MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Carolinahallen: Session 1

Dynamic clusters – formula for high competetiveness

Salmson: Session 2

Industrial symbiosis – reuse resources, raise values and save the environment

Session 2

Industrial symbiosis – reuse resources, raise values and save the environment

Moderator: Mats Eklund

Professor • Linköping University

MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Session 2

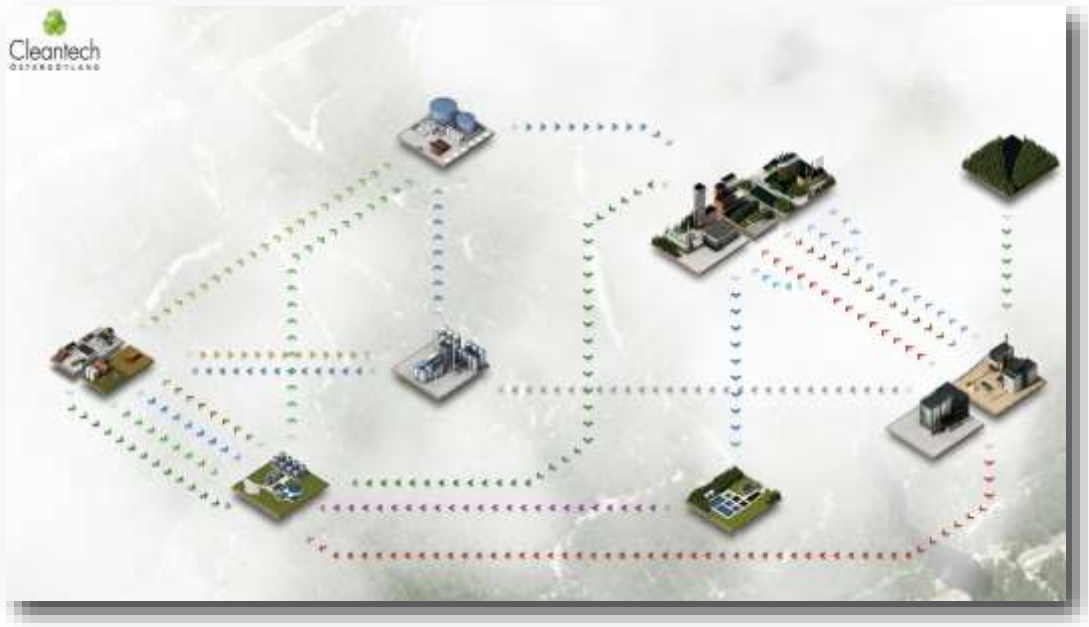
Industrial Symbiosis – Forms, potentials and ways forward

Murat Mirata

Assistant professor • Linköping University

Industrial Symbiosis

Forms, potentials & way forward



Murat Mirata

Industrial symbiosis

Collective approach to resource management with cooperations among local and regional actors involving:

- value addition to under-utilised material and energy resources;
- development of more efficient, shared utility and service solutions;
- knowledge exchange and innovation.

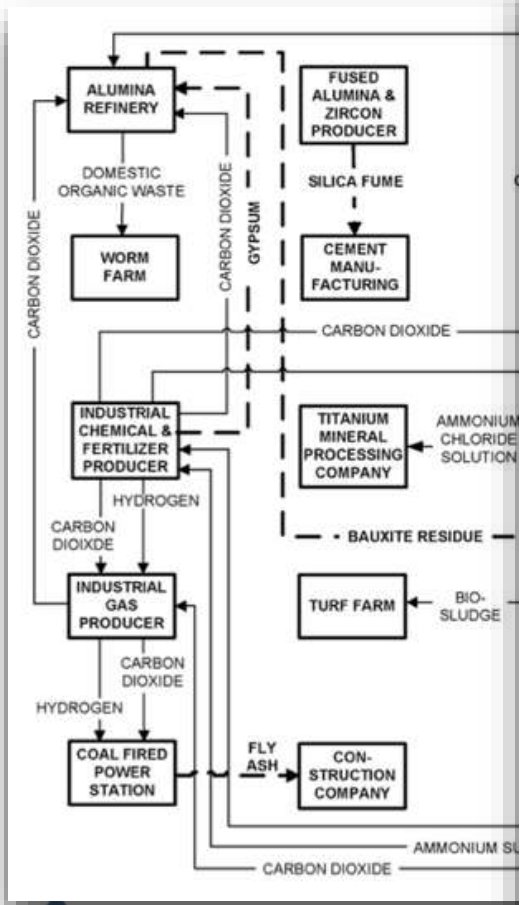
Resulting in:

Business Competitiveness	Environmental Performance	Regional/global Sustainability

