



# KALUNDBORG SYMBIOSIS

A NETWORK OF PUBLIC-PRIVATE PARTNERSHIPS

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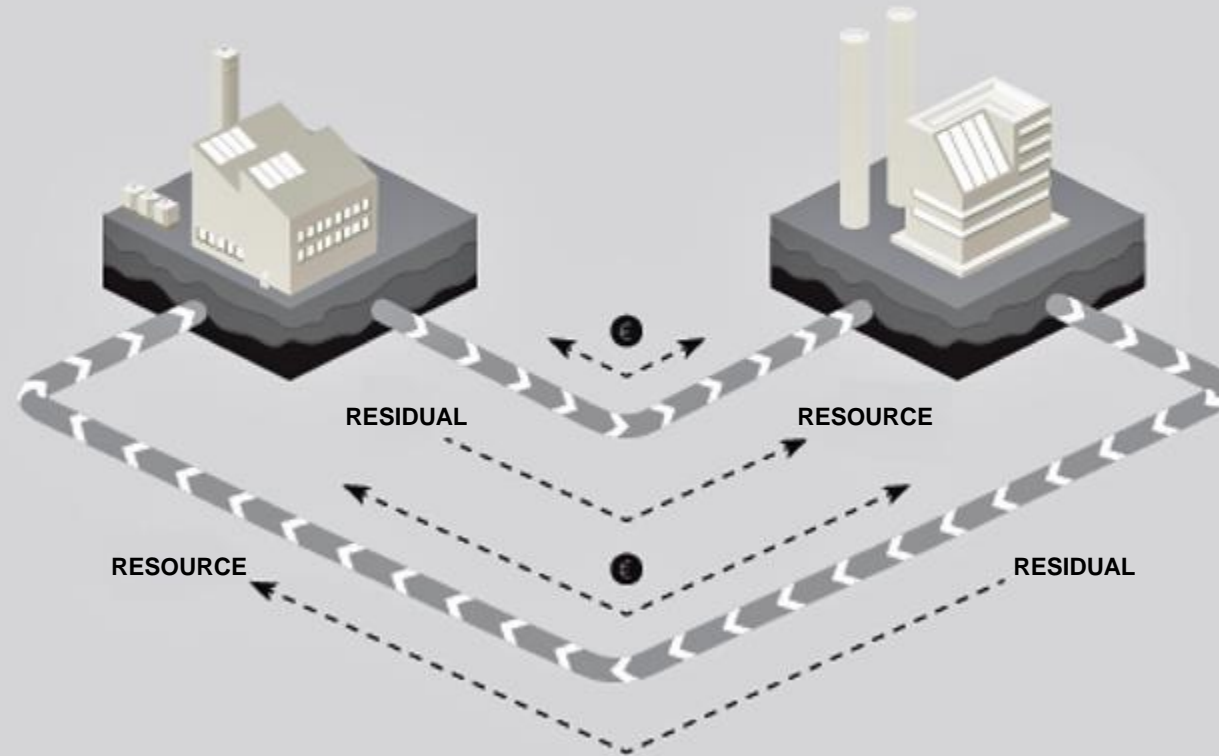
I-SUSTAIN

17. SEPTEMBER 2019



KALUNDBORG  
SYMBIOSIS

# INDUSTRIAL SYMBIOSIS FOR MUTUAL BENEFIT



Redefining “waste” as a secondary resource !



Winner of the 2018

**WIN** GOTHENBURG  
**WIN** SUSTAINABILITY  
AWARD

The Jury's motivation:

As a pioneer within the field, the Kalundborg Symbiosis has shown the way for many other industrial clusters, inspiring businesses all around the world.

# A brief presentation



Symbiosis Center Denmark is a national knowledge center working to identify and facilitate industrial symbiosis projects between industrial partners.

# Activities



## Company programs

- Identifying & implementing Industrial Symbiosis



## Marketing

- Promoting green solutions
- Attracting investments



## Training

- Educational programs



## Knowledge platform

- Research activities
- Test & demonstration
- Triple helix collaboration

# Our process of facilitation

- Industrial Symbiosis = effective green business model that reduce production costs and increase competitiveness and growth potential for industries.
- Takes time and resources and requires data, mutual trust and knowledge sharing between the partners as well as network relations, facilitation and support.



