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Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO

Industrial symbiosis opportunities: potential and challenges

Le Xuan Thinh

VNCPC

Global Eco-Industrial Park Program

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Orientation towards eco-industrial park

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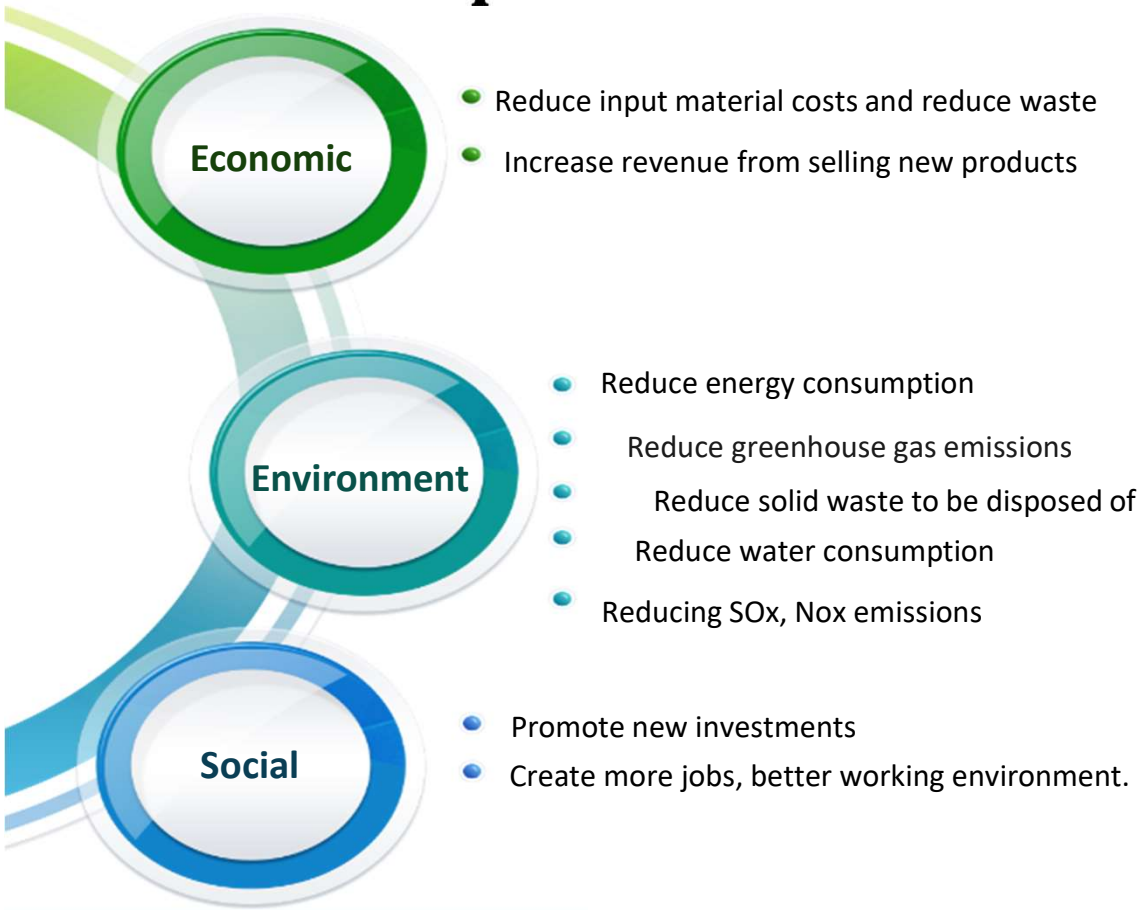
Opportunities