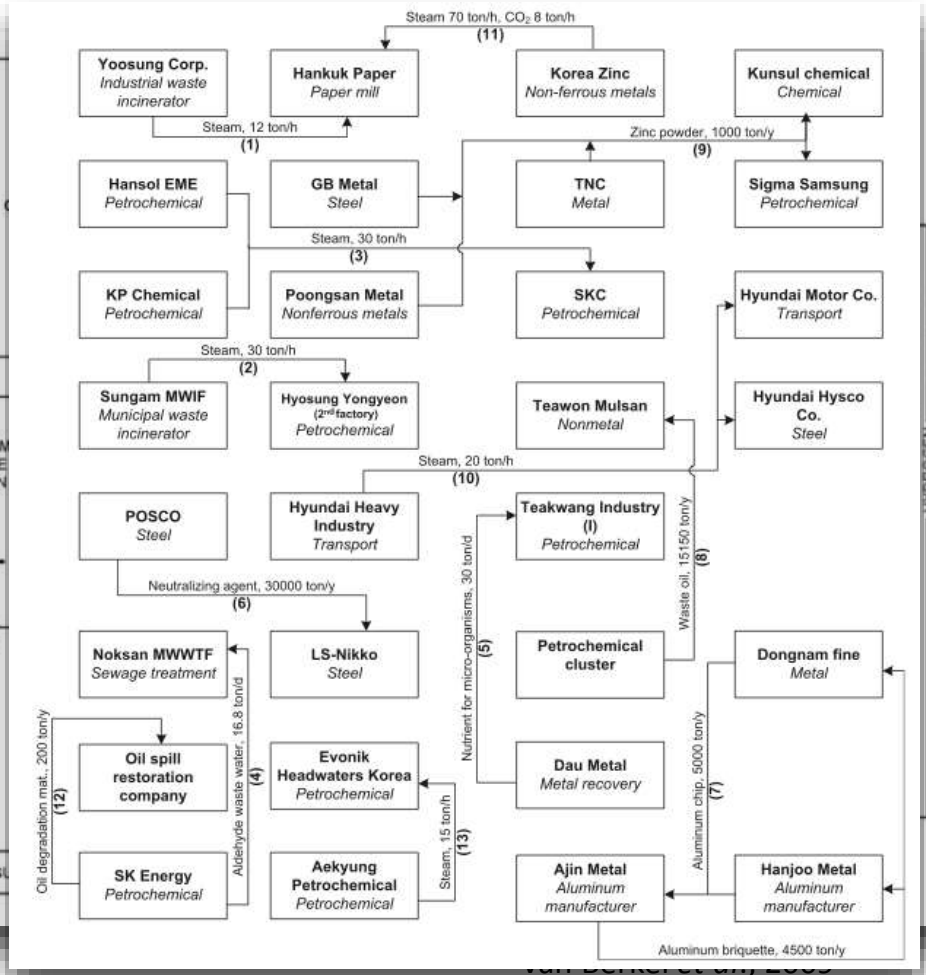
Different forms and features of IS

Integration among conventional industries

Kwinna, Australia

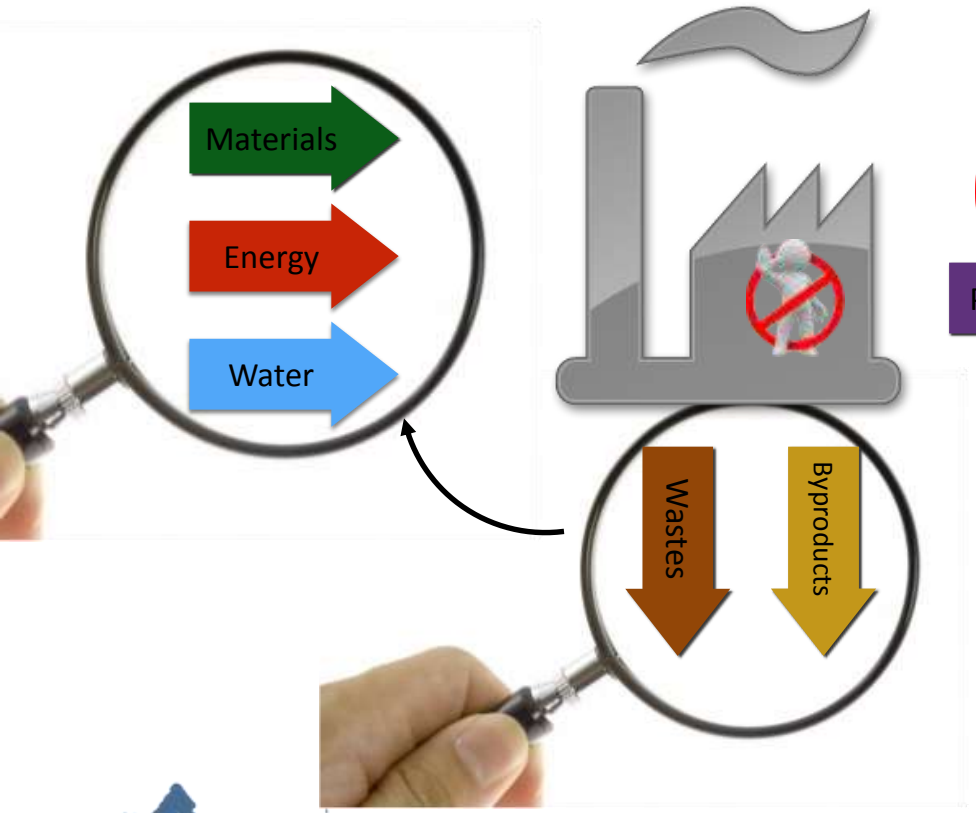


Ulsan, South Korea



Kumar *et al.*, 20012

Key features



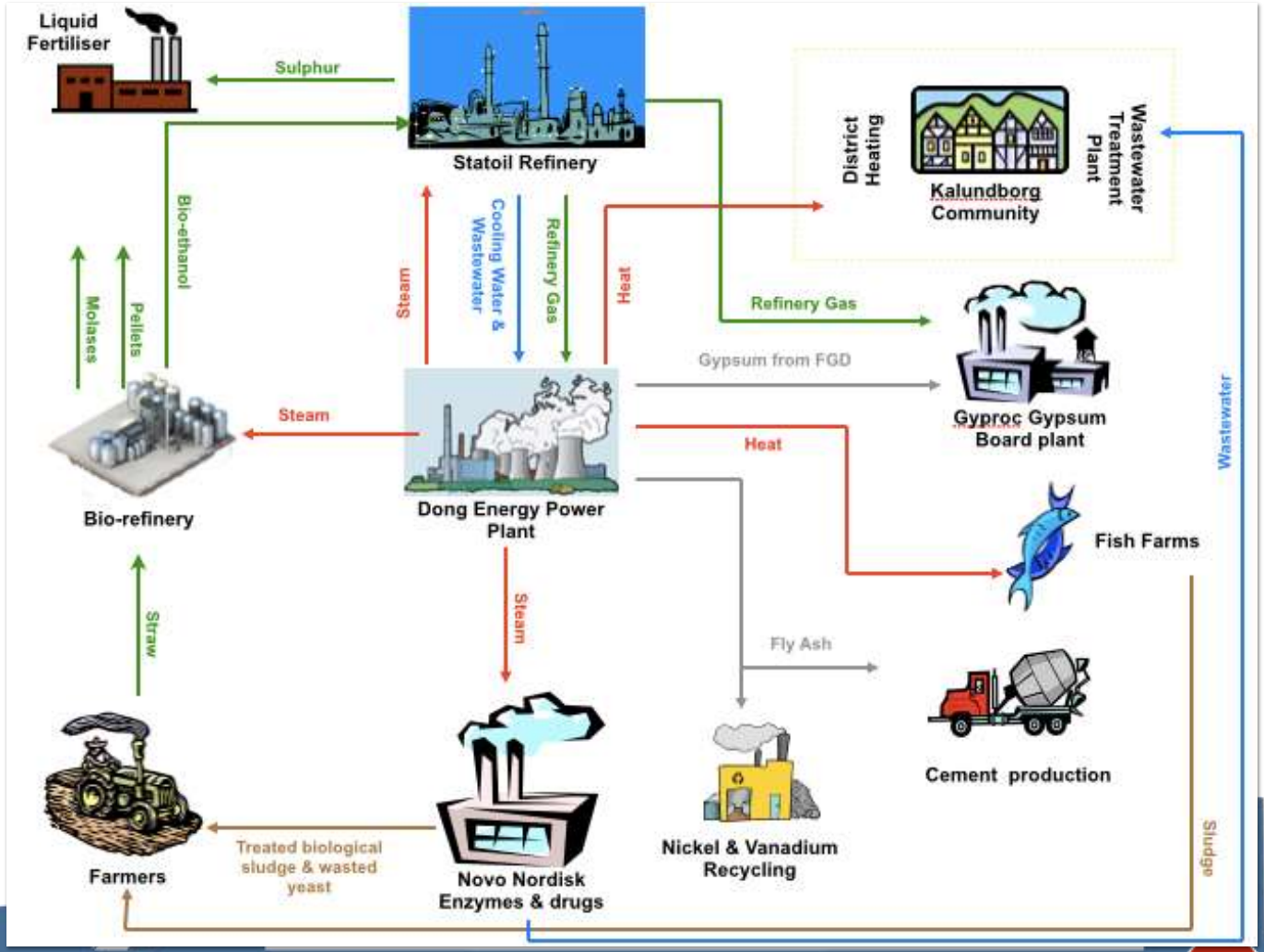
Business to business

Conventional production becomes more efficient

Limited systemic change

Diversified integration

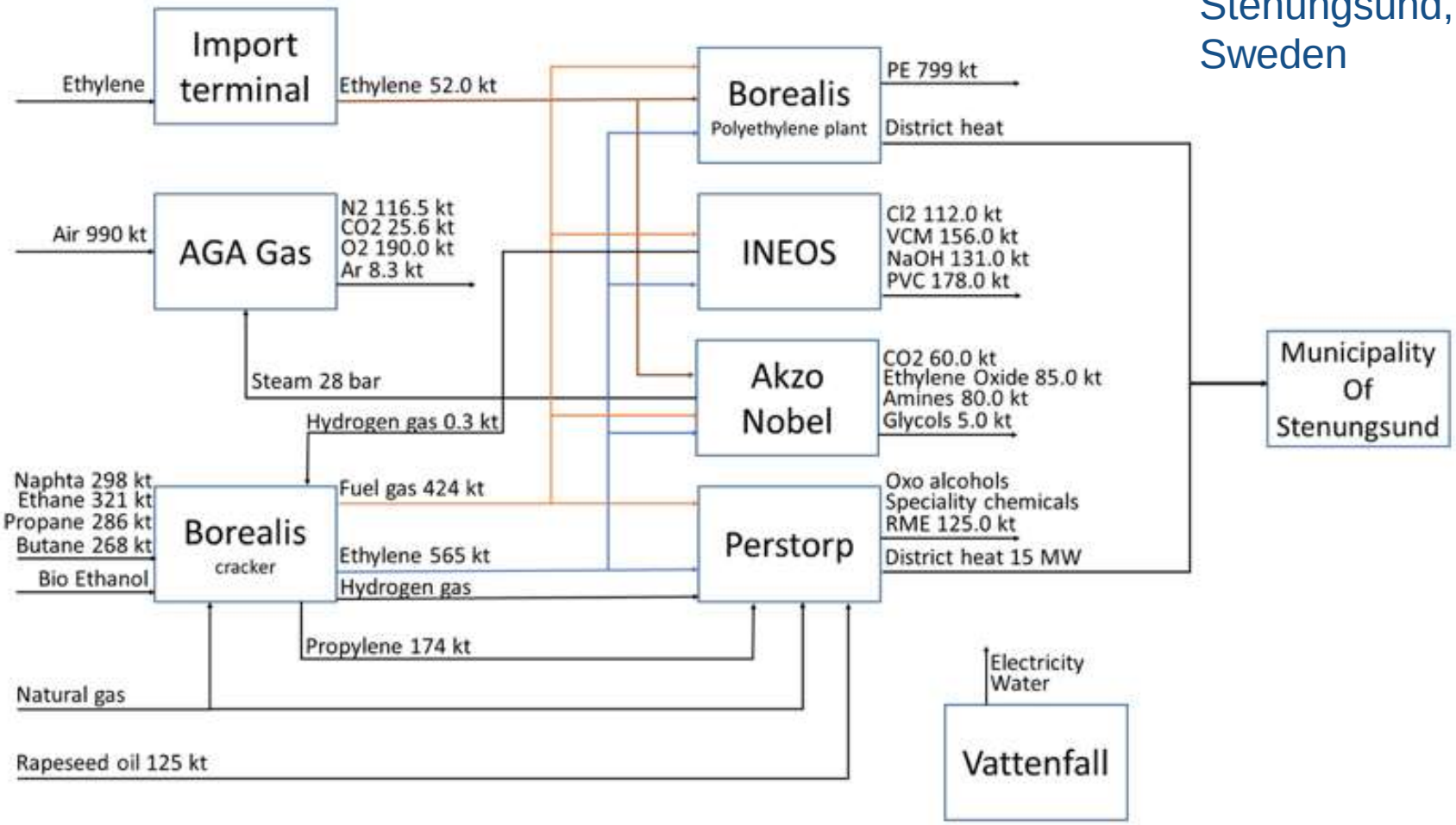
Increased integration with urban and rural systems



Kalundborg, Denmark

Diversified integration

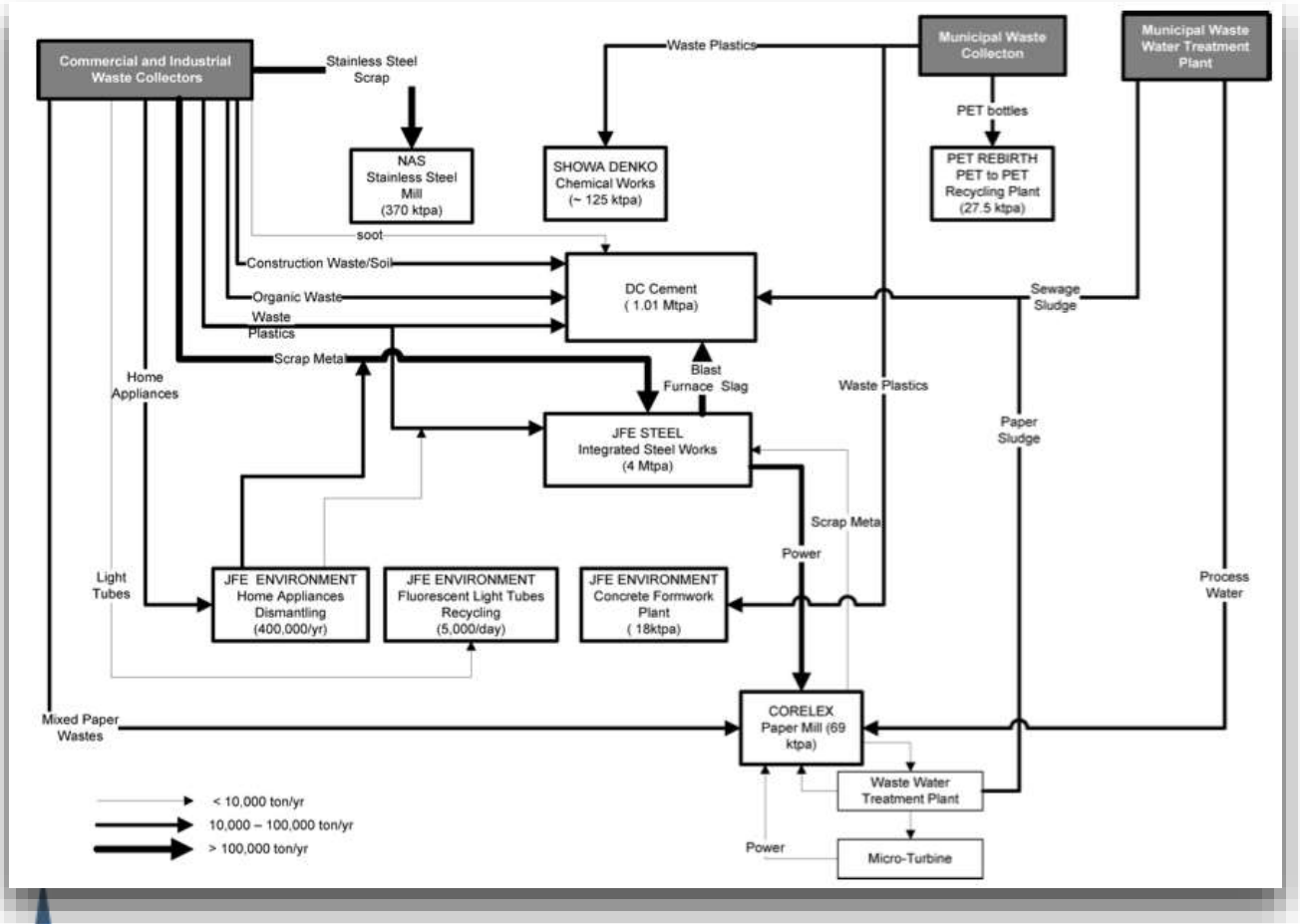
Stenungsund, Sweden



Hackl, 2010.