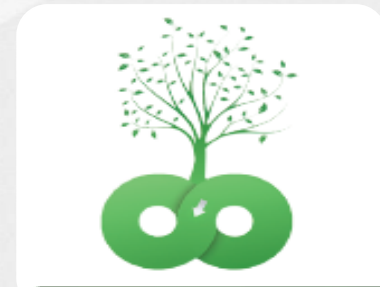
## Potential

- Screening
- Assessment



## Match

- Business case



## Anchoring

- Partnership
- Network

# BURNING PLATFORM - DRAMATIC INCREASE IN COMMODITY PRICES

**Sharp price increases in commodities since 2000 have erased all the real price declines of the 20th century**

McKinsey Commodity Price Index (years 1999-2001 = 100)<sup>1</sup>

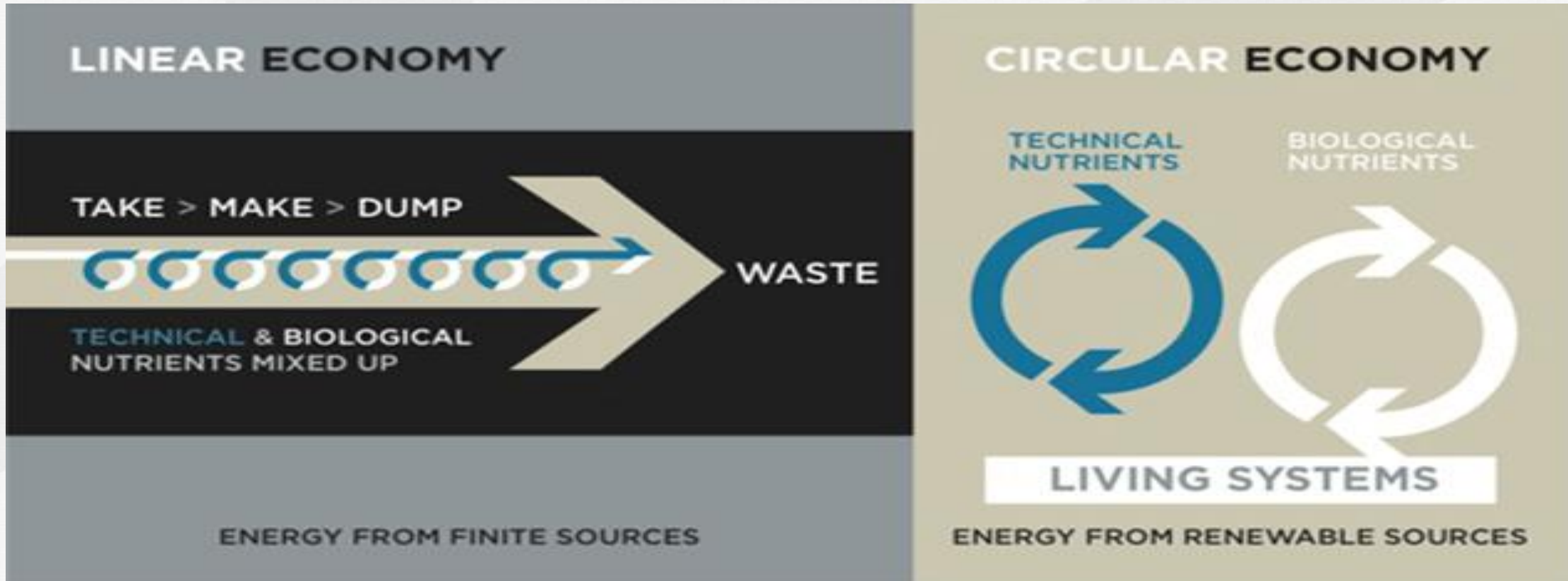


<sup>1</sup> Based on arithmetic average of 4 commodity sub-indices: food, non-food agricultural items, metals, and energy; 2011 prices based on average of first eight months of 2011.

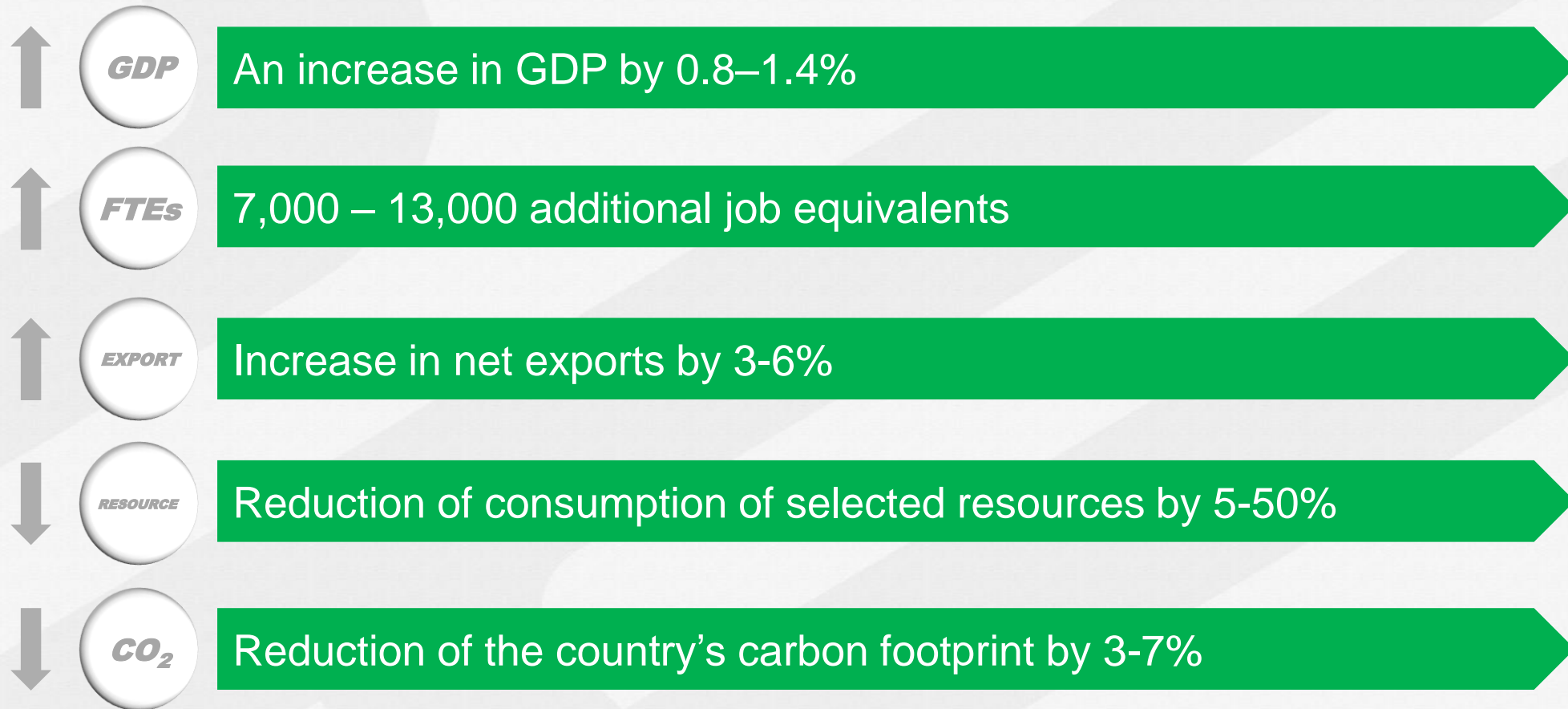
# FROM LINEAR TO CIRCULAR ECONOMY



**DELIVERING THE  
CIRCULAR ECONOMY  
A TOOLKIT  
FOR POLICYMAKERS**



# CIRCULAR ECONOMY TRANSITION IN DENMARK BY 2035 COULD LEAD TO...



# NEXT STEPS TOWARDS CIRCULAR ECONOMY

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## 27 RECOMMENDATIONS TO GOVERNMENT

**Advisory Board for cirkulær økonomi**  
Anbefalinger til regeringen



  
Advisory Board for  
cirkulær økonomi

### Advisory Board for cirkulær økonomi består af



**Flemming Besenbacher**  
(formand)  
Bestyrelsesformand,  
Carlsberg Group



**Aja Guldhammer**  
CEO, Reshopper



**Anders Byriel**  
CEO, Kvadrat



**Pernille Blach Hansen**  
Senior Director, LEGO



**Christian B. S. Christensen**  
CEO, Solum Gruppen



**Mik Kristensen**  
CEO, Nykredit Leasing



**Franz Ocultza**  
CEO, Aage Vestergaard Larsen



**Martin Petersen**  
CEO, EcoXpao



**Matias Mel Dalsgaard**  
CEO, GoMore



**Jais Valeur**  
CEO, Danish Crown



**Kasper Guldager**  
CEO, GXN



**Jeanett Vikkelsee**  
COO/CSO, Marius Pedersen

### Den cirkulære værdikæde

- #1 Gøre cirkulær økonomi til en vækstmotor for danske virksomheder
- #2 Etablere én indgang til det offentlige for virksomheder, der oplever barrierer for cirkulær omstilling
- #3 Etablere cirkulære kommuner
- #4 Indarbejde cirkularitet i de makroøkonomiske modeller og statistikker
- #5 Udvikle standarder som understøtter cirkulær økonomi
- #6 Indarbejde cirkulær økonomi i hele uddannelsessystemet
- #7 Fremme forskning, udvikling, test, demonstration og markedsmodning af cirkulære løsninger og teknologier
- #8 Styrke finansiering til acceleration af cirkulære virksomheder
- #9 Udnytte den danske styrkeposition inden for digitalisering og ny teknologi til at understøtte den cirkulære omstilling