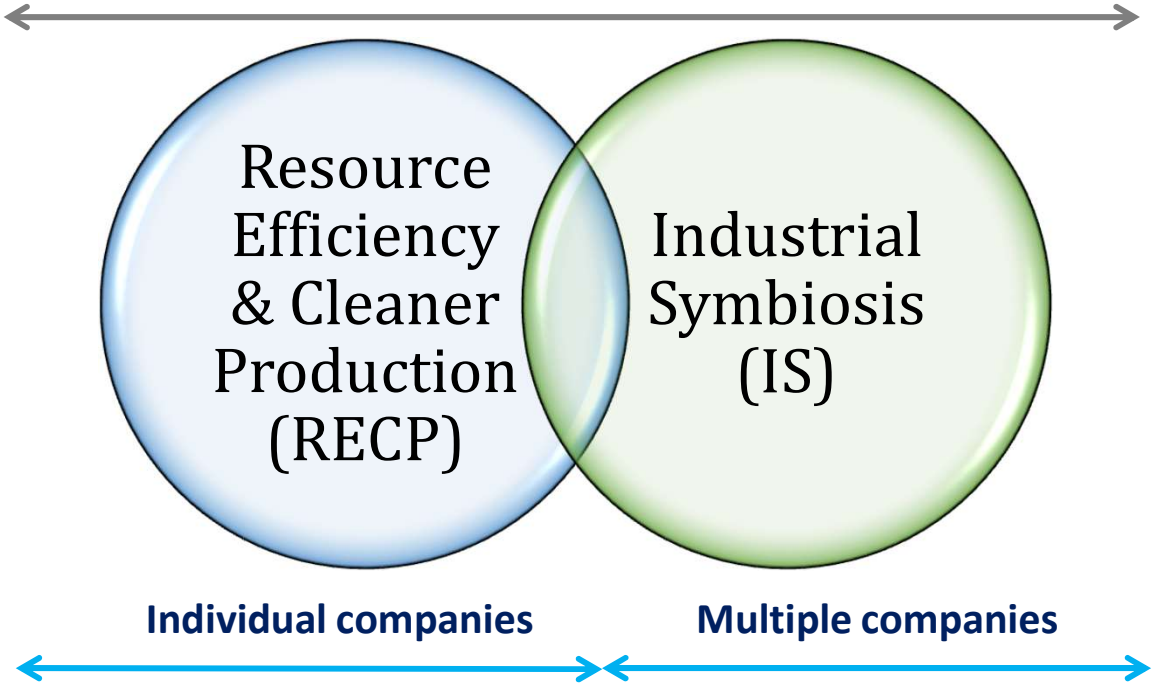
Focus on 3 areas:

- Resource efficiency and cleaner production
- Industrial Symbiosis
- Green infrastructure



Main activities Eco IP

Improve economic, environmental, and social performance and increase resource efficiencies



Some preliminary results of the project

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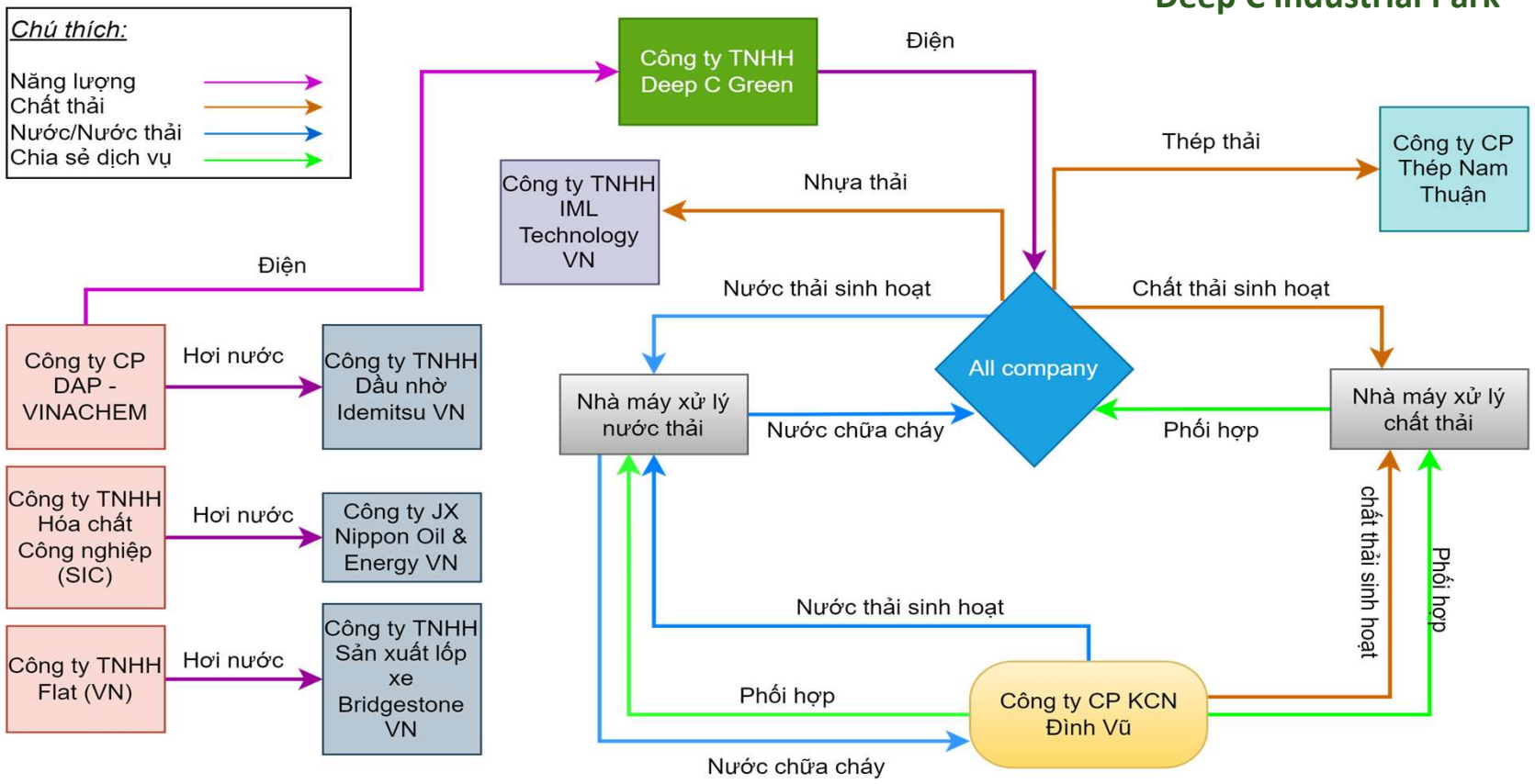
The result of the idea of industrial symbiosis



