



**ESPON Workshop:  
“Green Economy in European Regions?”**

**Contribution of spatial planning to the greening of the economy**

**– the Industrial Symbiosis example**  
*or How Global Challenges become Local Advantages*

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# The first large scale Industrial Symbiosis

**”An Industrial Symbiosis is a physical exchange of materials, energy, water, and by-products among diversified clusters of firms” *Marian Chertow, Yale University***

**Industrial Symbiosis is a business collaboration where residuals from one enterprise serve as input for another enterprise – thereby improving bottom-line figures and competitiveness for the business partners and reducing the total impact of the industry on the environment.**

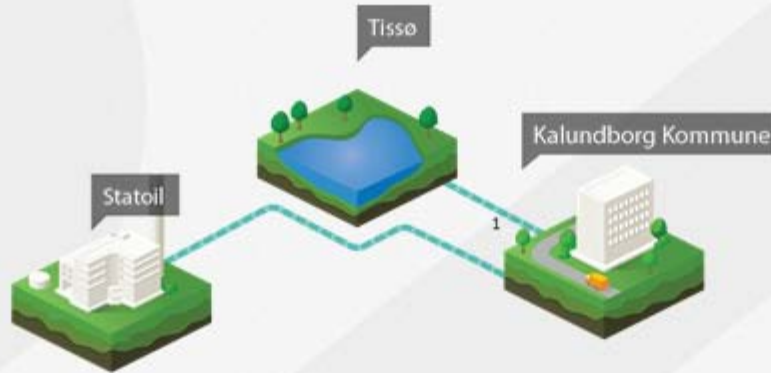
Kalundborg Symbiosis has 40 years of experience in Industrial Symbiosis, cooperation between companies and today the Symbiosis is an international brand. The collaboration has evolved gradually and organically. Each individual symbiosis project has reduced production costs and/or the intake of virgin resources, which together has improved the competitive edge of both or all companies.