### Design og produktion

- #10 Styrke den cirkulære produktspolitik i bl.a. eodesign-direktivet
- #11 Indarbejde cirkulær økonomi i produktionsvirksomhedernes vilkår
- #12 Udarbejde et cirkulært bygningsreglement
- #13 Udvikle standardiserede bygnings- og produktpas
- #14 Fremme rammevilkårene for bioraffinering
- #15 Etablere nye værdikæder for landbrugsafgrader, der udnytter fotosyntesen bedre
- #16 Optimerer udnyttelsen af animalske produkter

### Forbrug

- #17 Bygge og købe ind i det offentlige på baggrund af totalekonomi og livscyklusberegninger
- #18 Fremme cirkulær økonomi gennem virksomheders og det offentlige indkøb
- #19 Udvikle de cirkulære aspekter ved relevante mærkningsordninger og udbrede brugen af dem
- #20 Fremme udnyttelse af overskuds kapacitet f.eks. gennem deleøkonomiske forretningsmodeller
- #21 Forebygge madspild
- #22 Fremme reparation og genbrug

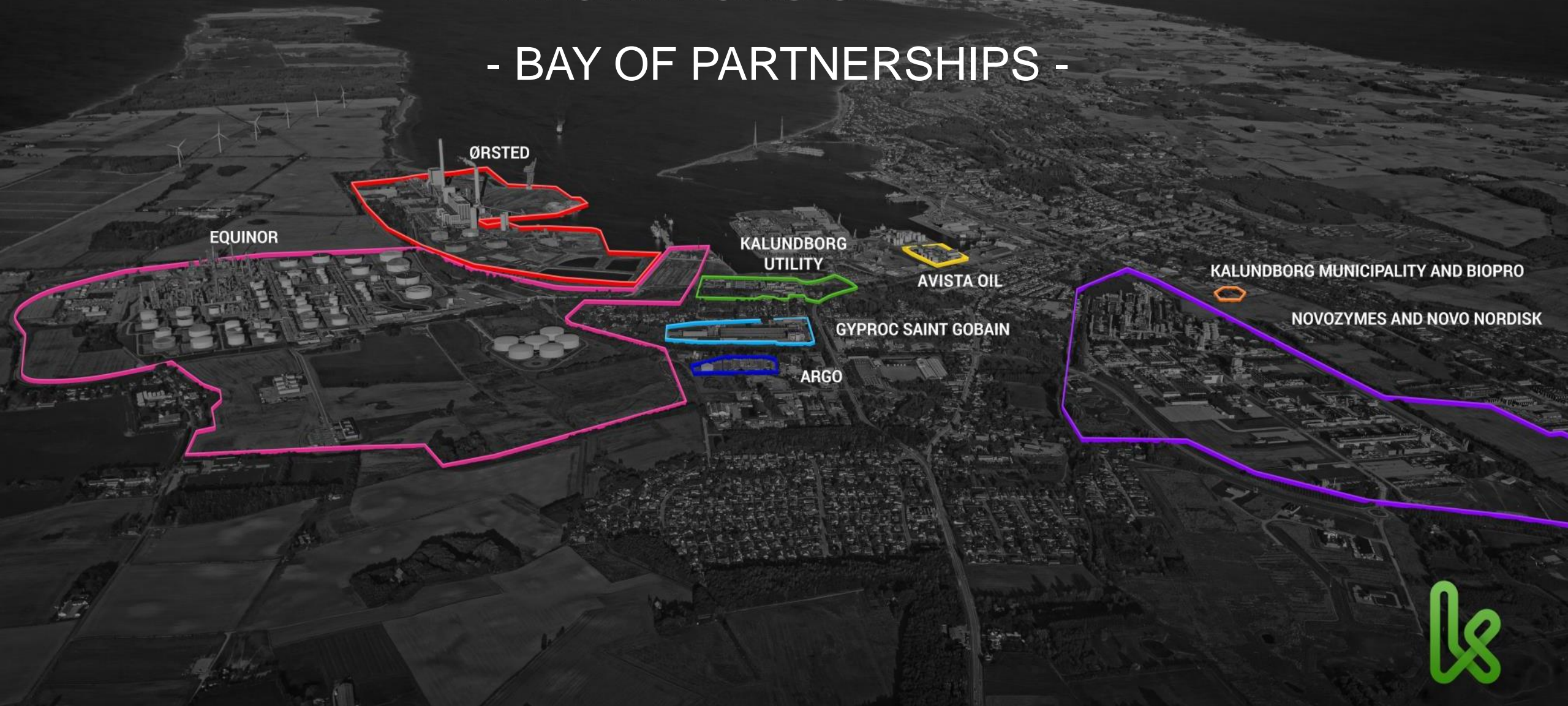
### Genanvendelse

- #23 Ensætte den kommunale indsamling af husholdningsaffald for at fremme genanvendelse
- #24 Skabe klarhed om affaldssektorens rammevilkår og et bedre udbud af genanvendte råvarer
- #25 Forbedre konkurrencevilkårene på markedet for affald og genanvendte råvarer gennem ensartet klassificering og et styrket risikobaseret affaldstøyn
- #26 Udbrede selektiv nedrivning af byggen
- #27 Indføre et mere cirkulært producentansvar for elektronikaffald