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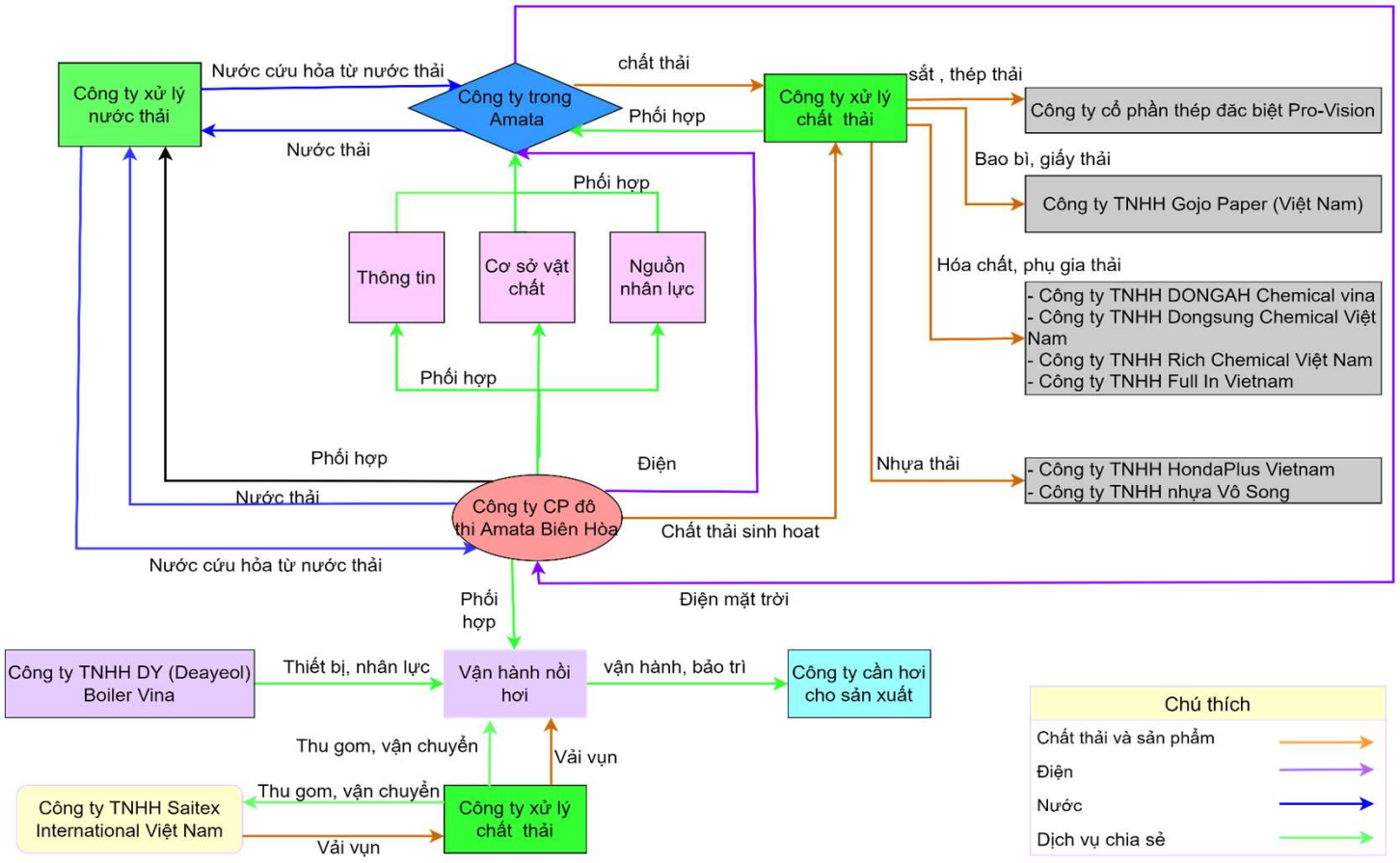
The result of the idea of industrial symbiosis