Diversified integration

Kawasaki, Japan

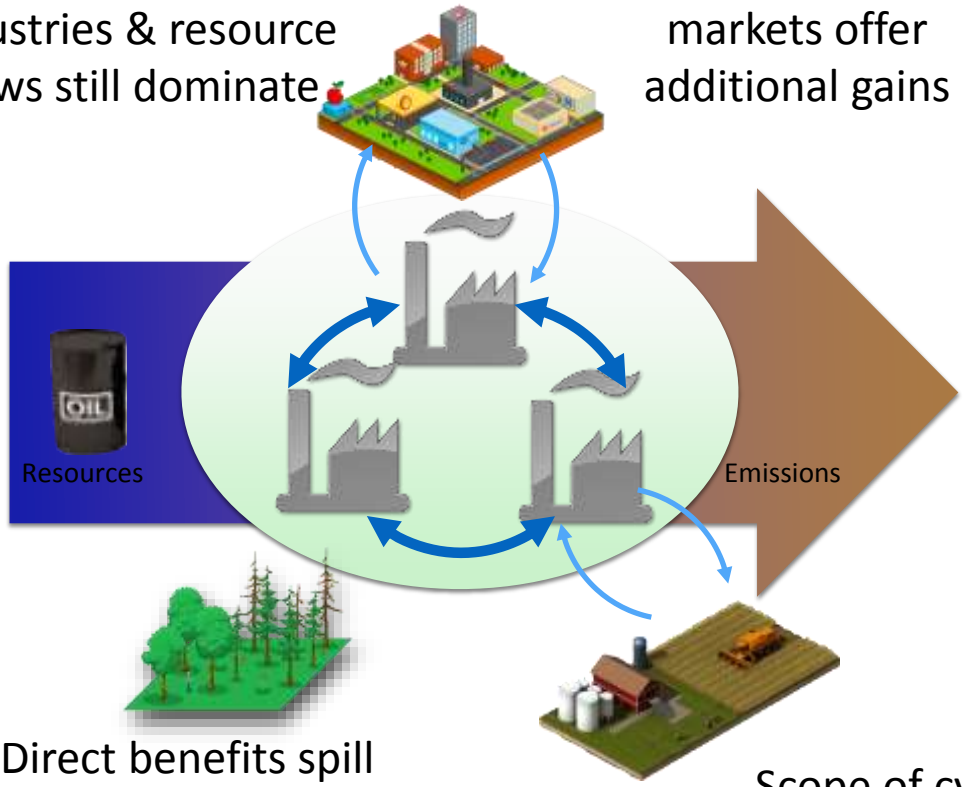


Behera et al., 2012

Key features

Conventional industries & resource flows still dominate

New input- & output-markets offer additional gains

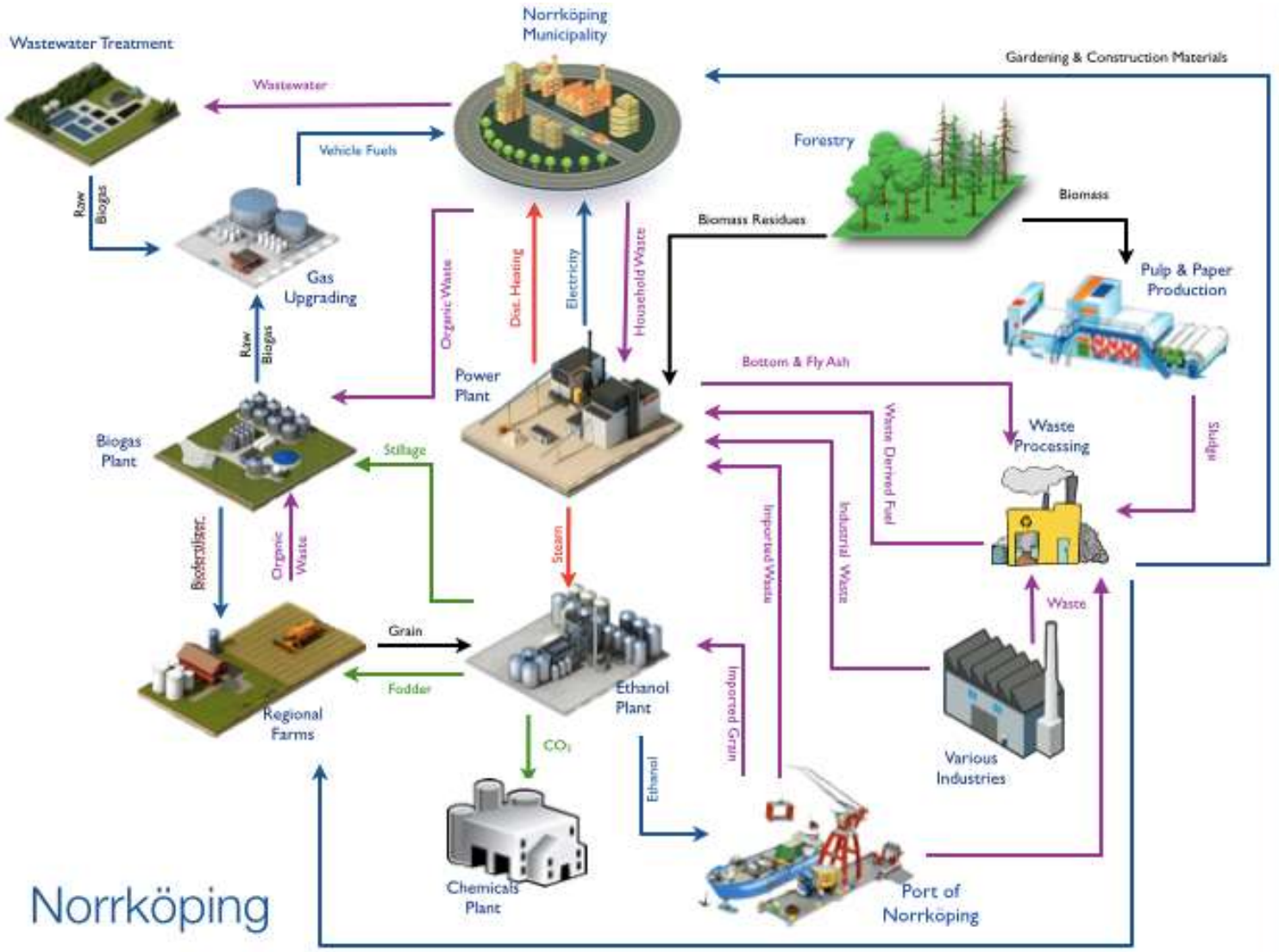


New, including public-private, partnerships are established

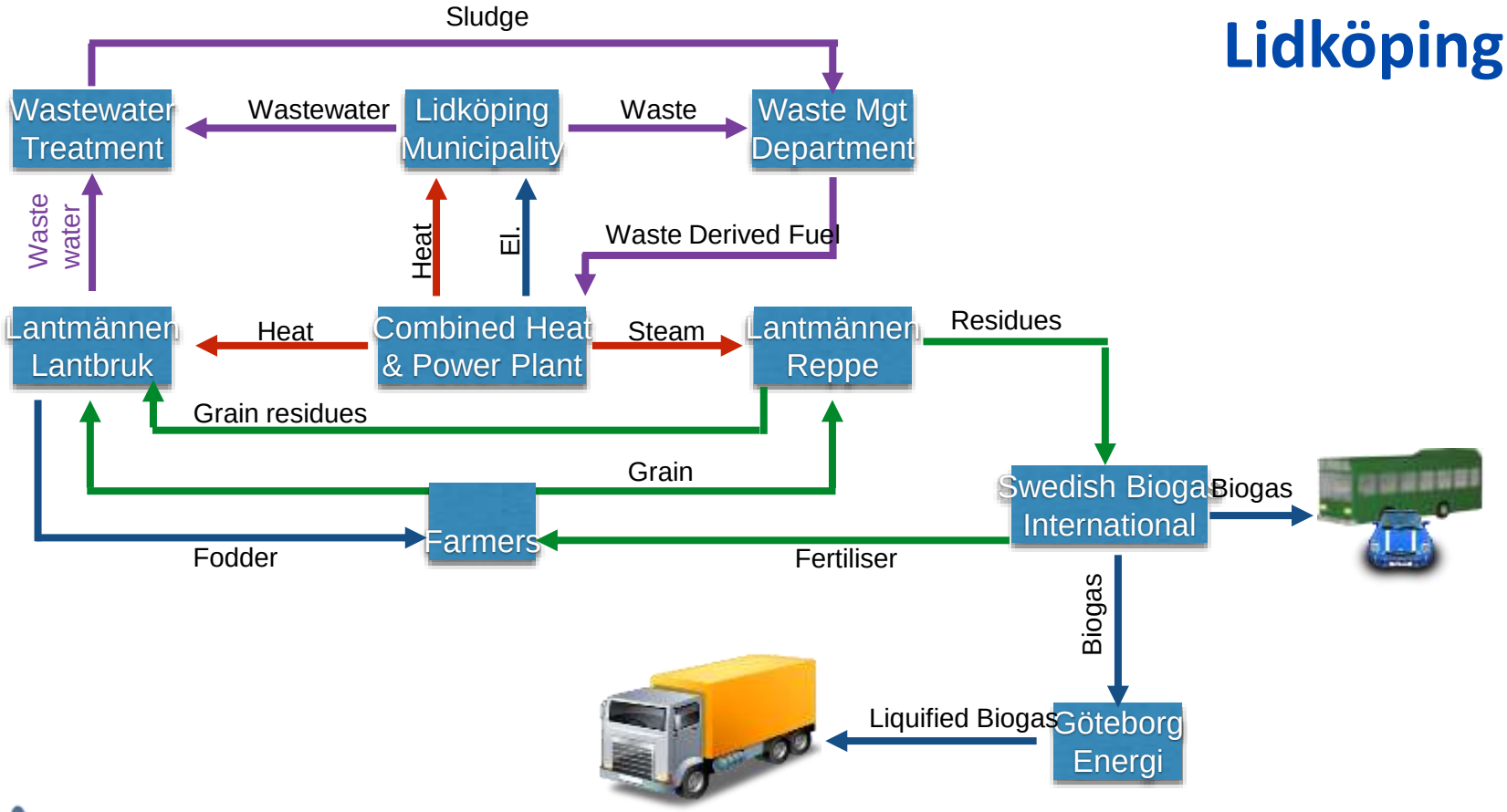
Direct benefits spill over to other societal actors