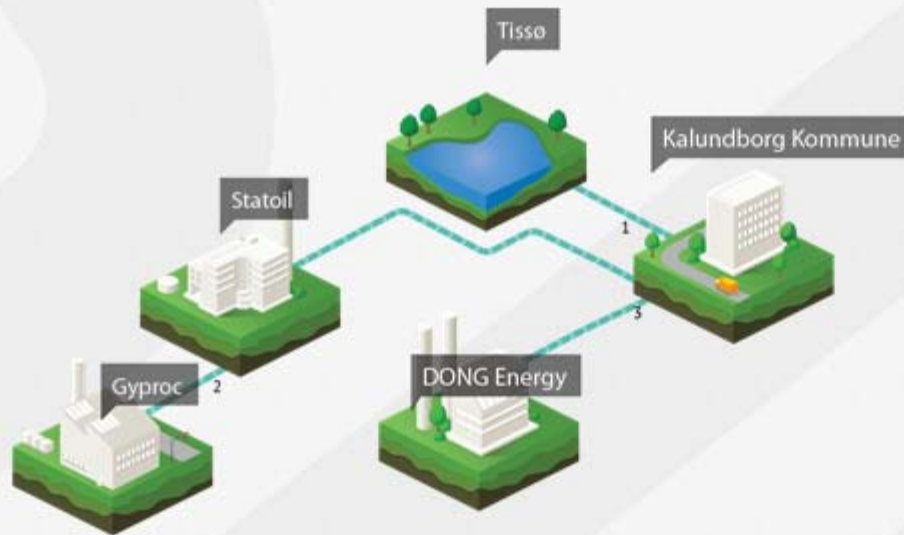
# Kalundborg Symbiosis



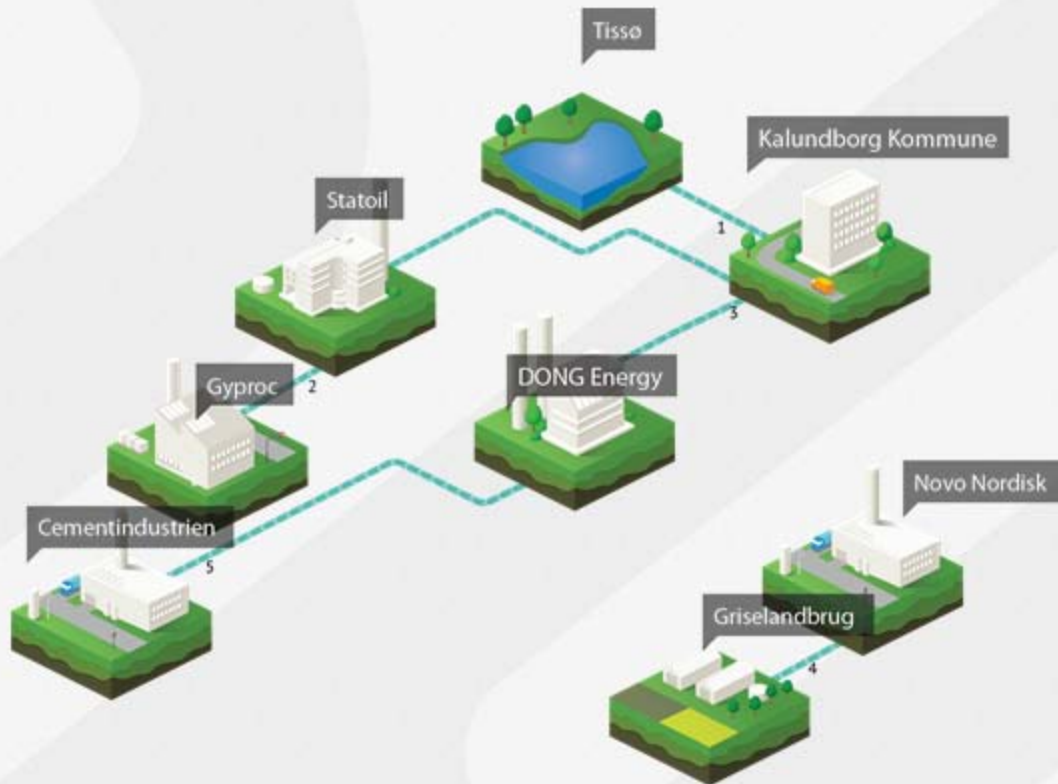
# 1961



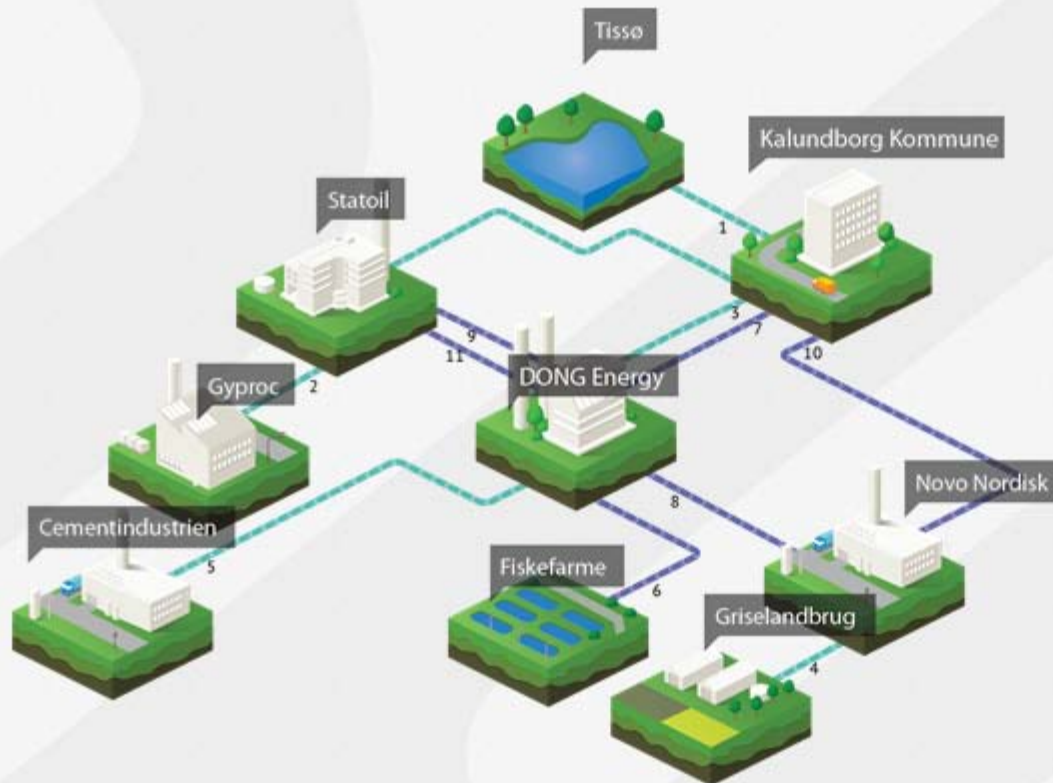
# 1972



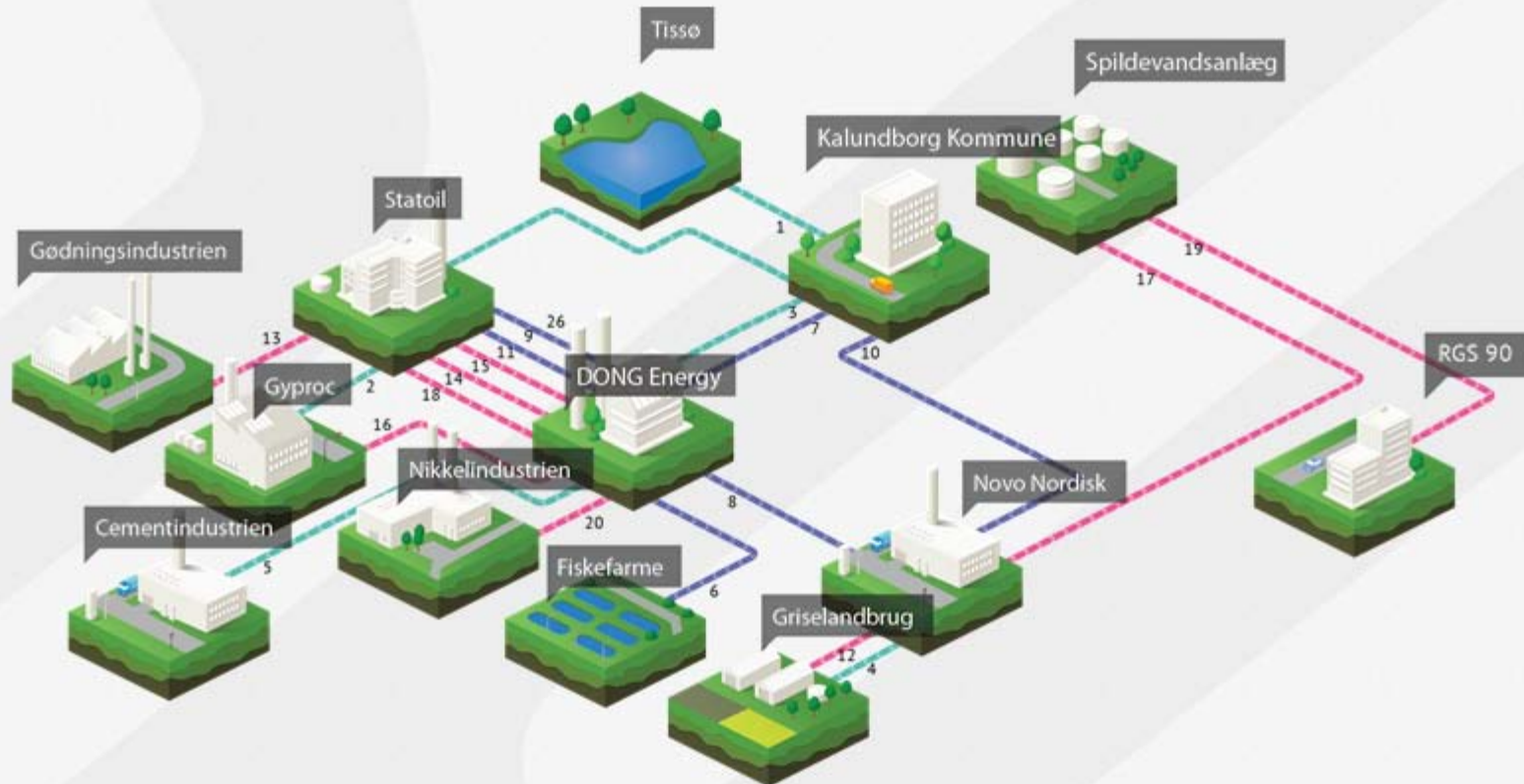
# 1979



# 1980-1989

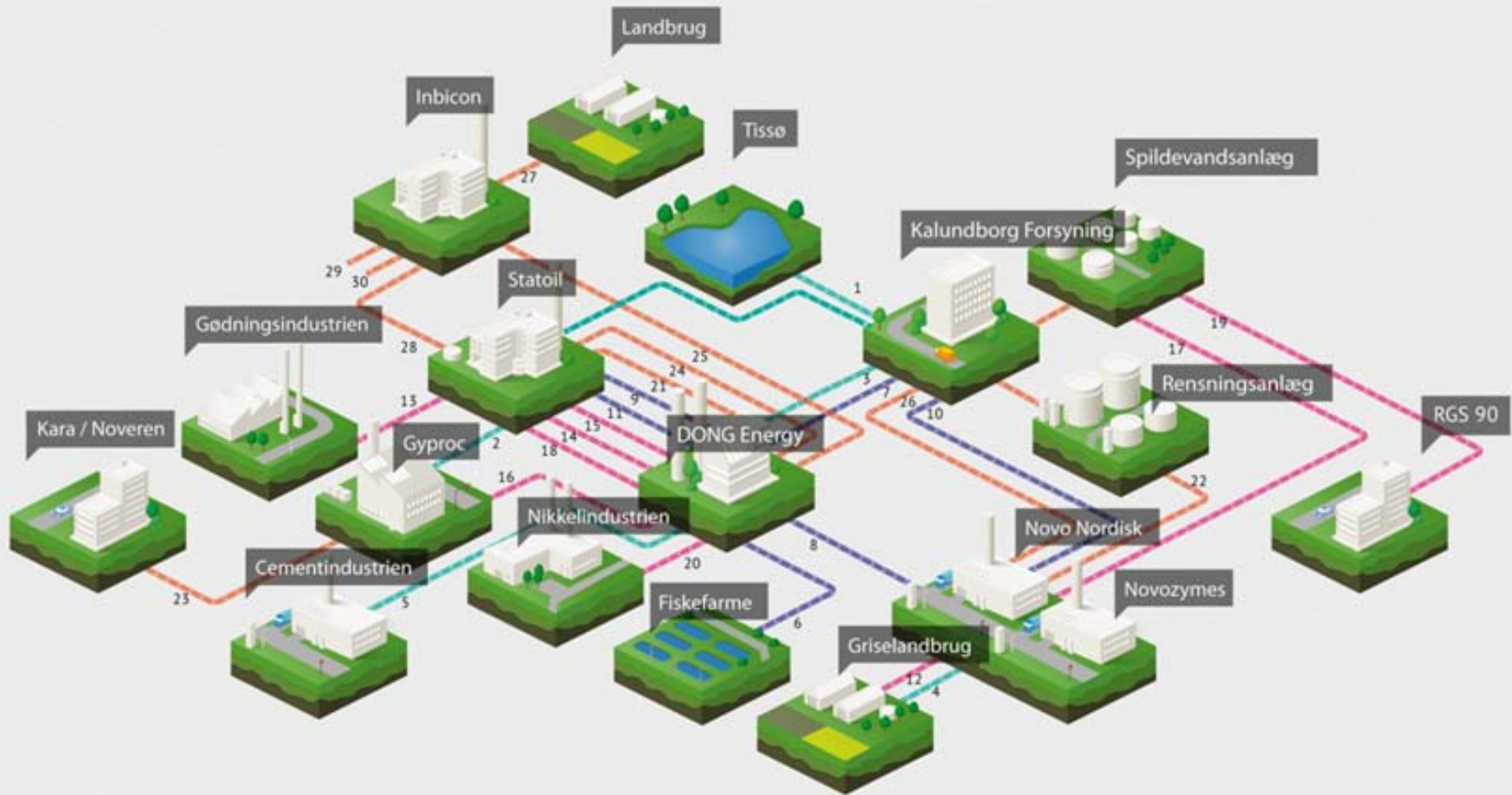


# 1990-1999





# 2000-2010



# Industrial Symbiosis infrastructure



# The Symbiosis Model - development in 3 dimensions

**Economy:** Minimizing