Amata Industrial Park



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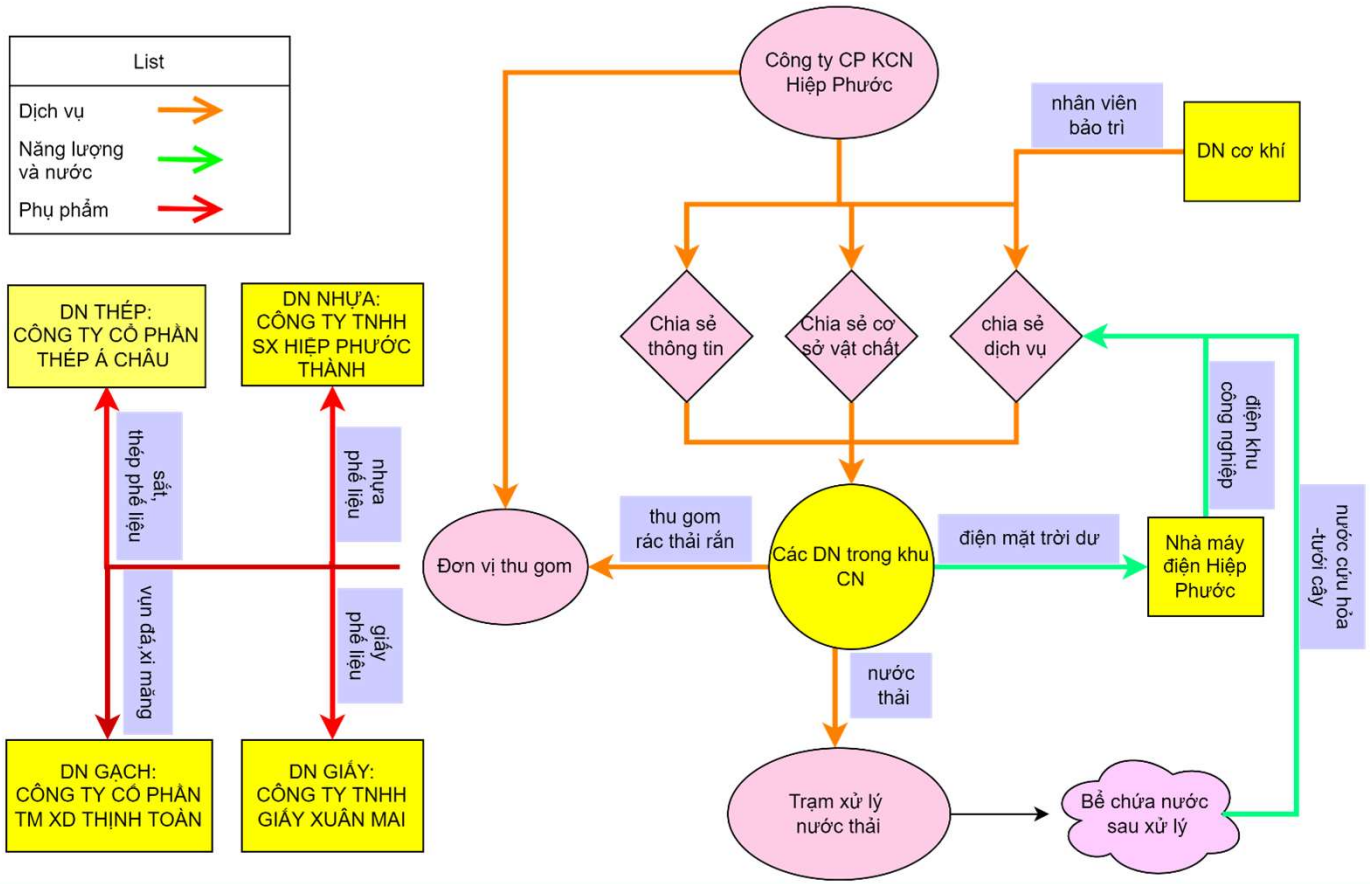
The result of the idea of industrial symbiosis

