Wood Co., Ltd (41) → 0.5 – 1 ton/month.
- *Needs :* No needs identified but this waste can be reused as refrigerant liquid (under ammoniac form) in heat pump.

## 2.8 Other waste (Sludge, sand, coal ashes)

- *Sources :*
  - 1) Chengdu Jingu Wheel Co. Ltd. (4) → Sludges have to be dried before being collected and treated outside Chendgu area. No recycler available in the zone, but a discussion with FAW (13) should be started.
  - 2) Chengdu Yunnei Power Co., Ltd (6) → High quantity of sand without any information about quality. Partly reused, partly sold to other company to make melding sand. Good existing solution, but the non reused part should be assessed.
  - 3) Chengdu Canya Wood Co., Ltd (41) → Coal ashes given to a recycler. To assess if it could be useful for FAW (13) to reuse it as construction material in cement industry.
- *Needs :*
  - 1) Chengdu FAW Environmental Protection Technology Co. Ltd. (13) and recyclers (located in Chengdu industrial zone) to identify and support in getting the license → Reuse in the cement industry as construction material.

## 3 PERSPECTIVES

The last steering committee meeting with the park administration at the end of mission 3 opened the discussion about potential future development of the industrial symbiosis network.

Suggestions for further assistance to the park administration by Sofies SA are summarized below:

1. **Sideline technical assistance for opportunity identification and feasibility analysis of symbioses.**  
The park administration underlined the need for guidance related to organizational and technical aspects. The assistance may involve contribution to feasibility study, identification of adequate business models and examples on similar symbioses, waste management systems and recycler business models.
2. **Technical assistance for the continuous development of the material and energy flow database.**  
The database, internal to the park administration is still under development and to be consolidated.
3. **Training on carbon balance.** Training should be organized to improve the park management capacities to implement a carbon balance project in order to monitor carbon reduction and to reflect on carbon trading opportunities.