# KALUNDBORG SYMBIOSIS

- BAY OF PARTNERSHIPS -



EQUINOR

ØRSTED

KALUNDBORG  
UTILITY

AVISTA OIL

KALUNDBORG MUNICIPALITY AND BIOPRO

GYPROC SAINT GOBAIN

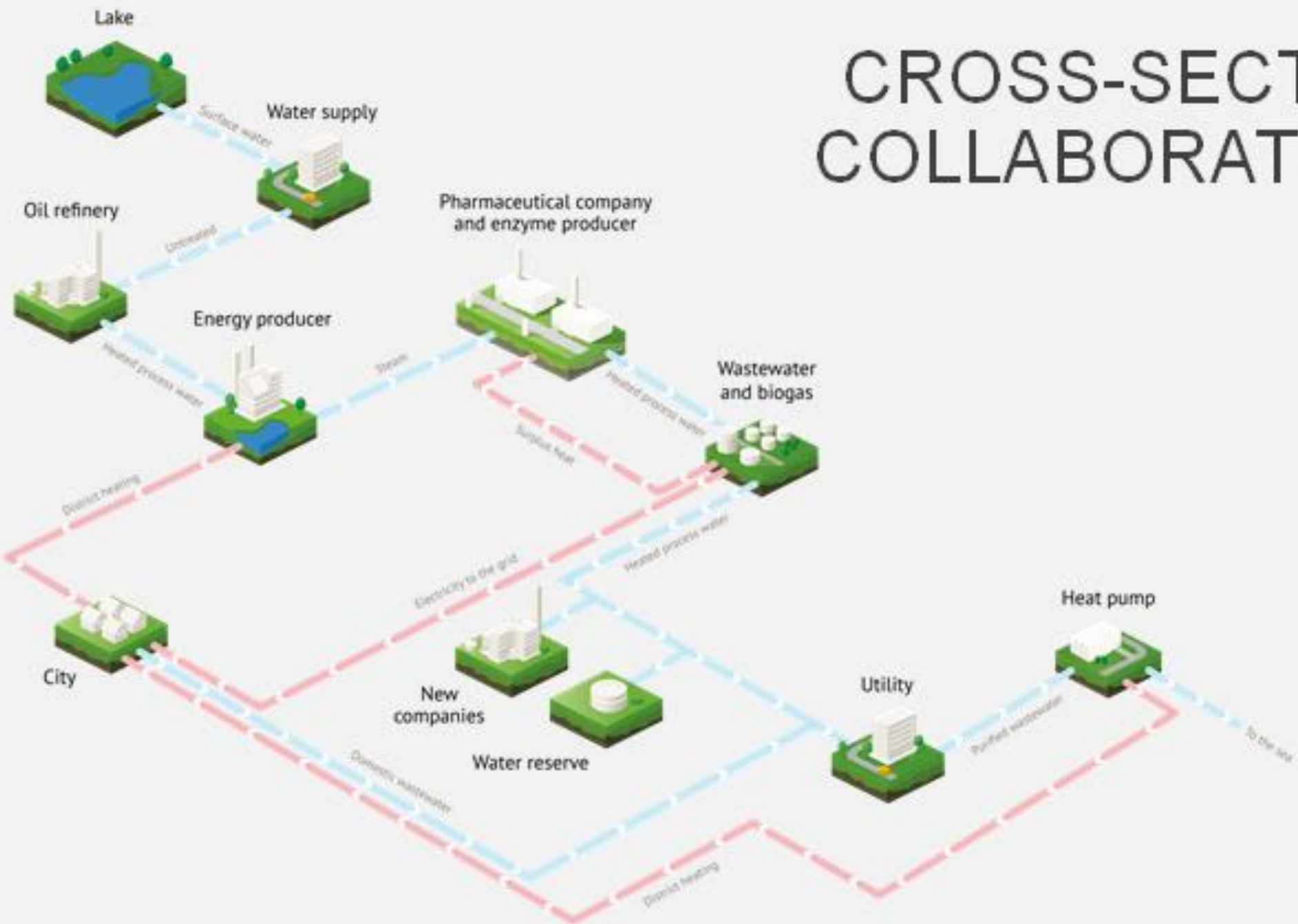
NOVOZYMES AND NOVO NORDISK

ARGO





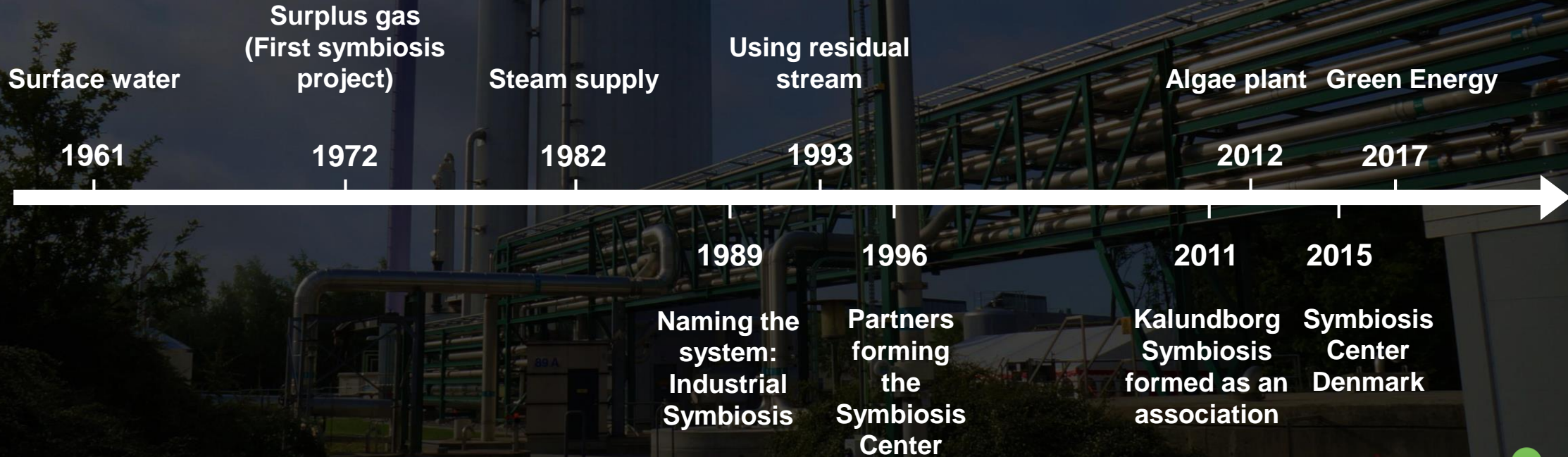
# CROSS-SECTOR COLLABORATION



# MORE THAN 40 YEARS OF COOPERATION

PROJECTS

ORGANIZATION



KALUNDBORG SYMBIOSIS

# WORKING TOGETHER: SURFACE WATER SPRINGS IN 1961



Surface water

1961

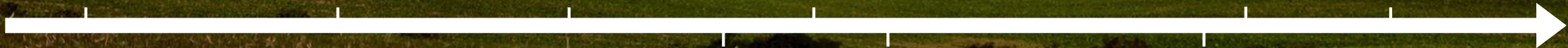
1972

1982

1993

2012

2017



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# GOOD BUSINESS CASE: FROM FIRST STREAM IN 1972

Surplus gas  
(First symbiosis  
project)

1961

1972

1982

1993

2012

2017



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# ADAPTABLE: NEW BUSINESS MODEL GAINING STEAM FROM 1982

Steam supply

1961

1972

1982

1993

2012

2017



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# MINDSET: MATERIALIZED IN GYPSUM FROM 1993

Using residual  
stream

1961

1972

1982

1993

2012

2017



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# TEST & DEMONSTRATION: ALGAE PLANT 2012