Hiep Phuoc Industrial Park



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Example of IS in Vietnam

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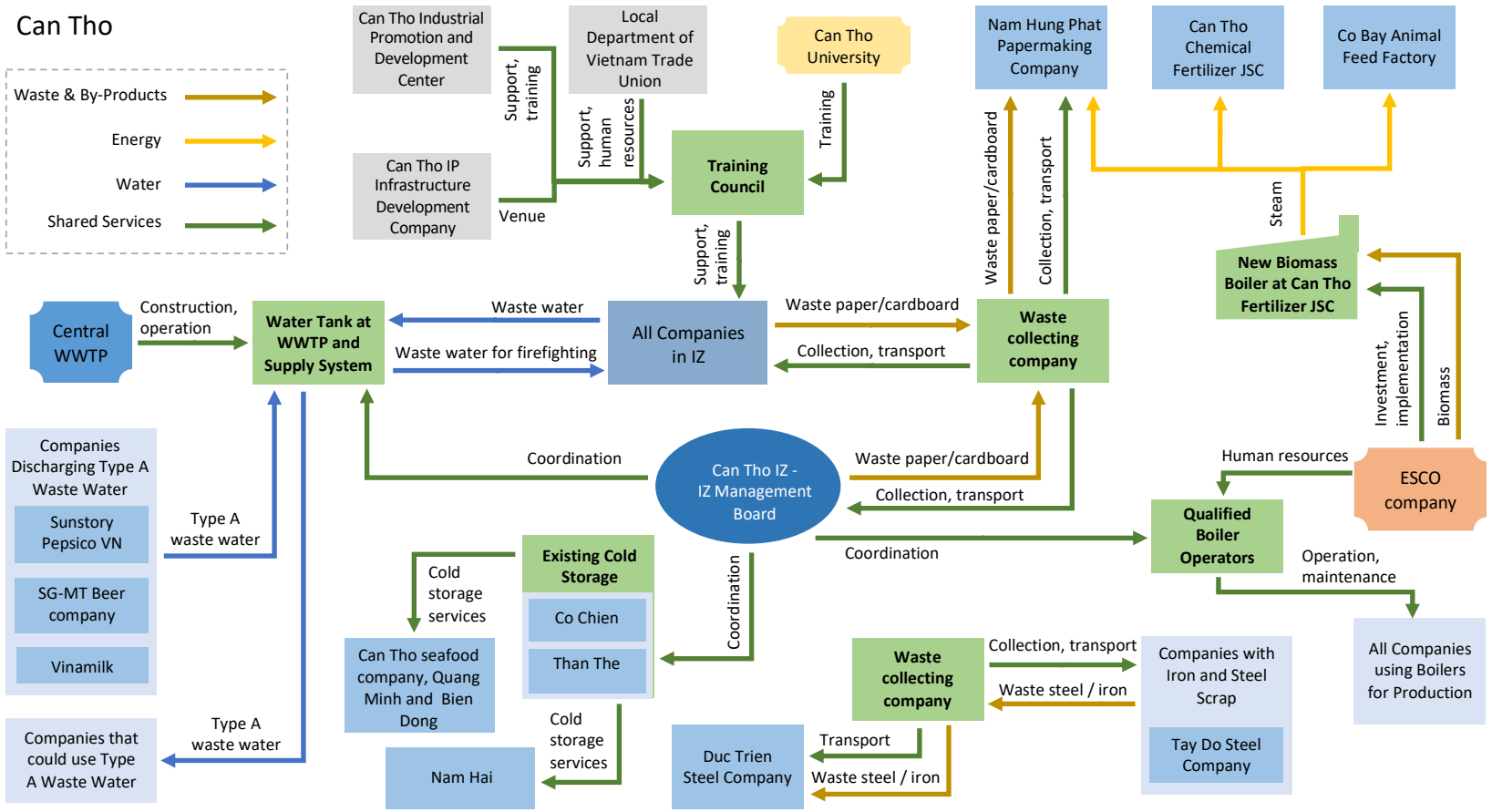