Scope of cyclical flows expands

New products, businesses systems



New products, businesses systems

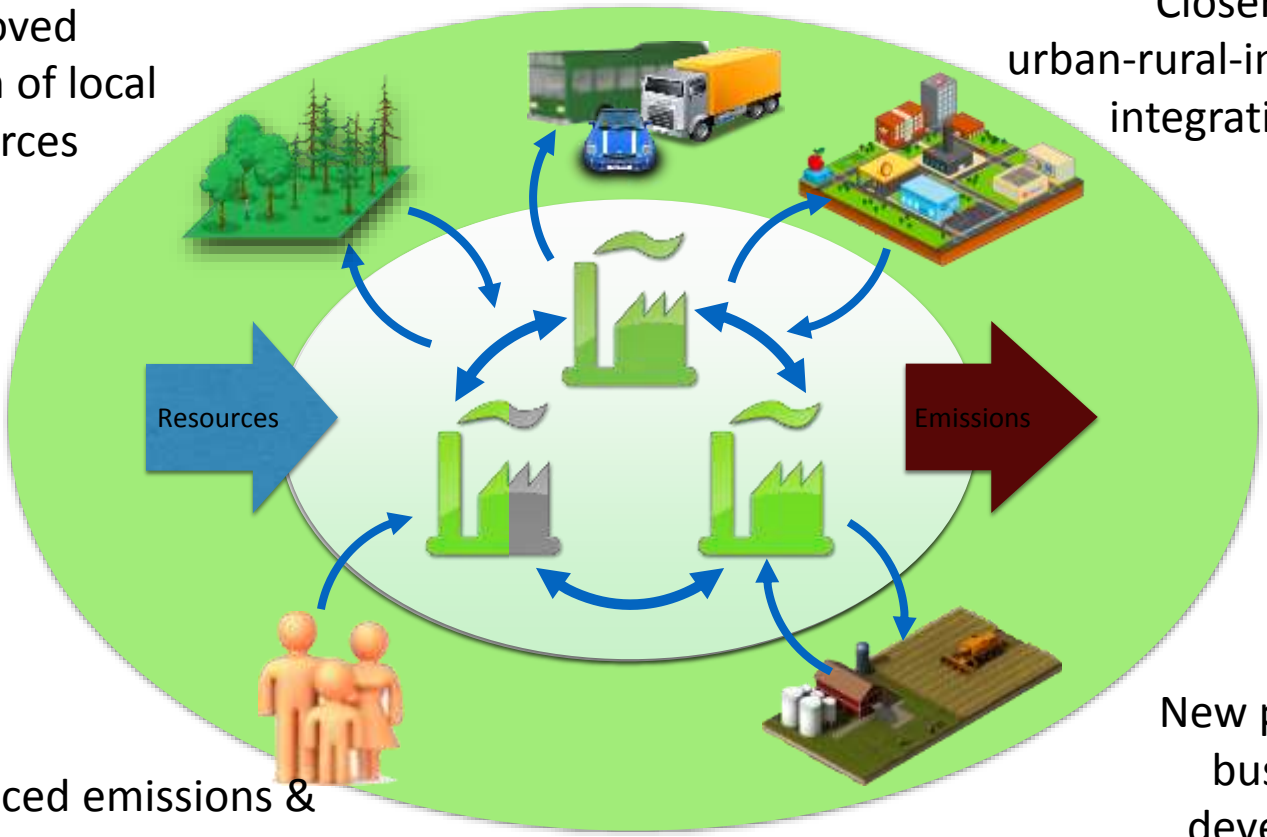


Features

System level transformations

Improved utilisation of local resources

Closer urban-rural-industrial integration



Increased reliance on bio-based resources

Innovation

Reduced emissions & waste

New products & businesses development

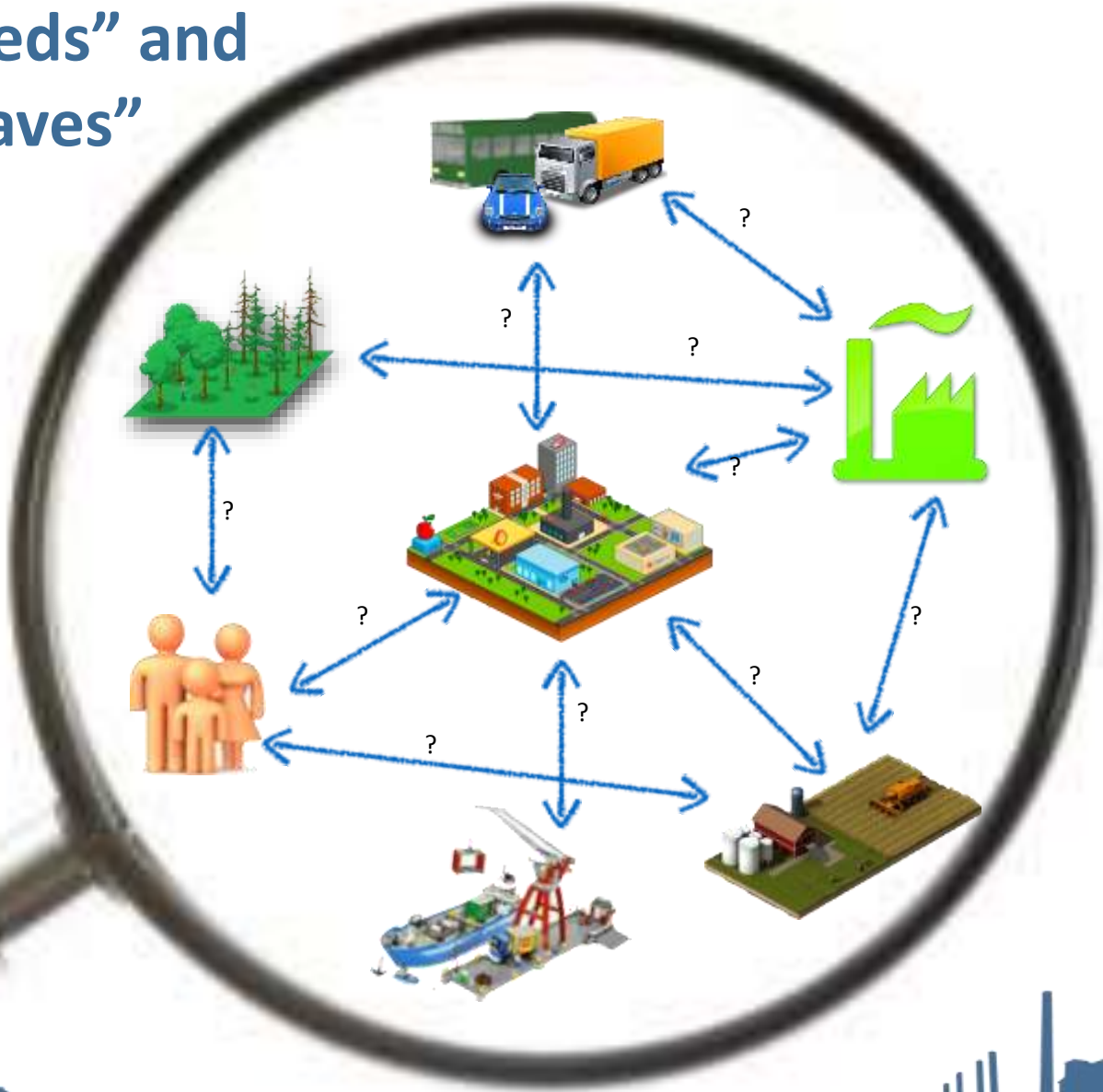
Wealth creation for a wider group of stakeholders

Facilitating progress

Create a shared vision

Systemically identify options

Broader assessment of “needs” and “haves”



Facilitating progress

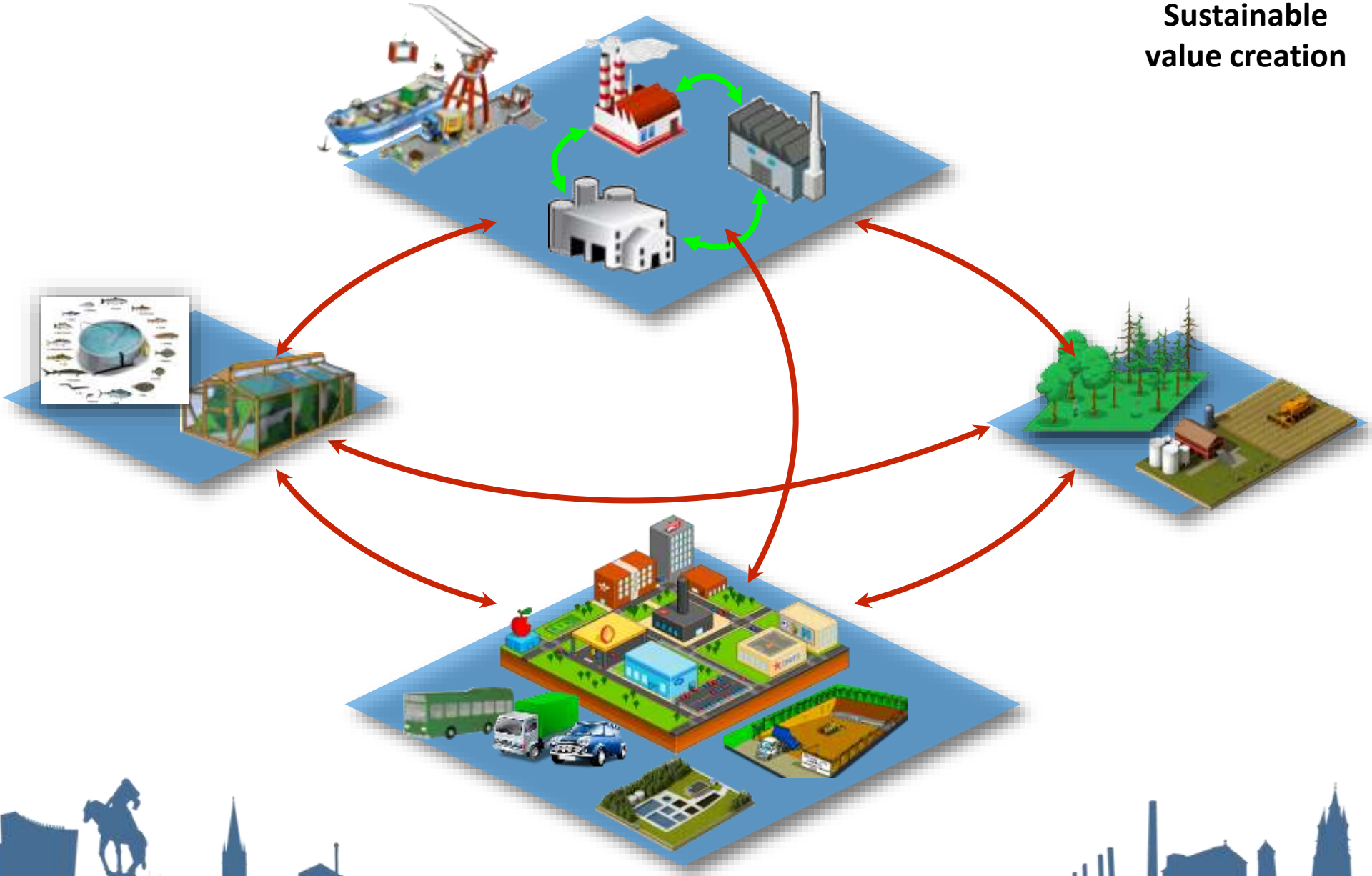
Create a shared vision

Systemically identify options

Facilitate communication & interaction

Engage additional actors to overcome barriers

Sustainable value creation



murat.mirata@liu.se

Session 2

Role and opportunities for system operators with industrial symbiosis – experiences from E.ON

Mattias Örtenvik

Head of sustainable cities • E.ON

Role and opportunities for system operators with industrial symbiosis – experiences from E.ON

Mattias Örtenvik, Head of Sustainable city
March 18th, 2015
E.ON Sverige

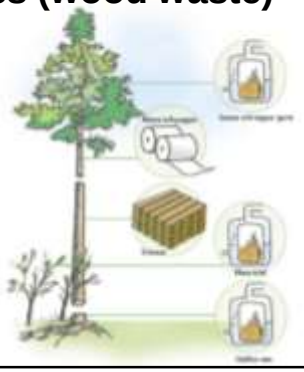
District heating grids as integrator of resource flows that otherwise would have gone to waste