1961

1972

1982

1993

Algae plant

2012

2017



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# GREEN ENERGY FROM 2017

1961

1972

1982

1993

2012

2017

Green Energy



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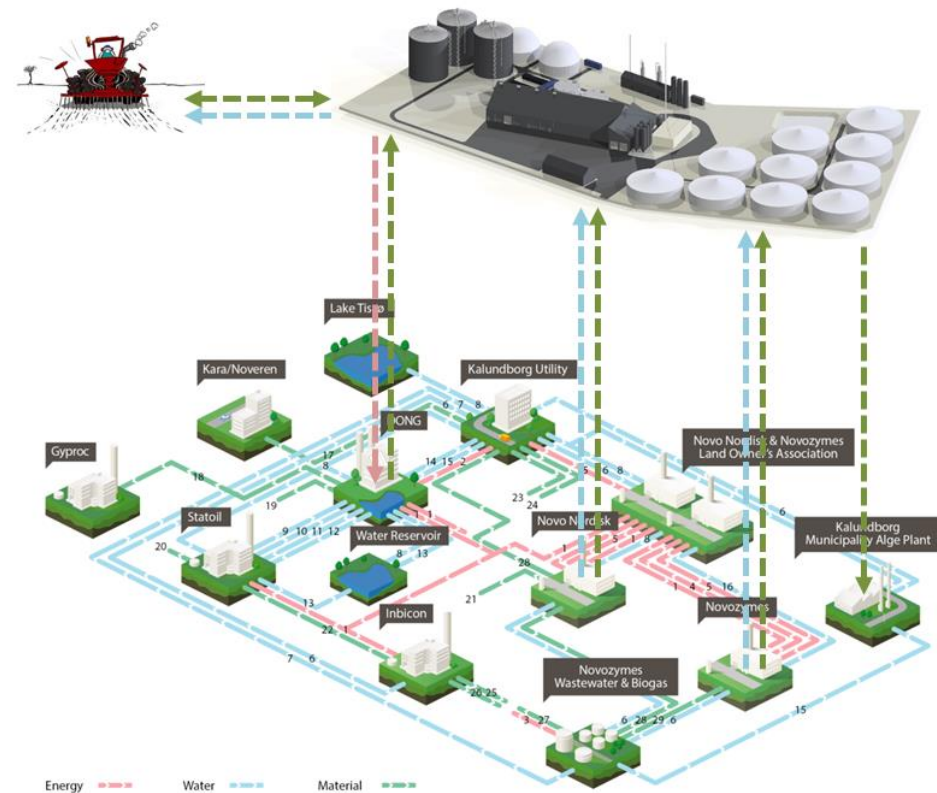
# BIOMASS BASED POWERPLANT (2019)

- Wood chips replacing coal
- Yearly saving: 800.000 ton CO<sub>2</sub>  
(400.000 cars)
- Green steam, electricity and heat