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IS 1

BIOGAS RECOVERY AT HEINEKEN COMPANY FOR USE AS FUEL IN THE BOILER OF GREEN ENERGY COMPANY - HOA KHANH IZ

IMPLEMENTED

IS1: Biogas Recovery at Heineken Company for use as Fuel in the Boiler of Green Energy Company - Hoa Khanh IZ

Initial situation

- A large volume of **biogas** is generated at **Heineken Beer Company wastewater treatment plant**: around **4,800 m³ biogas/day** estimated considering Heineken production capacity being **240 million litres of beer per year** .
- This **biogas**, composed of **CO2 (20~30%), CH4 (60~70%)** and trace amounts of N2, O2, and water vapour, was being **discharged directly to the environment**, without being burnt.
- **Methane (CH4)** is the only combustible portion and has a **Gross Calorific Value (GCV) of 39.8 MJ/m3**. Thus, the Theoretical **Calorific Value of biogas** is around 0.65–0.7 times the GCV of CH4 and equates to **~27.68 MJ/m3**.

GREEN ENERGY ESCO

- Green Energy ESCO Company, located nearby, uses a biomass boiler to supply steam (about 4,000 tons of steam/month) to Heineken Beer Company.
- The existing boiler system consists of 2 boilers that utilise as fuel 1,000 tons/month of woodchips and 800 tons/month of rice husk per month. Amounting to a total cost for fuel of about 60,200 USD per month.
- Green energy is located at a **distance of approximately 350 m** from Heineken company

IS1: Biogas Recovery at Heineken Company for use as Fuel in the Boiler of Green Energy Company - Hoa Khanh IZ

Type of symbiosis	**By-product synergies and waste exchanges**
Basis	***The objectives of the industrial symbiosis opportunity were:*** • To valorise the biogas, generated by the wastewater treatment plant of Heineken Company, that is currently discharged into the atmosphere without being burnt. • To substitute some of the current fuel used in the boiler of Green Energy Company, with the recovered biogas, to reduce the fuel consumption and associated costs.
Relevant stakeholders	• Energy service company: investment, operation and maintenance • Brewing company: biogas supply

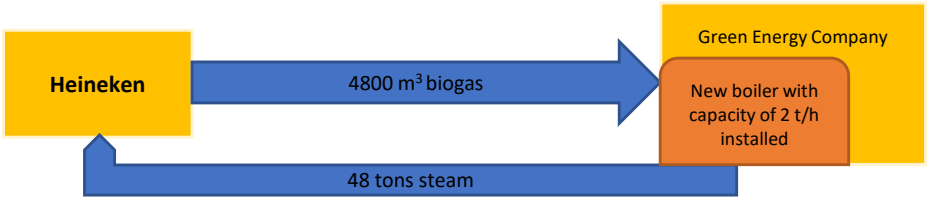
IS1: Biogas Recovery at Heineken Company for use as Fuel in the Boiler of Green Energy Company - Hoa Khanh IZ

Proposed Intervention

- The energy service company invests in a biogas-fired boiler with a capacity of 2 tons/hour, in which biogas recovered from the beer company is used to generate heat energy to produce steam. The produced steam is supplied back to the beer company.

The main equipment of the system:

- Boiler capacity: 2 tons/hour
- Biogas recovery system
- Tanks for storing biogas
- A gas pipeline to transport biogas



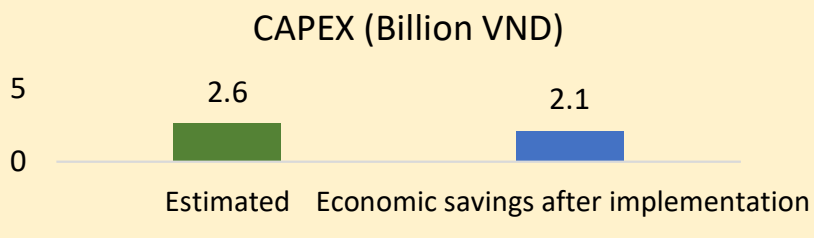
Actual Implementation details

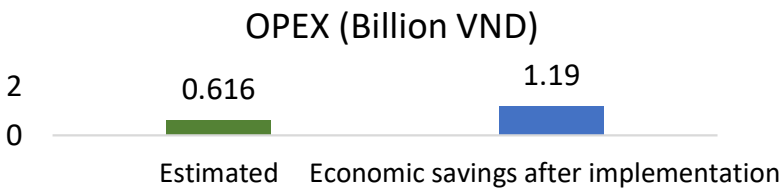
- The IS opportunity was implemented in 2019 with a biogas powered boiler of a slightly smaller capacity: 1.5 ton/hour installed at Green Energy company
- With this installation, 30% of the steam supplied from Green energy to Heineken is from biogas recovery, replacing existing biomass as fuel.
- There was an overall slowdown in production at Heineken due to the pandemic over the past 2 years.