E.ON fuel mix for district heating in Malmö

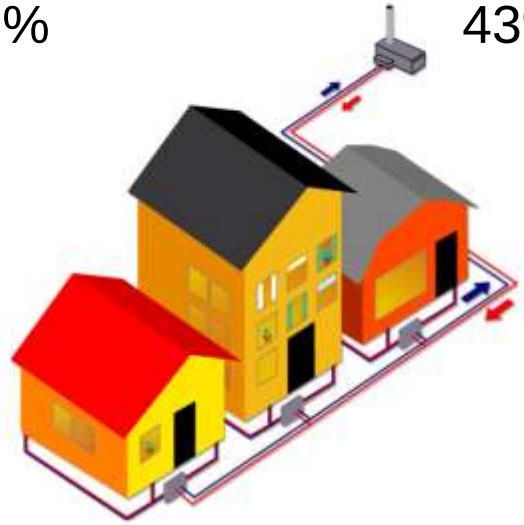
Industrial waste heat

3%

Biomass (wood waste)



43%



Other fuels (incl. heat pumps)

25%

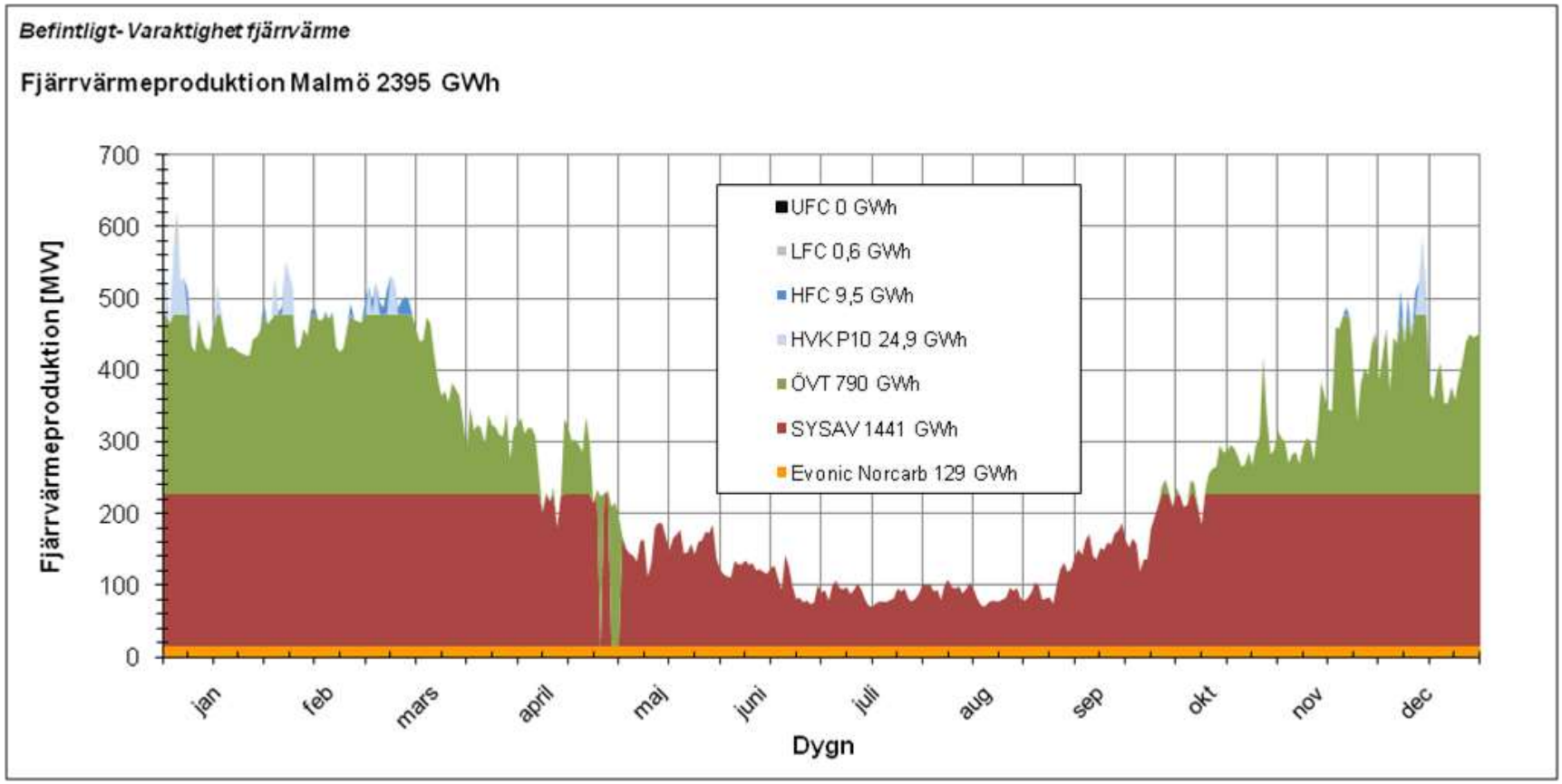
Waste (households and industry)

29%

→ Interest of finding and enhancing local partnerships for heating and cooling supply utilizing district heating and district cooling grids

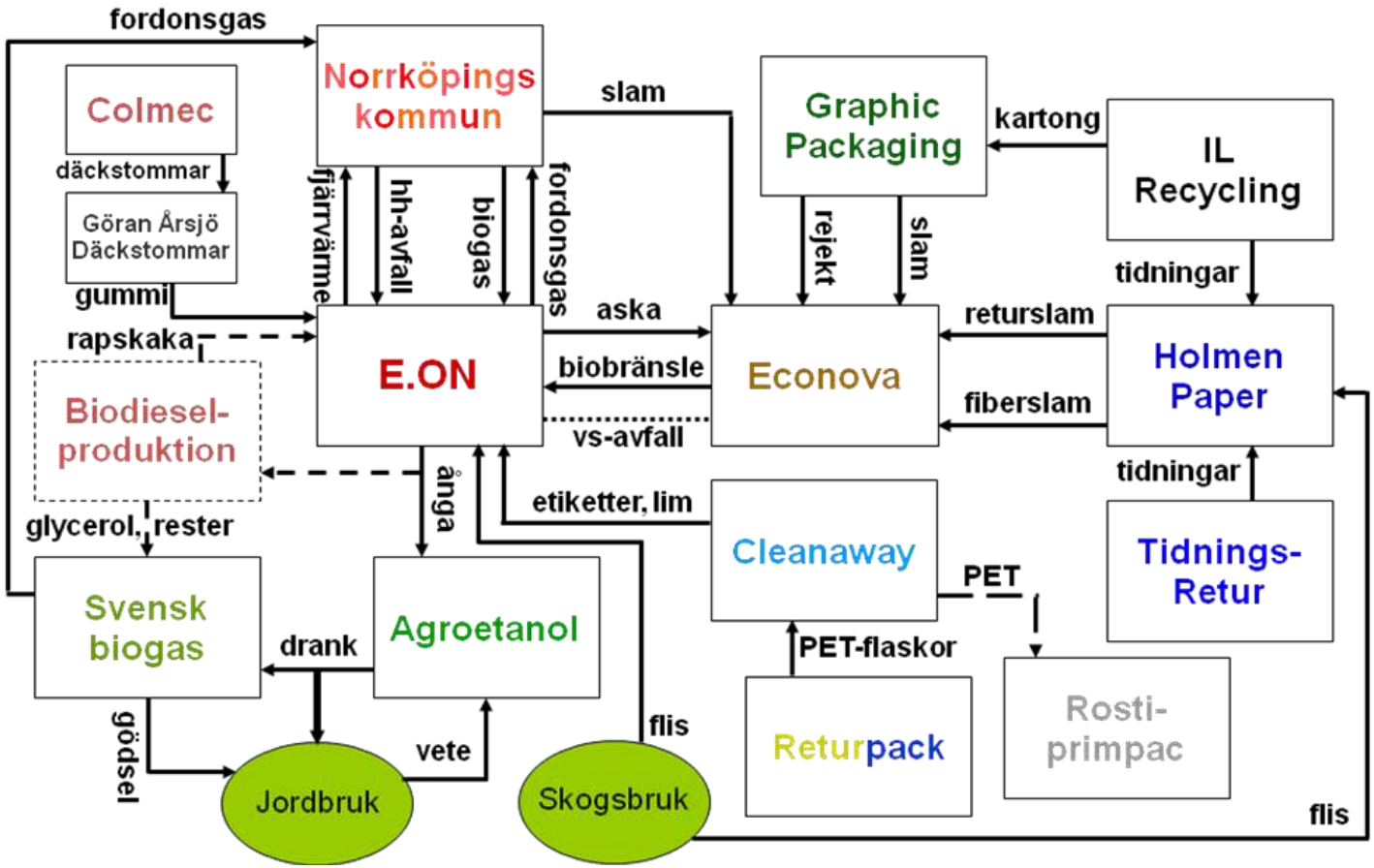
Clear potential to use already existing production capacity for competitive supply solutions towards industry segment

District heating production – annual capacity utilization



→ Interest of finding complementing utilization of existing and future plants for production of heating and cooling

Industrial symbiosis case in Norrköping demonstrates the potential of finding value creating solutions



E.ON agenda to develop system operator capabilities and further explore industrial symbiosis potential

4 Smart grid connection of industries

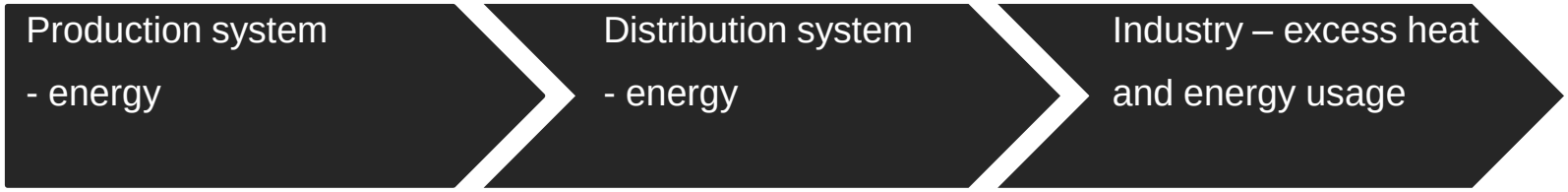
- Study/test of smart grid solution for industries with focus on the entire energy profile

5 New areas of application for DH

- Increase dynamics in usage of DH grid, e.g. test of generating steam with DH

6 Collaboration with partners and stakeholders

- Municipalities, customers and universities



3 Production system development DH

- Transformation of production mix, optimization between energy carriers, energy storage and smart grid optimization

2 Distribution system development DH

- Increased temperature dynamics in the grid and improved pre-requisites to fully utilize industrial excess heat potential

1 Increase utilization of industrial excess heat

- In-depth studies of energy flows for relevant industries

Brunnshög in Lund – Future energy solutions requires innovative and holistic approach and collaboration