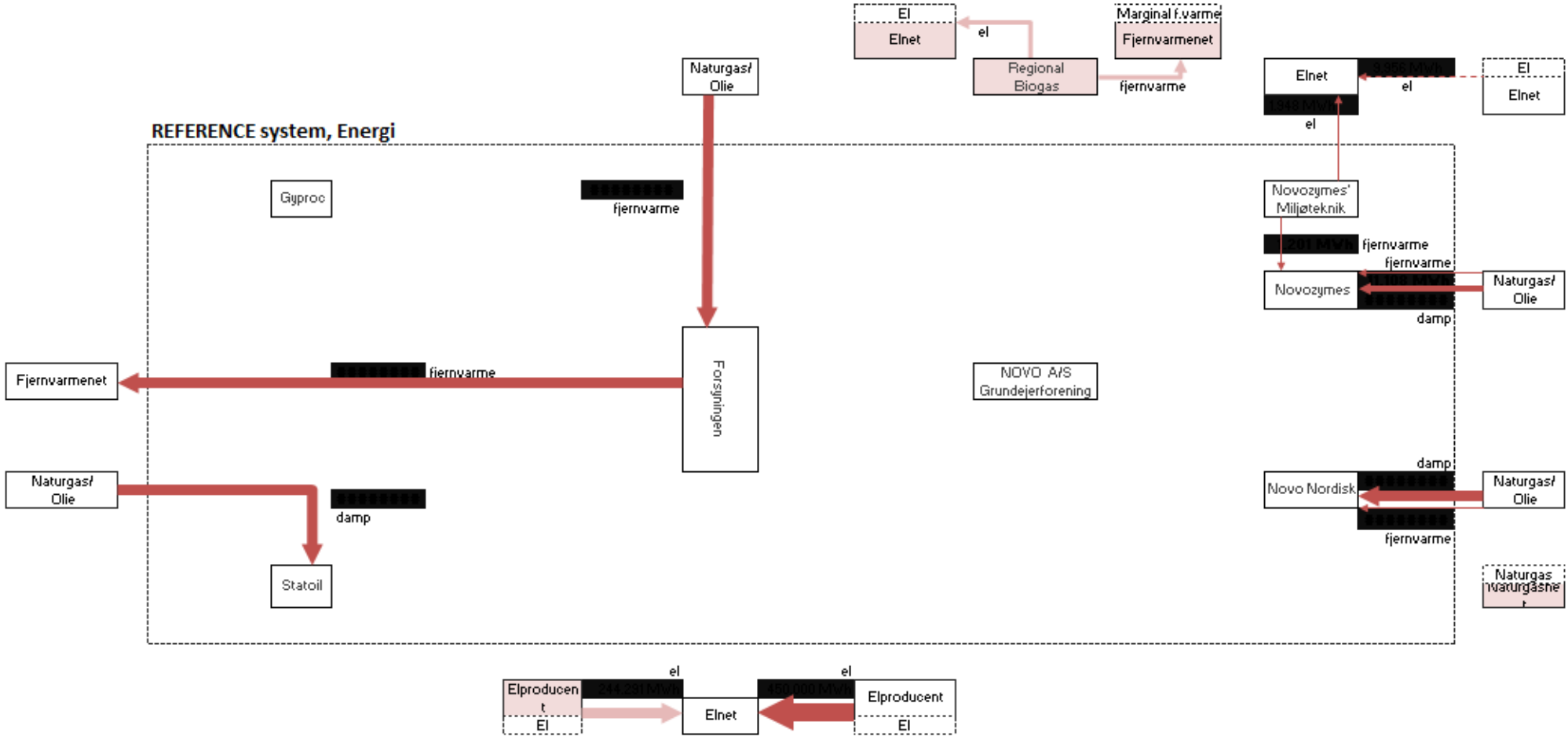


# FROM BIOMASS TO NATURAL GAS (2018)

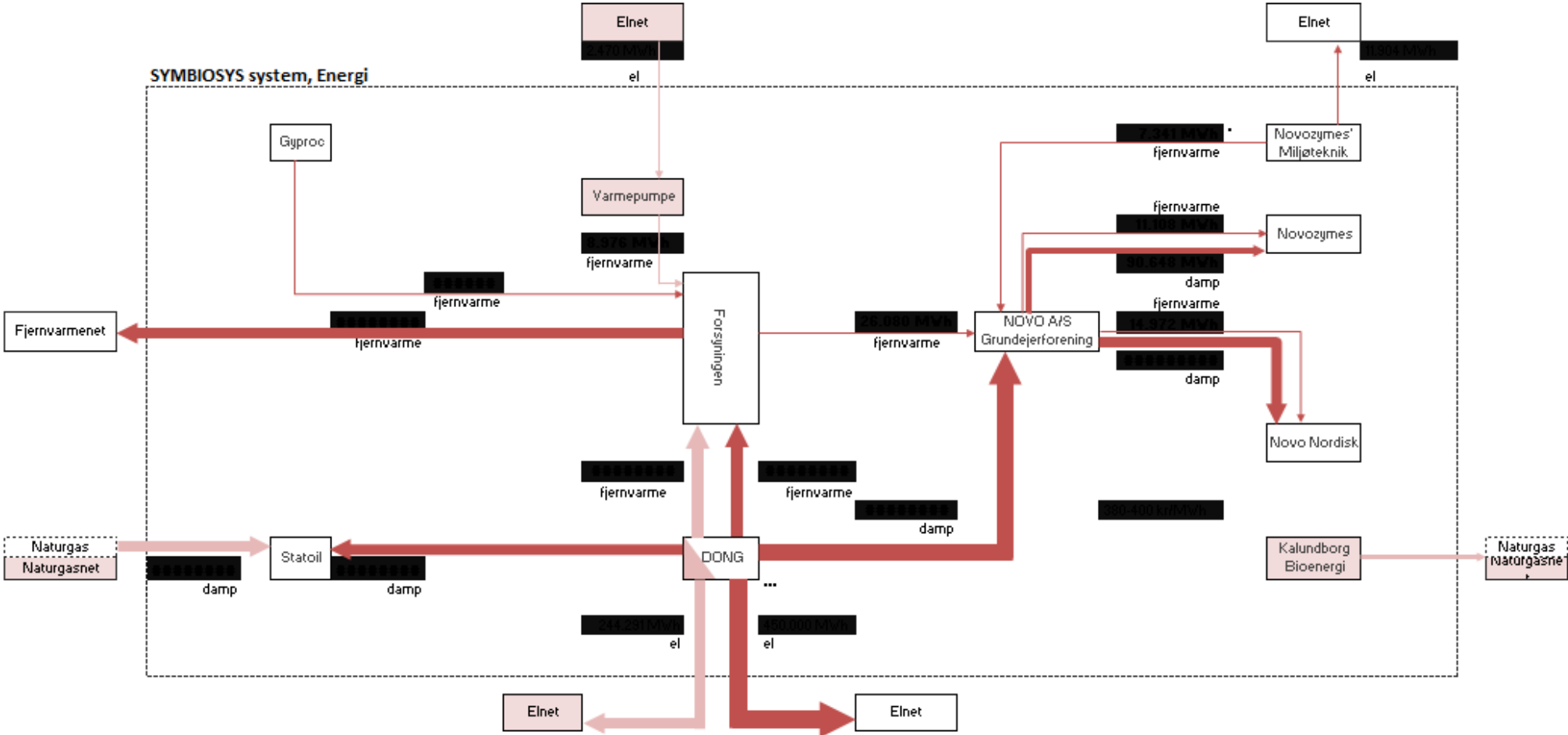
- Biogas plant (Kalundborg Bioenergi)
- Will treat 300.000 ton biomass pr year
- Natural gas (upgraded biogas) and fertiliser
- Energy = 4.000 households
- CO<sub>2</sub> savings = 17.000 tons/y