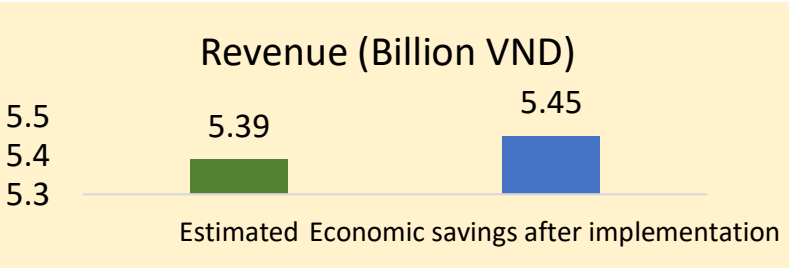
Installed biogas boiler

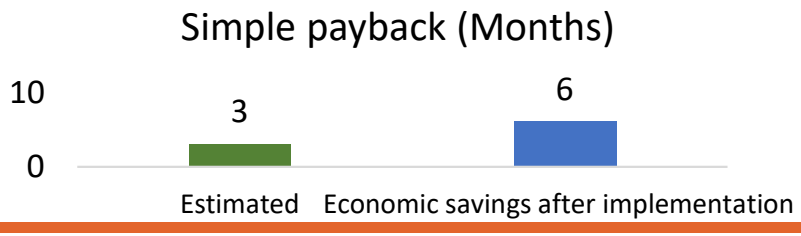
De-aerator system – to remove H_2S

Economic benefits









CAPEX

- Boiler capacity of 1.5 ton/hour was installed instead of 2 ton/hour as estimated.
- Further, pipe insulation and biogas recovery systems weren't installed as part of this IS.
- These explain the lower CAPEX than the estimation.

OPEX

- Green energy company reported annual OPEX for the total company assets to be 9.585 Billion VND/year.
- Due to unavailability of specific cost headers contributing to the overall OPEX, the Green energy company estimated that OPEX needed for biogas boiler operation is between 10-15% of their total OPEX. For the calculations, 12.5% (average) of the total OPEX was assumed as OPEX for the biogas boiler.

Revenue

- Granular data was for steam generation as per the source (biogas/biomass) was unavailable.
- Based on information that the Green Energy Company supplies 3250 tons per month of steam to Heineken company, it was arrived that 30% of steam is supplied from the biogas boiler to Heineken and the same was validated by Green Energy company
- By applying 30% biomass reduction after implementation of the IS, the savings with respect to the procurement cost of the Company was calculated as revenue.

Payback Period

A slight increase in OPEX costs, due to electricity, water, and labour requirements as well as a shortage of biogas volume supplied from Heineken to Green Energy Company, has extended the payback period from three to six months.

ENVIRONMENTAL BENEFITS

- There was an overall slowdown in production at Heineken due to the pandemic over the past 2 years.
- Due to this, the actual environmental savings achieved from avoiding the direct release of biogas into the atmosphere, were a little lower than expected and averaged at about: 10,000 tons of CO2eq savings per year, which is equivalent to the CO_2 emissions caused by approximately 2850 average Vietnamese in an entire year.
- Solid waste mentioned here is assumed to be the ash content, which needs management after combustion of the biomass.
- The Green Energy company utilizes 40% rice husk, 45% wood chips and 15% saw dust as input for the biomass boiler. Assuming 20% ash content for rice husk, 2% for wood chips and 1% for saw dust, for a 30% reduction in biomass usage due to the IS opportunity, **500 tons of ash generation is avoided**.

IS11: Collection and Sorting of Paper and Cardboard Waste to be Used as Input for Companies Making Kraft Paper

During the meeting held with Tan Long Paper company in September 2022, Tan Long company showed a keen interest in the IS and said they are willing to carry out and lead on this Industrial Symbiosis themselves, under the following conditions:

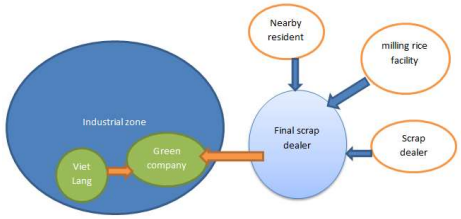
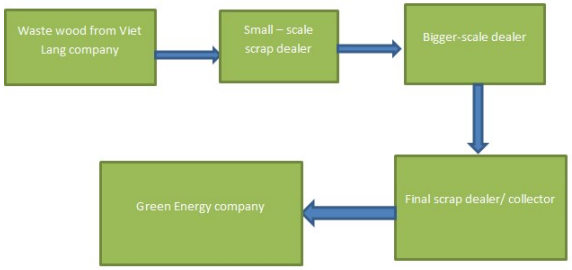
The generators should classify and segregate their paper waste first, into two types of waste: carton waste and document paper waste

The generators should issue invoices for the transfer of waste

From Tan Long's side, Tan Long commits to buy all two types of paper waste and will provide the facility, transport vehicles and personnel to collect this directly from the companies at the same or slightly (up to 5%) higher rate than they currently sell it for.

Potential savings in case of Implementation	**Environmental benefits** » 75% Reduction in transport distances and corresponding fuel requirements - result in energy savings of 75%. » Reduction in emissions by about 13.7 tons CO2/year - due to shorter transportation distances.	**Economic benefits** » No CAPEX » OPEX is estimated at 247.5 million VND/year » Revenue is estimated at 1.2 Billion VND/year » Payback in less than 3 months	**Social benefits** Impacts on the health of neighbouring communities (less emissions due to no transport of paper outside the IP) By collecting their waste paper, communities have a collection agency catering to their waste paper management needs
Barriers	» Existing informal mechanism for waste collection – companies were not keen to re-establish a new system due to this » Lack of interest from CIPCO		
Potential next steps	» A pre-feasibility study has been developed as part of this project for this opportunity. Tan Long can consider this and plan their next steps accordingly.		

IS12: Use of waste wood from a Forest Products Company to fuel an Energy Company's boiler

Short Description	The objective of using waste wood from a Forest Products Company to fuel the boiler of an Energy Company, located within the IZ, is to optimise the efficiency of collection and thus reduce the associated costs and environmental burden associated with larger transport distances. In addition, using waste biomass from surrounding communities would further strengthen this opportunity
Simulation for the collection of waste wood from IZ and neighbouring areas 	*Simulation of waste wood collection in the IP* 
Stakeholders involved	• Viet Lang Forest product Processing Company • Green Energy
Status in December 2022	Status: Implemented as spontaneous symbiosis This case is considered a spontaneous symbiosis as it was initiated based on the discussions and workshops held during the previous phase of the project. Viet Lang is now using industrial processed wood for their production instead of natural wood like they did before, so waste wood is reduced. They sell this waste to an agency who collects waste also from other companies. During 2 years of Covid pandemic, the productivity was reduced, the company nearly closed. From Jan 2022 to July 2022: the company got some domestic contracts with Vinhomes and Alacarte, so the wood waste has increased. Viet Lang has signed a contract with an agency to collect waste wood.

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IS12: Use of waste wood from a Forest Products Company to fuel an Energy Company's boiler

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Potential savings in case of Implementation	**Environmental benefits** » ~ 85% fuel energy savings related to more efficient transportation (76.16 litre) » Reduction in GHG emissions from transportation equivalent to about 1.1 tons CO2/year	**Economic benefits for Green energy company** » No CAPEX » OPEX is estimated at 17.6 million VND/year » Revenue is estimated at 25.6 Million VND/year » Payback in less than 9 months **Economic benefits for Green energy company** » CAPEX is 31.9 million VND » OPEX is estimated at 20.81 million VND/year » Revenue is estimated at 38.4 Million VND/year » Payback in less than 2 years	**Social benefits** » Improved environmental and health conditions in neighbouring communities
Barriers			
Potential next steps			

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Reusing waste sand to produce non-fired bricks

Waste sand from casting and pouring metal products and cleaning metal processing surfaces, etc. of molding and metal finishing factories is used as input materials for producing non-fired bricks

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Status

- Đại Dũng Green Material Co.: Consumed about 5,000 ton sand/year with average price 150,000 VND/ton
- Casting company (Vietnam Agricultural Machinery And Engine Company): wasted sand 500 ton/year with treatment cost 1,800,000 VND/ton
- Kondo Vietnam Co: wasted sand 1,000 ton/year with treatment cost 1,800,000 VND/ton

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Challenge

- Legal barriers, legislation and policies in the classification, treatment and transportation of waste.
- Source of capital to invest in a waste sand treatment system
- The cooperation of companies

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Conclusion

- Circular economy is an inevitable trend that brings many benefits: economic, social, environmental
- There are many barriers in the implementation process

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