Challenges

LUND NORTHEAST
BRUNNSHÖG

Approach

Creating value for customers

www.brunnshogenergi.se

e·on

MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Session 2

Warmth from the World’s Brightest

Thomas Parker

Head of energy division • European Spallation Source

EUROPEAN
SPALLATION
SOURCE

Warmth from the World's Brightest

Thomas Parker

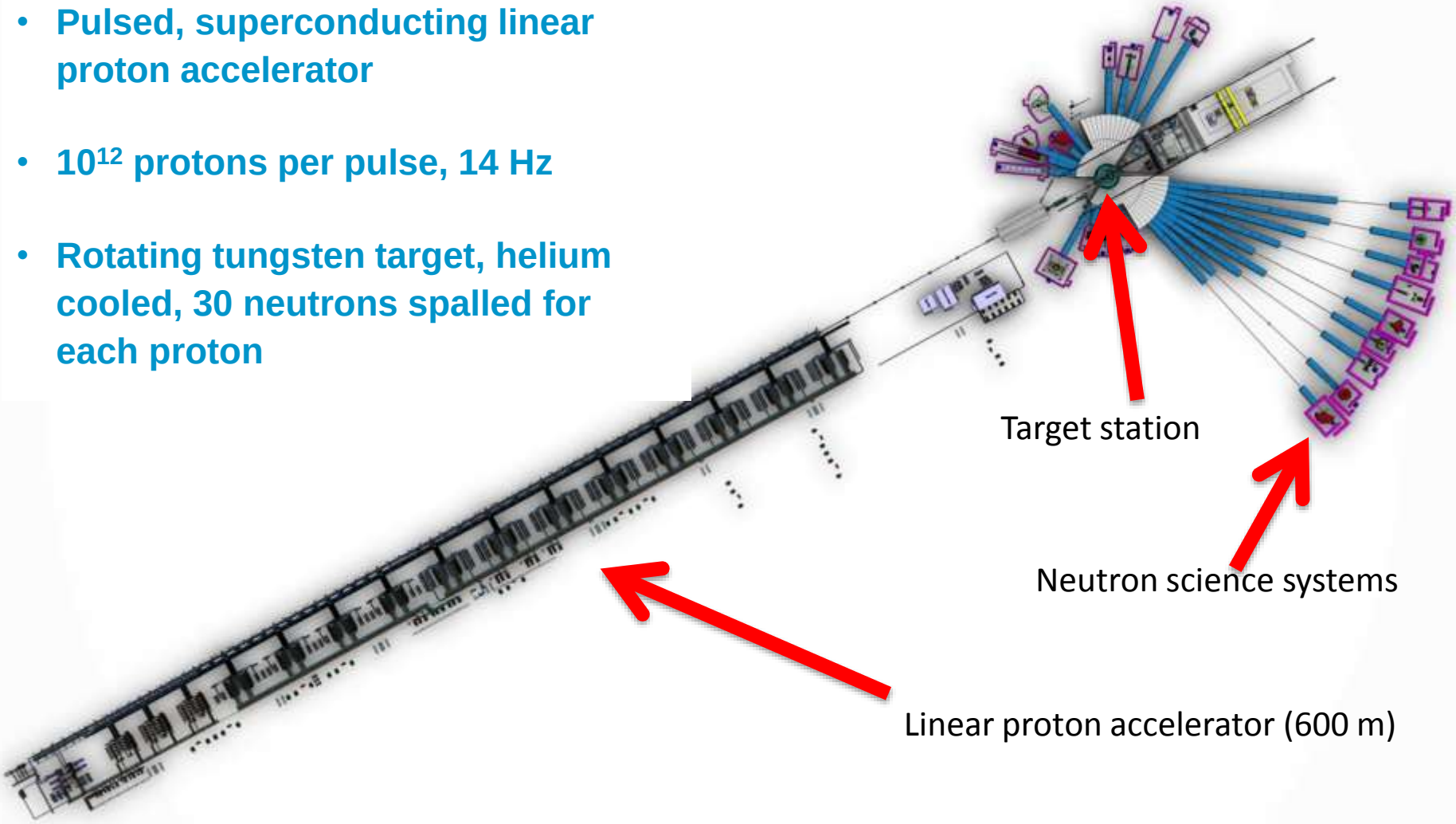
Head of Energy Division

European Spallation Source

The World's brightest neutron source will use around a quarter TWh of electricity and produce as much heat.

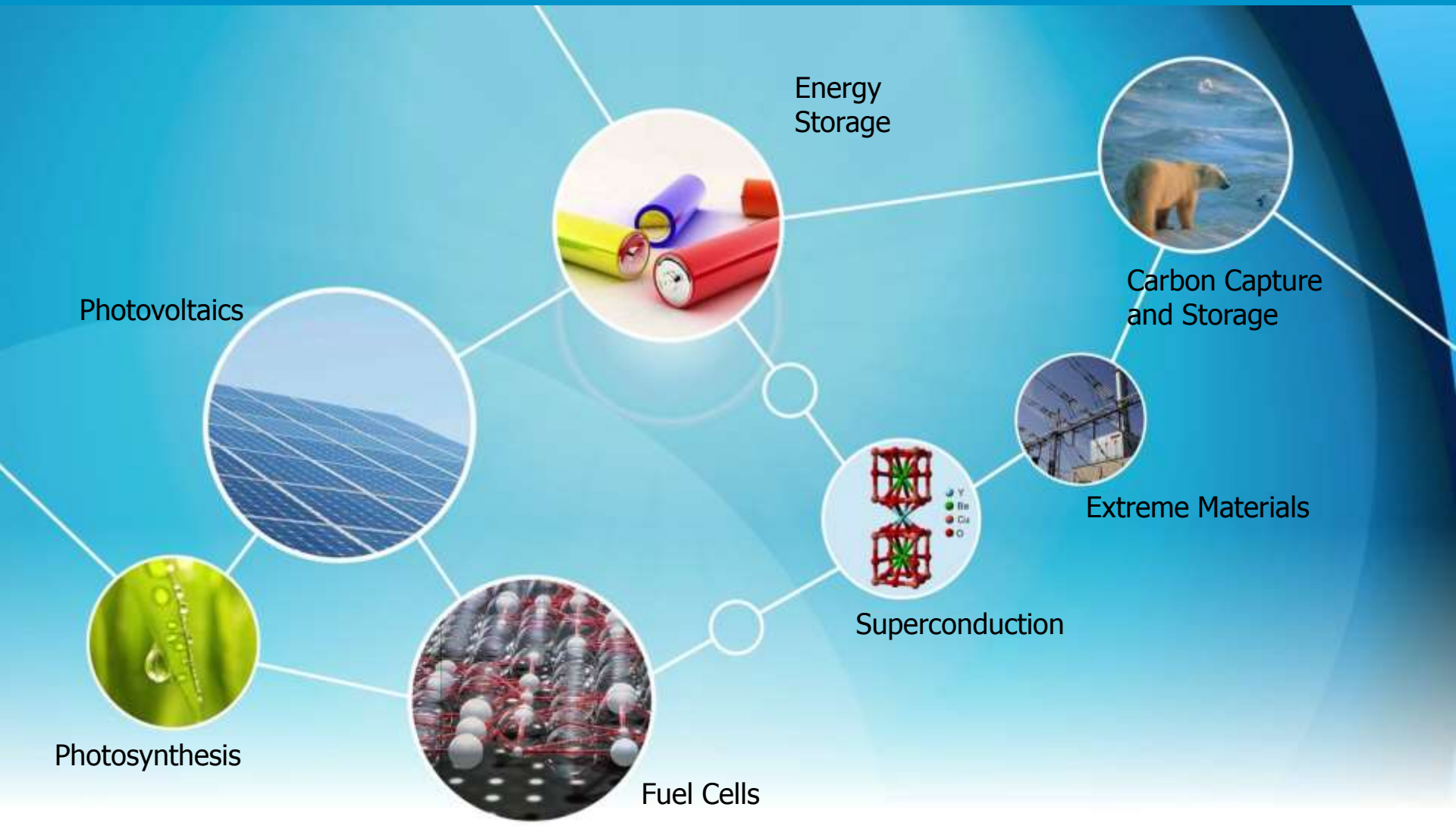
EUROPEAN SPALLATION SOURCE

- **Pulsed, superconducting linear proton accelerator**
- **10^{12} protons per pulse, 14 Hz**
- **Rotating tungsten target, helium cooled, 30 neutrons spalled for each proton**