costs and improved bottom line and competitive edge

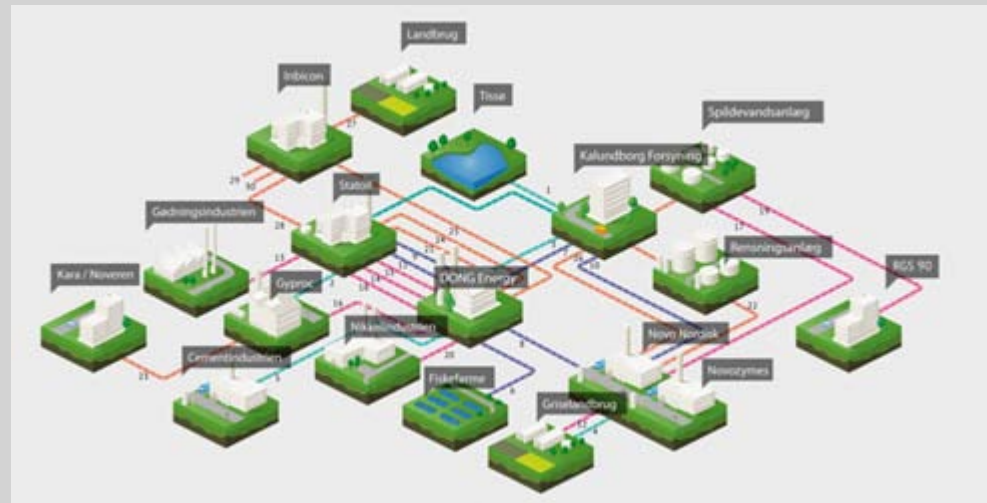
**Environment:** Resource efficiency through reuse, recycling, and reduced intake of virgin materials

**Innovation and development:** Improved introduction and access to new technologies and R&D, job creation and regional development



# Economy

- Minimized costs on waste management
  - Minimized costs on resource purchases
  - Income from by-product sales
- = Competitive edge



# Environment and climate

Resource savings:

Ground water .....	2,0 mill. m <sup>3</sup> /year
Surface water .....	1,0 mill. m <sup>3</sup> /year
Natural gypsum .....	200,000 tons/year
Oil .....	20,000 tons/year

Reduction of CO<sub>2</sub> emission (2008): app. **275.000 tons**



# Test and demonstration

Kalundborg Symbiosis has proven to be an environment which nurtures **innovation and the establishment of test facilities** (pitstop between laboratories and market):

- DONG Energy's demonstration plant Inbicon
- DONG Energy's Pyroneer
- E4Water micro algae test facility



# Programmes and instruments

Kalundborg Municipality involvement and support →  
Regional project on raising awareness and diffusion of Industrial  
Symbiosis model →  
National task force and funding scheme