# LCA: ENERGY BASELINE

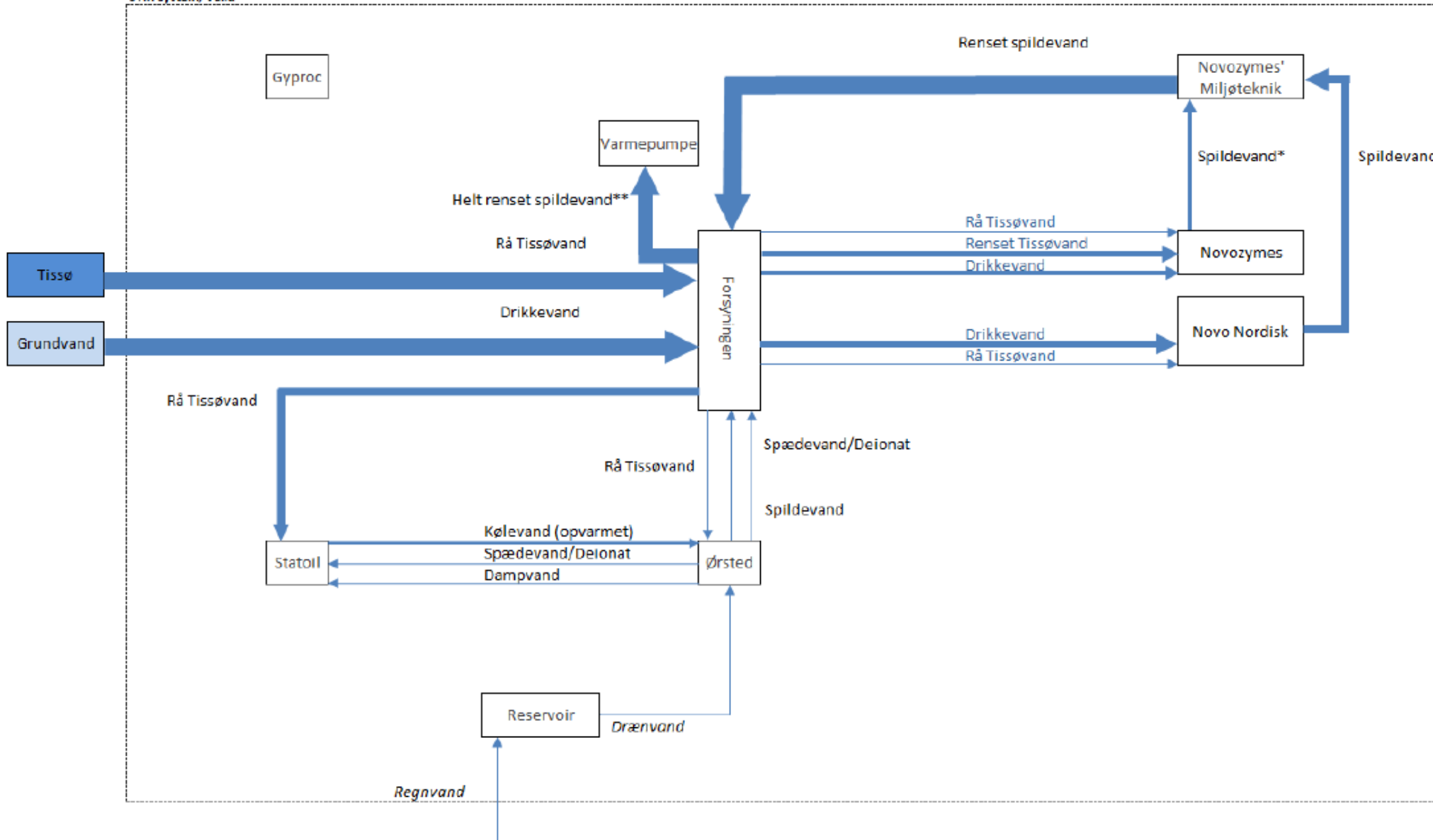


# LCA: ENERGY SYMBIOSIS



# LCA: Water Symbiosis

SYM system, Vand

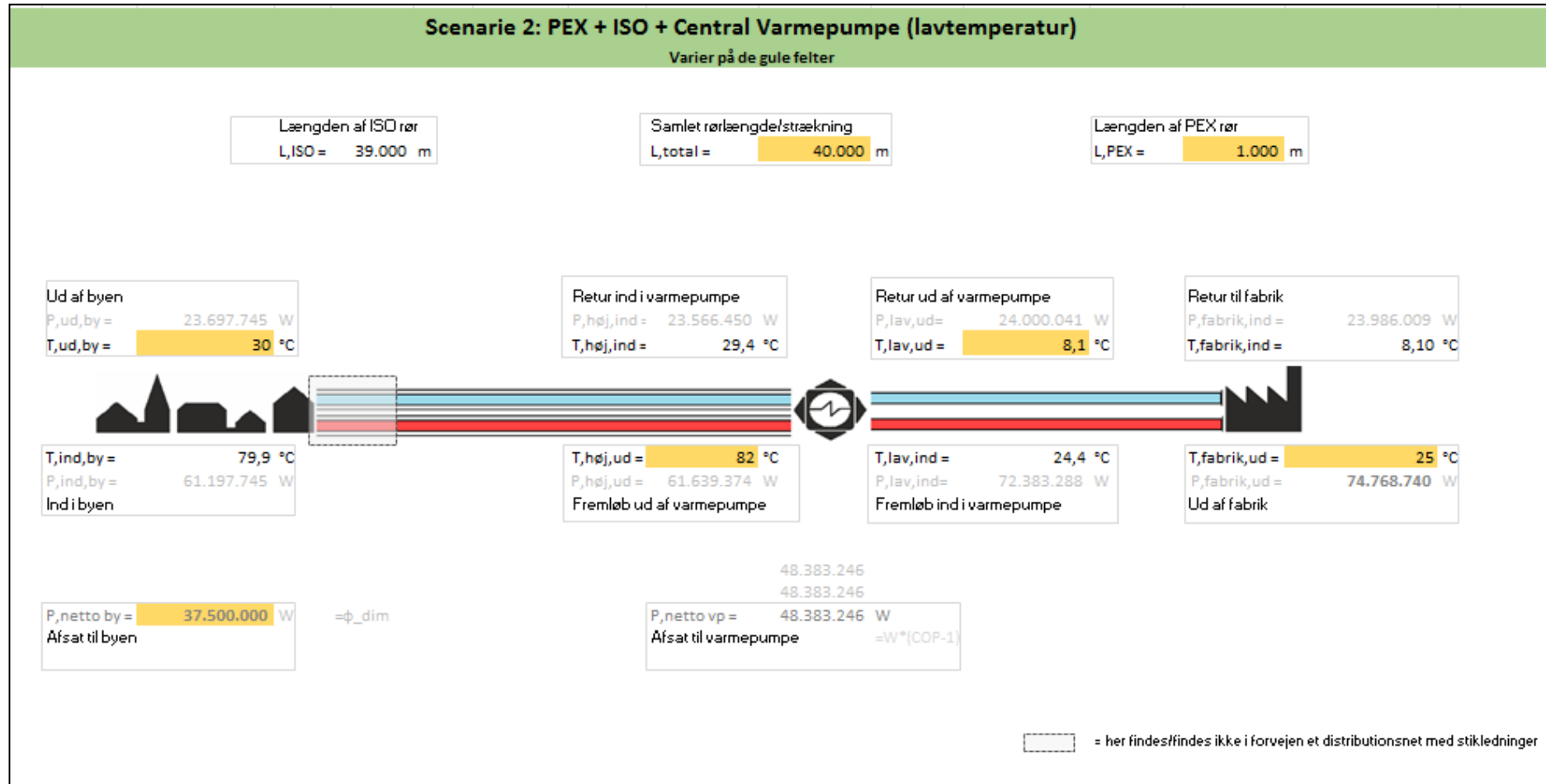


\*Består af to delstrømme, både spildevand fra Novozymes' produktion samt dræn fra afvandet Biomasse/SBM

\*\*Med en temperatur på ca. 23°C er denne vandstrøm energibærer og leverer varme til varmepumpen, der vha. el booster energien til at levere fjernvarme. Denne varme fra spildevandsstrømmen er "gratis" og afbelastet dermed ørsted

Det formodes, at Statoils kølevand hentet fra Fjorden er det samme i SYM og REF og at mængderne dermed opvejes

# GENERIC MODELS



# KALUNDBORG SYMBIOSIS WILL BE THE WORLD LEADING INDUSTRIAL SYMBIOSIS WITH A CIRCULAR APPROACH TO PRODUCTION.

Renew

Strengthening of the partnership

Connect

Full resource utilization

Promote

Sharing of the symbiotic mindset





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# ANNUAL SAVINGS

BY LIFE CYCLE ASSESSMENT (LCA)

**635.000 ton**

CO<sub>2</sub> (environmental)



The same amount of CO<sub>2</sub>  
used on average over a year  
by **37.352 Danes**

**14 mill.**

Euro (socioeconomic)



Enough to buy **354**  
**brand new** electric powered  
cars

**24 mill.**

Euro (business economic)