Neutrons can be used for fantastic science, for example within energy

EUROPEAN SPALLATION SOURCE

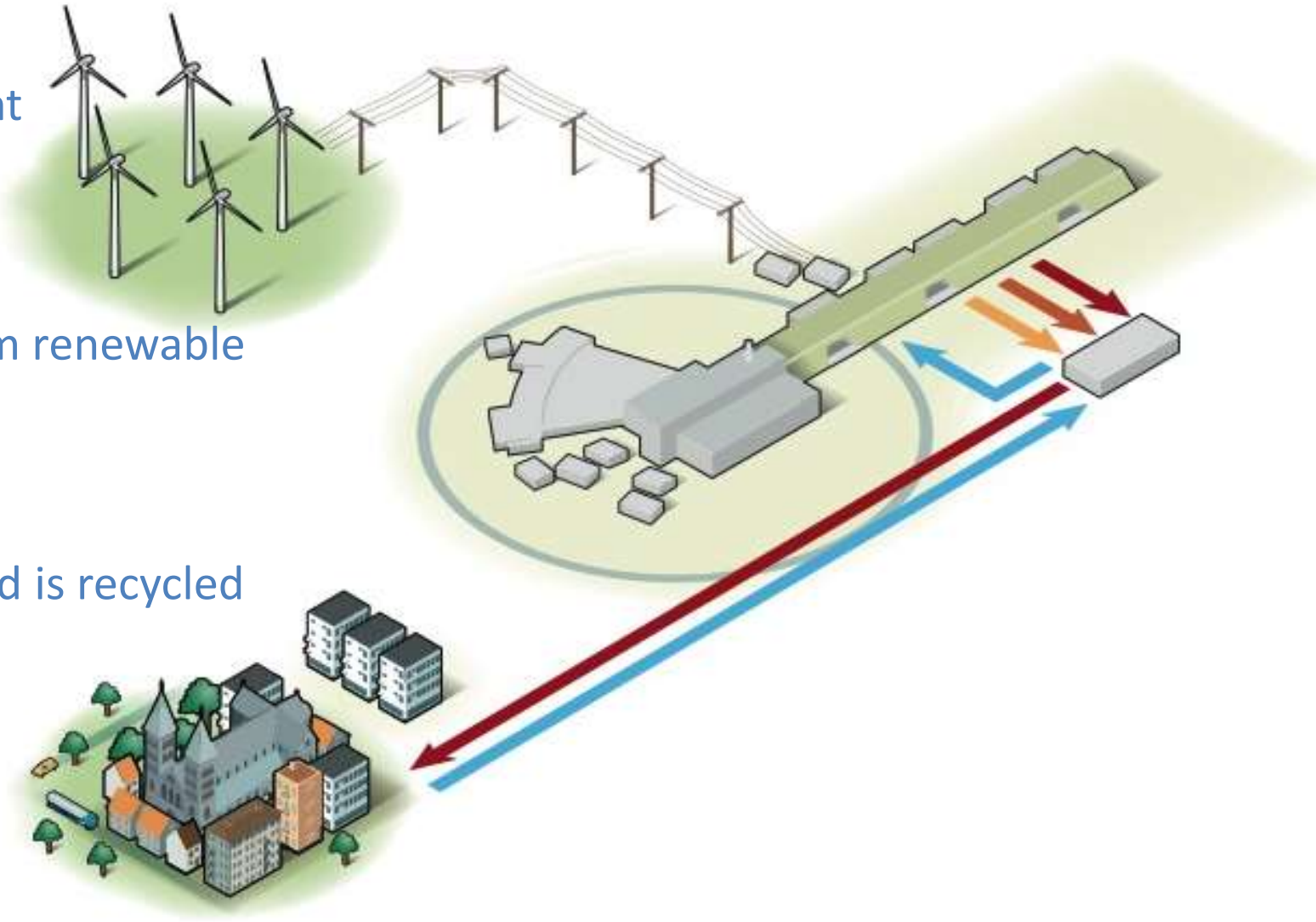


The first sustainable research infrastructure

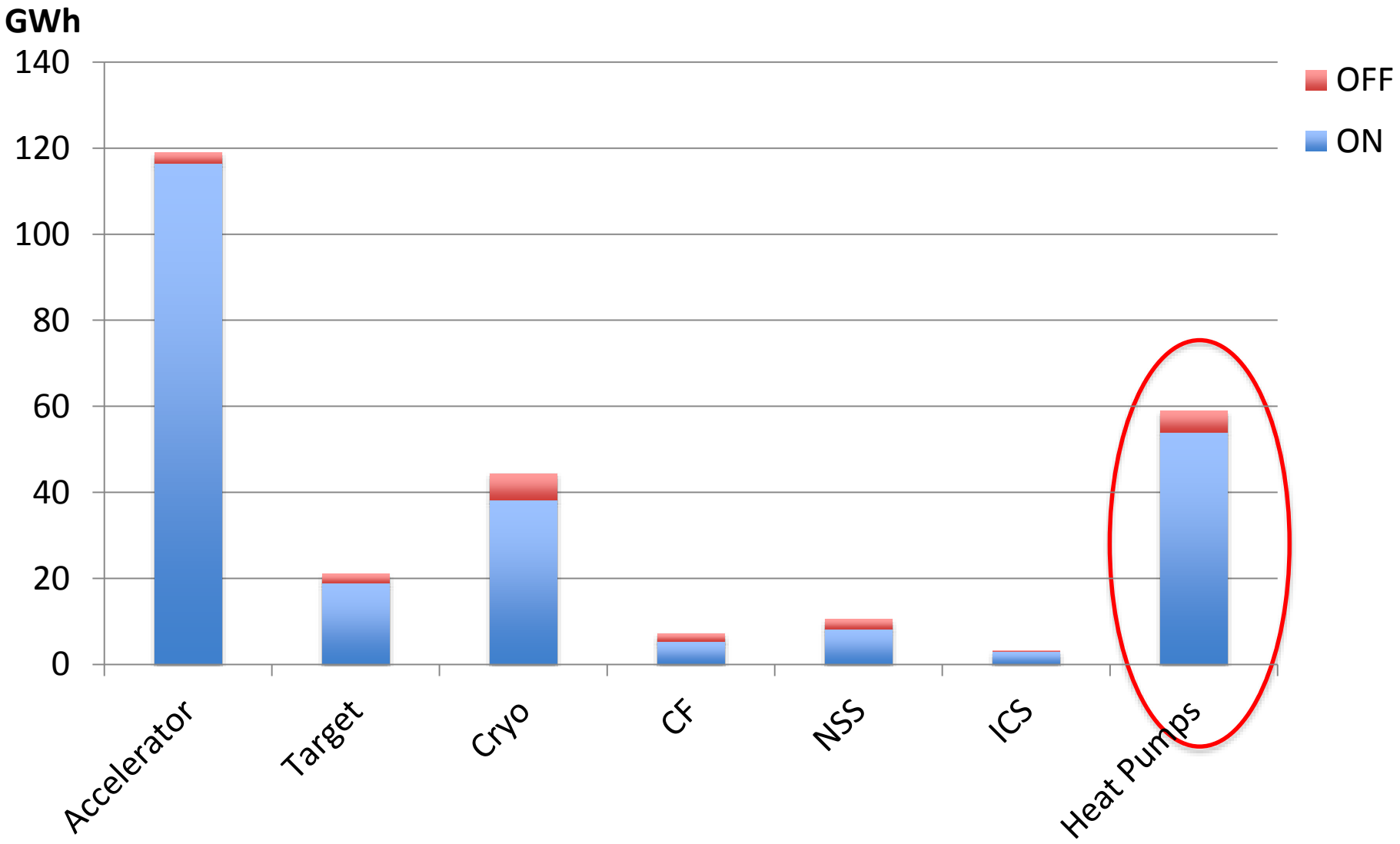
Responsible
Energy Efficient

Renewable
All energy from renewable resources

Recyclable
Heat generated is recycled



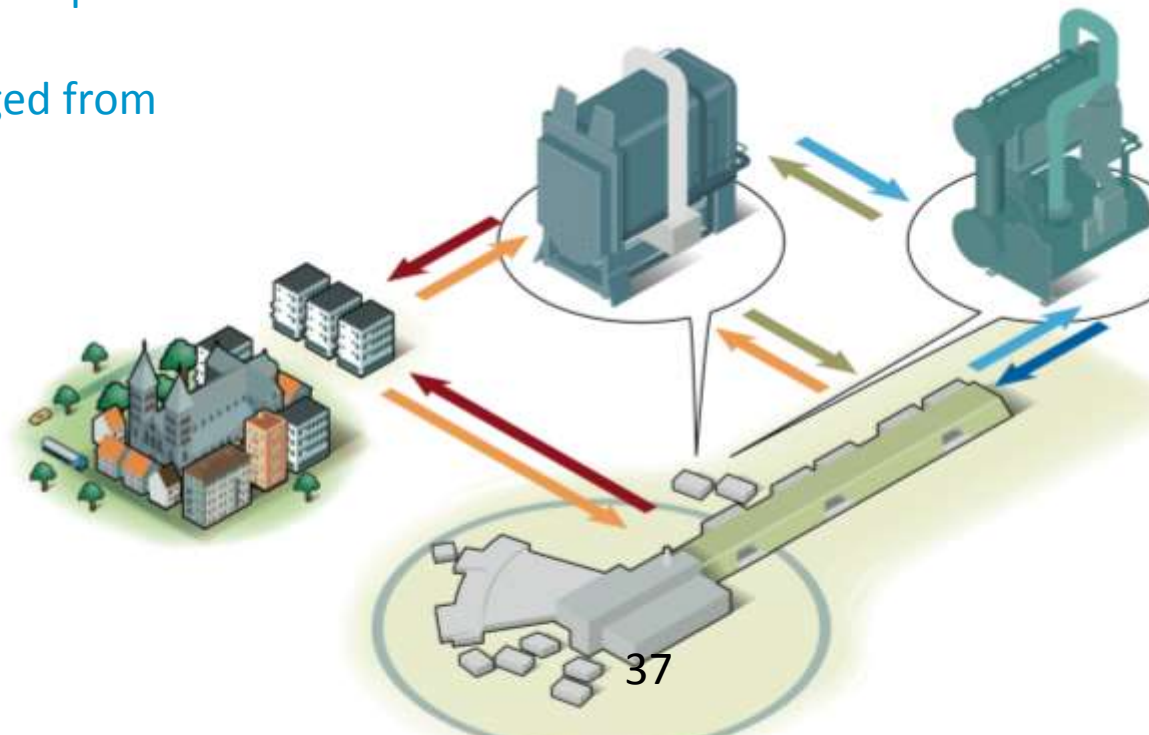
Distribution estimate of electricity consumption 2013 – the real challenge are the heat pumps



Recycling to district heating with heat pumps

- In the baseline solution, low and medium cooling loops are up- graded through heat pumps into suitable temperature so that it can be supplied to the local district heating grid.
- The return feed is supplied at suitable temperatures and low temperature loop is achieved with chillers.
- In total around 250 GWh is exchanged from ESS to the local district heating net.

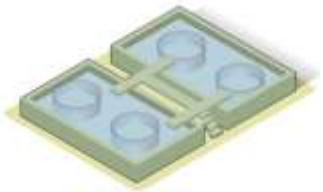
- The average price of waste heat to district heating is 2¢.
- The average price of district heating to consumer is 7¢.

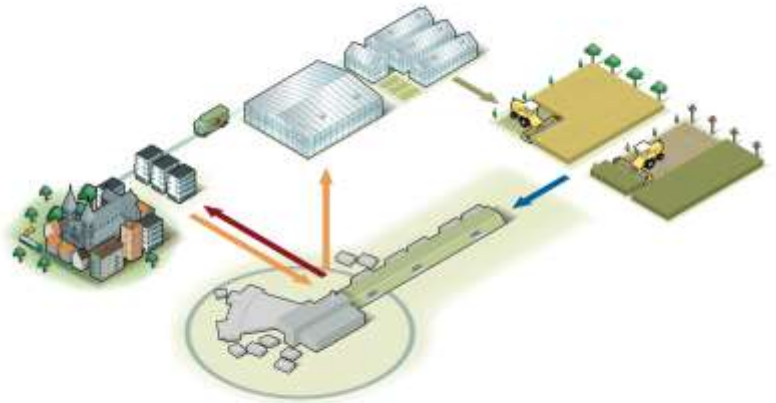


Recycling at low temperature to high-intensive food production

The food-production recycling solution was developed in collaboration with industry and science, and consists of two separate biological heat sinks:

- Green house production with heat at 55 C and open farmland production, where the surplus heat extends the growing season allowing higher yearly yield
- The solution is estimated to provide heat for 25 HA of land
- Supply temp is 55 C and return temp is <15 C





