SYMBIOSIS
INDUSTRIEL COOPERATION

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Kalundborg Symbiosis
The Industrial Symbiosis at Kalundborg is a resource and environmental network, consisting of more than thirty agreements between five industries, two waste handling companies, a wastewater treatment plant and the municipality.
Asnæs Power Station

Production of electricity and heat

120 employees

Denmark’s largest power station

The Symbiosis Activities Kalundborg Symbiosis Institute
Statoil Refinery

Production of petrol and other oil-based products

350 employees

Denmark’s largest oil refinery.
NOVO NORDISK A/S
Production of insulin etc.

NOVOZYMES A/S
Production of industrial enzymes

Altogether
>4000 employees
Gyproc

Production of plaster boards.

165 employees
RGS 90

Remediation of 250,000 tons oil and metal polluted soil per year.

65 employees
KARA/NOVEREN

Waste handling company, owned by 9 municipalities.

Kara/Noveren handles 350,000 tonnes of waste per year, recycling 82%
Kalundborg Community

Supply of water and heat

50,000 inhabitants
The Symbiosis projects 2010
What is Industrial Symbiosis?

Our definition of Industrial Symbiosis:

It is collaboration between different industries for mutual economic and environmental benefit
Principles for a Symbiosis project:

• "Someone's waste is another one's raw material"

• Economically and environmentally profitable

• Partners should be independent ("across the fence")
Three types of projects:

Recycling of water: 14 Projects
Exchange of energy: 7 Projects
Recycling of waste products: 12 Projects

+ a special project: The Industrial Symbiosis Institute
Gypsum production in 2009

98.039 tons from Asnæs block 5
How did the symbiosis develop?

• A “non-project” made by a “non-organization”
• Not invented, but evolved through 3 decades
• Not by one person, but by many
• Projects were initiated independently
• The name “Industrial Symbiosis” was not introduced until 1989
• After that, the “symbiotic consciousness” spread
Why did it evolve at Kalundborg?

• The industrial potential existed: Several large industries Limited physical distances ”A good fit”
• The economic incentive existed
• There were no legal barriers
• The communication was good
Resource savings.
Examples:

- Ground water .................. 1,9 mill. m$^3$/year
- Surface water .................. 1,0 mill. m$^3$/year
- Natural gypsum .............. 200,000 tonnes/year
- Oil .................................. 20,000 tonnes/year

Reduction of emissions to water and air is E.g. 240,000 t CO$_2$ per year.
• Economic Results (as of 1998):

• Total investments in 18 projects: ~ 75 mio. US$

• Annual savings: > 15 mio. US$

• Total savings until 1998: ~ 160 mio. US$

• The economic results is much better to-day!
Important factors for an industrial symbiosis:

- Participants must fit, but be different.
- Projects must be environmentally and commercially attractive.
- There has to be a short physical distance between the participants.
- There has to be a short mental distance between the participants.
- Communication is more important than technology.
Lessons to be learned from Kalundborg:

- The Kalundborg I.S. is a spontaneously developed network, - a bottom-up, not a top-down phenomenon.
- Economy was the initial incentive, - environmental idealism came later
- In practice, the mutual dependence between the partners has never been a problem
- Kalundborg has been used as a model for other IS projects
- Regulation can be an incentive to projects, but may also become a barrier
- Communication is more important than technology.
Systems make it possible,
- but people make it happen!