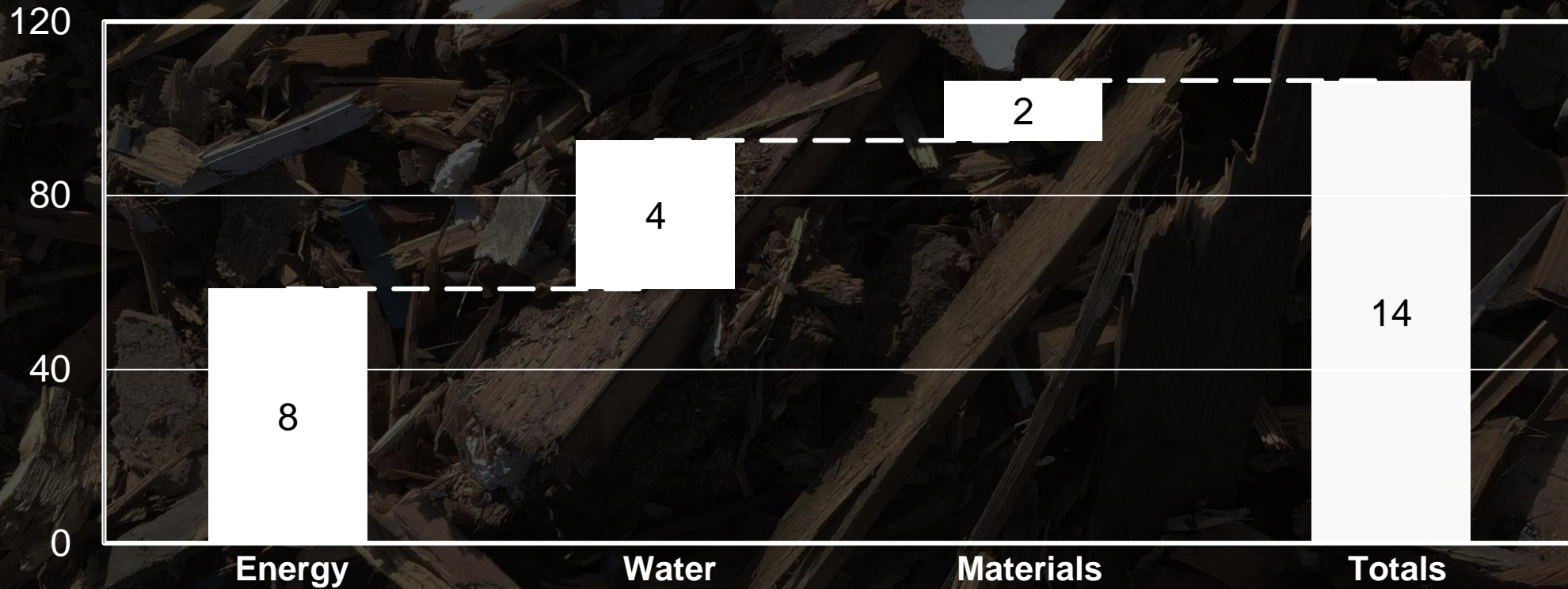
Equivalent to having  
**252 academics**  
employed for a year



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# SOCIOECONOMIC BENEFITS

Mio. euro. / year



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# BENEFITS

## **Increased growth and competitiveness**

- Lower production costs with fewer expenses for purchasing and disposal
- Income from by-products

## **Decoupling of growth and resource consumption**

- Growth, with improved resource efficiency and reduction in waste
- Lower CO<sub>2</sub> emissions



# BENEFITS

## Better control and adaptability

- Wider choice of suppliers and increased energy security with multi-pronged strategy (by creating and utilising one's own local resources, one obtains less dependence on imports and world markets)
- Increased resilience by acting in partnerships that, for example, secure local resources in the long term and are less exposed to the instability and fluctuations of world markets
- Increased control and management of the flow of resources and materials



# BENEFITS

## **Better innovation and business development**

- Development and innovation strength achieved by connecting different competences both internally at the companies and between companies
- Increased possibility of employee innovation. Development of new products, customer groups and markets
- New business models based on the utilisation of resources in the residual flows
- New export opportunities



# BENEFITS

## **Increased motivation and market value**

- Increased PR and CSR value locally and globally
- Opportunity for shared marketing and investor efforts
- Increased motivation, job satisfaction and pride among the employees involved



# **BENEFITS**

- **Increased growth and competitiveness**
- **Decoupling of growth and resource consumption**
- **Better control and adaptability**
- **Better innovation and business development**
- **Increased motivation and market value**

# NEXT STEP

- **Realizing 10 new symbiosis streams by 2025**
- **Symbiosis - Ground Zero Approach**
- **Improving screening tools and data for matching up**  
**Support system export**
- **Improving international collaboration and networks**
- **Support start-ups/SME's and educational initiatives**
- **IS value proposition – attracting industry**



A worker wearing a hard hat and work clothes is seen from behind, working in a trench. The worker is using a green power tool on a large, corrugated metal pipe. The trench is filled with several large pipes, and the background shows some vegetation. The scene is dimly lit, with the worker's work area illuminated by a light source.

**SYSTEMS MAKE IT POSSIBLE  
PEOPLE MAKE IT HAPPEN**

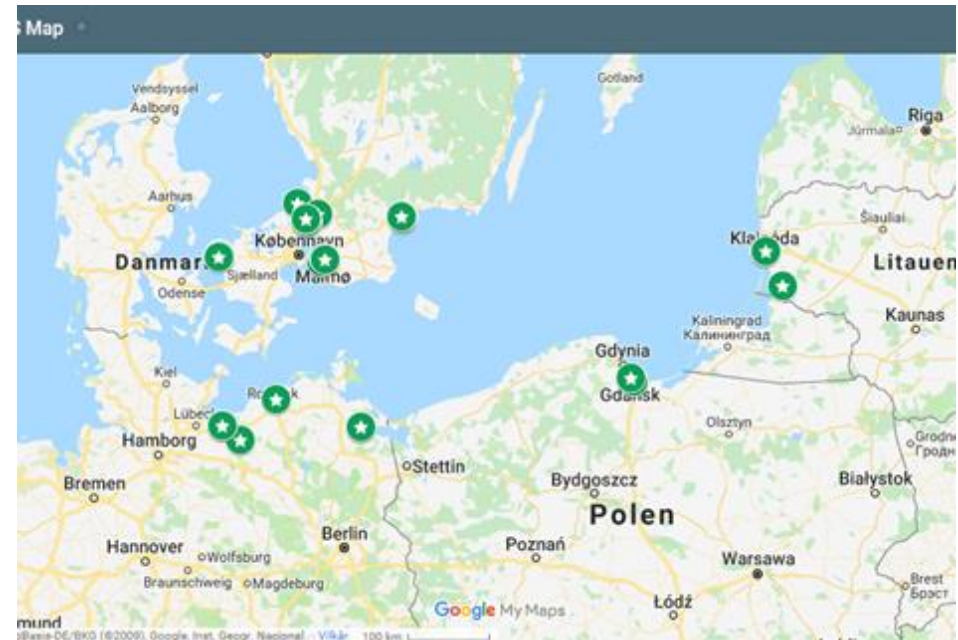
**For more information please contact:  
[per.moller@kalundborg.dk](mailto:per.moller@kalundborg.dk)**

# CAPACITY BUILDING IN THE BALTIC

- Knowledge transfer from symbiosis practitioners
- Pilots, test and demonstration



European  
Regional  
Development  
Fund



# CAPACITY BUILDING IN THE BALTIC

## "Baltic Industrial Symbiosis"

Funded by: Interreg BSR

Project period: 2019-2021 (30mdr )

Budget: ca. 2.3 mio Euro (incl. Norway)

Lead-partner: Symbiosis Center Denmark(0.27 mio)  
Kalundborg Symbiosis (0.29 mio)