Municipality



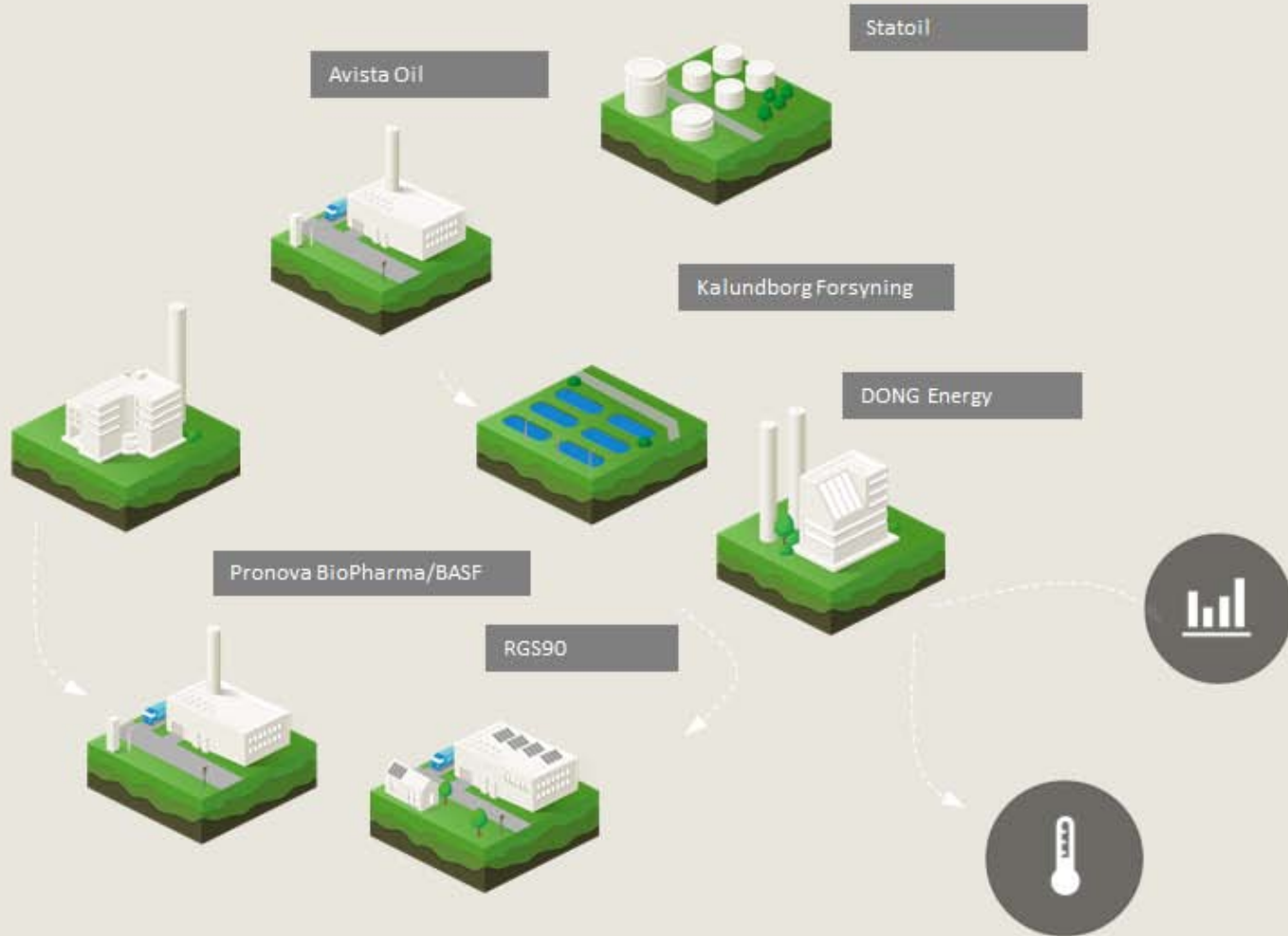
Regional



National

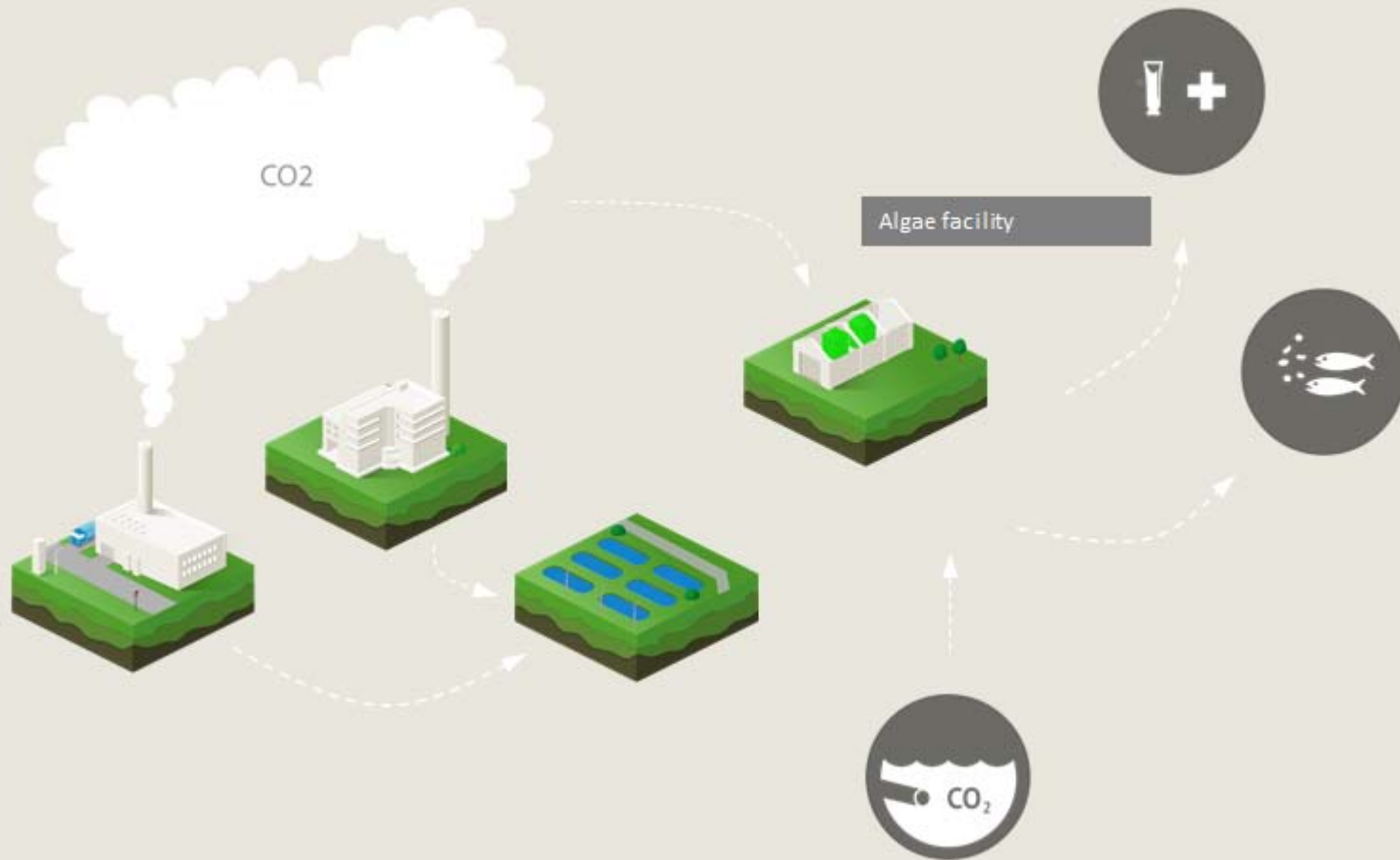


# New Industrial Symbiosis - New Water





# E4Water Test and Demonstration Facility



# Regional programme



# Regional toolbox



Initial screening of area or waste fractions



Training of management and employees



Matchmaking between potential partners



Facilitating of new projects



# Spatial planning for the greening of the economy

Next step:

- Spatial planning instruments: GIS plus existing Industrial Symbiosis infrastructure → new data → investments and new companies
- Infrastructure for potential Industrial Symbiosis developments → lower future investments
- Industrial Symbiosis planning combined with spatial planning for climate adaptation → sustainable cities