Session 2

Experiences from large-scale industrial symbiosis in Helsingborg

Emma Gunnarsson

Energy strategist • Kemira/industry park of sweden

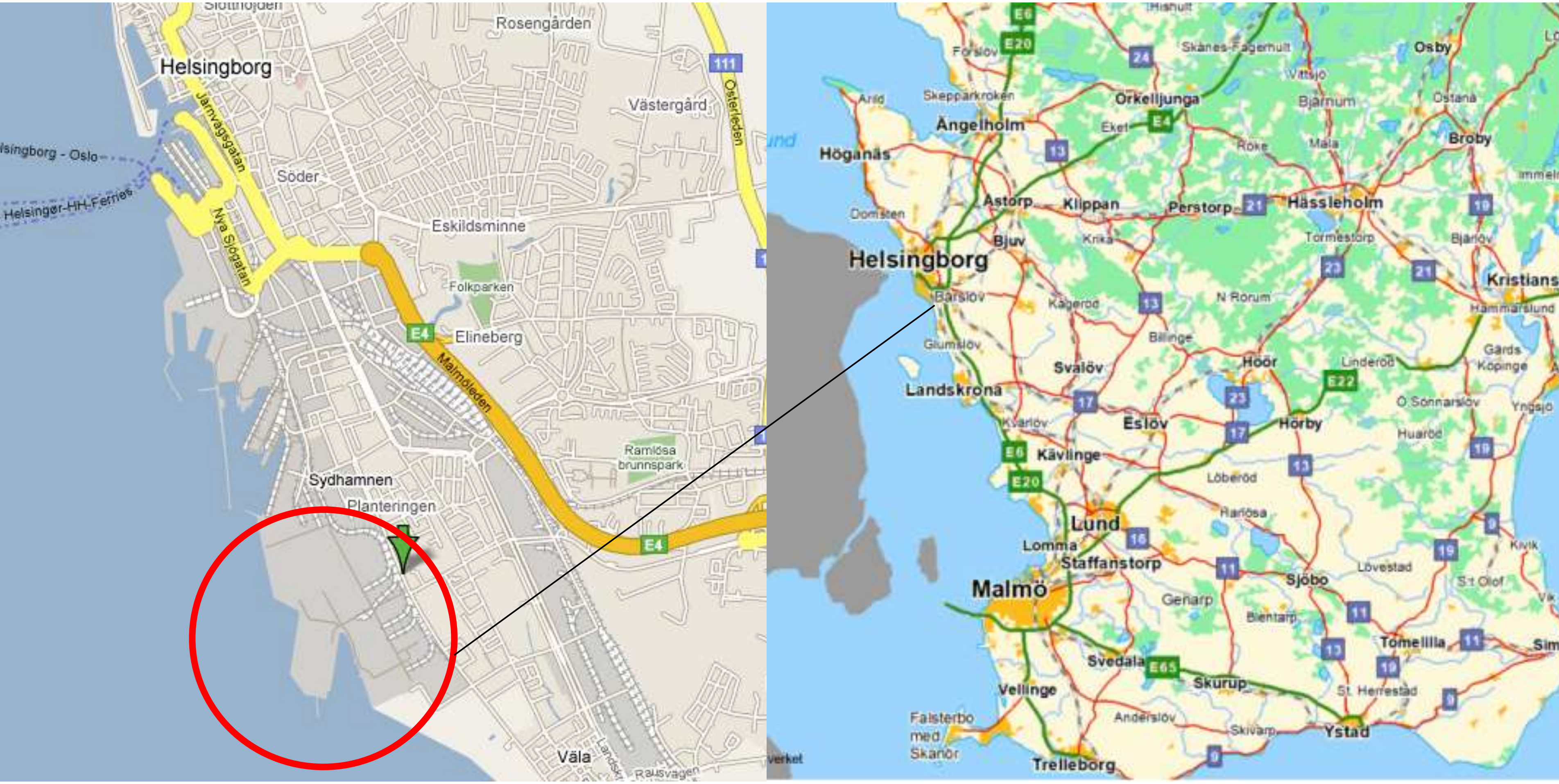
Experiences from large-scale industrial symbiosis in Helsingborg

Urban Magma
2015-03-18

Emma Gunnarsson, Energy strategist
Kemira Kemi AB - Industry Park of Sweden

Today

- Kemira and IPOS
- Real-life examples of industrial symbiosis
- Success factors and challenges
- Industrial symbiosis from a regional perspective


Helsingborg
Rosengården
Västergård
Österleden
Järnvägsgatan
Söder
Nya Sjögatan
Eskildsminne
Folkparken
Elineberg
Malmöleden
Ramlösa brunnspark
Sydhamnen
Planteringen
Väla
Helsingør-HH-Ferries
E4
111
Höganäs
Ängelholm
Orkelljunga
Osby
Broby
Klippan
Perstorp
Hässleholm
Åstorp
Bjuv
Kristianstad
Landskrona
Svalöv
Höör
Eslöv
Hörby
Kävlinge
Lund
Lomma
Staffanstorp
Malmö
Sjöbo
Svedala
Skurup
Vellinge
Tomelilla
Ystad
Trelleborg
Falsterbo med Skanör
E6
E20
E22
E65

Kemira

Global	~2,1 BEUR
	~4300 FTE
Helsingborg	~200 MEUR
	~300 FTE

- Operations in Helsingborg since 1875
- Owned by Kemira since 1989
- Head office in Helsinki

ISO 50001
ENERGY MANAGEMENT

Industry Park of Sweden (IPOS)

INDUSTRY PARK OF SWEDEN

kemira

EKOBALANS

TETRA

SCANDINAVIAN SILVER EEL

alufluor

HIGHER EFFICIENCY, LOWER IMPACT SINCE 1971

suez environnement

SITA

COOR SERVICE MANAGEMENT

YARA

SWECEM

AIR LIQUIDE

Creative Oxygen

INTER LINK LOGISTIK

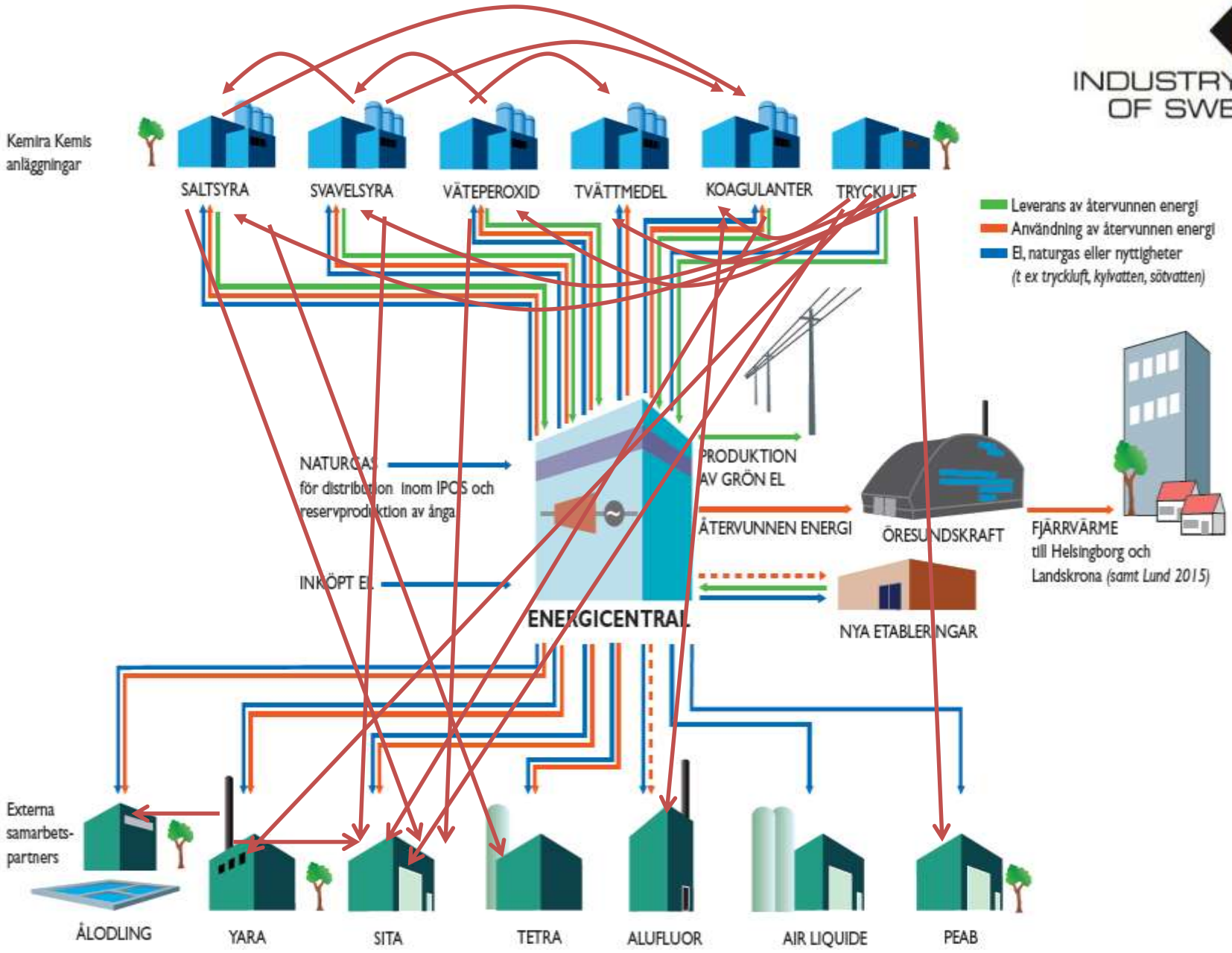
RESTAURANG KOPPAR GRYTAN

Industrial symbiosis to us

”By innovative resource co-operations create added value to reduce costs and environmental impact”

1. Profitability – Win-Win
2. Reduced impact on environment and climate
3. Innovative

INDUSTRY PARK OF SWEDEN



SITA – A great example of industrial symbiosis

- From oil to climate neutral energy
- Plug-in on existing infrastructure
- Business expansion and new clients
- Reduced transports (costs and emissions)

Co-operation with Öresundskraft – Much more than district heating

- 30% of DH in Helsingborg
  - Heating for 20 000 villas/year
- 1 600 000 tons CO2 saved since 1973
  - 400 cars (130 g/km) tar to the moon. Every year!
- Great for the environment, industrial competitiveness and district heating tariffs
- Innovative!

kemira

SAMVÄRME HELSINGBORG

ÖRESUNDS KRAFT

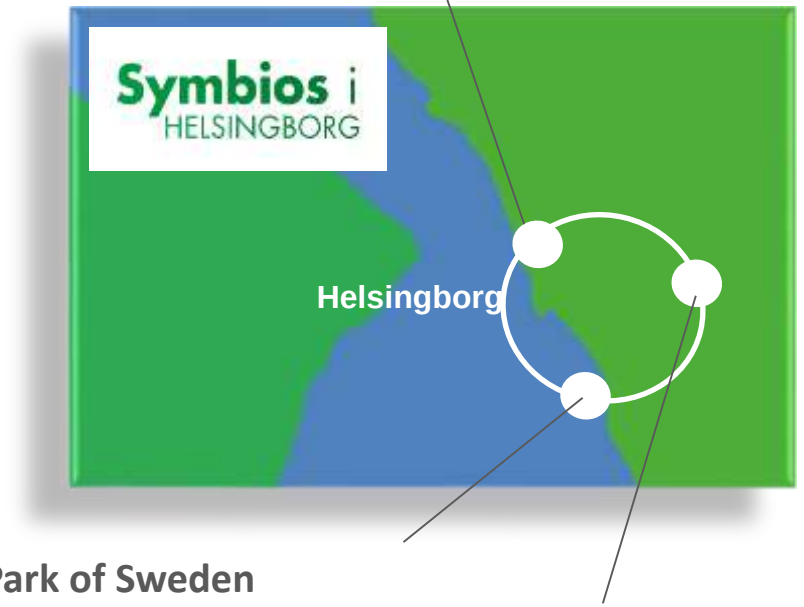
Kemira Kemi and IPOS
Winner of E-Prize 2014

Success factors and challenges

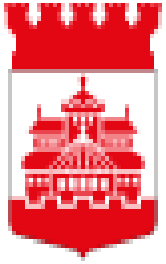
- Technical criteria are not enough
- Win-win thinking
- Transparency and understanding of each others businesses
- Communication
- Relationships on all levels
- The industrial park organisation
- Optimisation of dynamic systems
- Depencies

From a regional perspective…

- Reduced impact on environment and climate
- New business and job opportunities
- Competitive edge
- Regional development



Co-funded by the Intelligent Energy Europe Programme of the European Union



Thank you!

Questions?
emma.gunnarsson@industrypark.se

MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Session 2
Symbiosis in Sotenäs

Andreas Sülau

Usiness developer • Municipality of Sotenäs

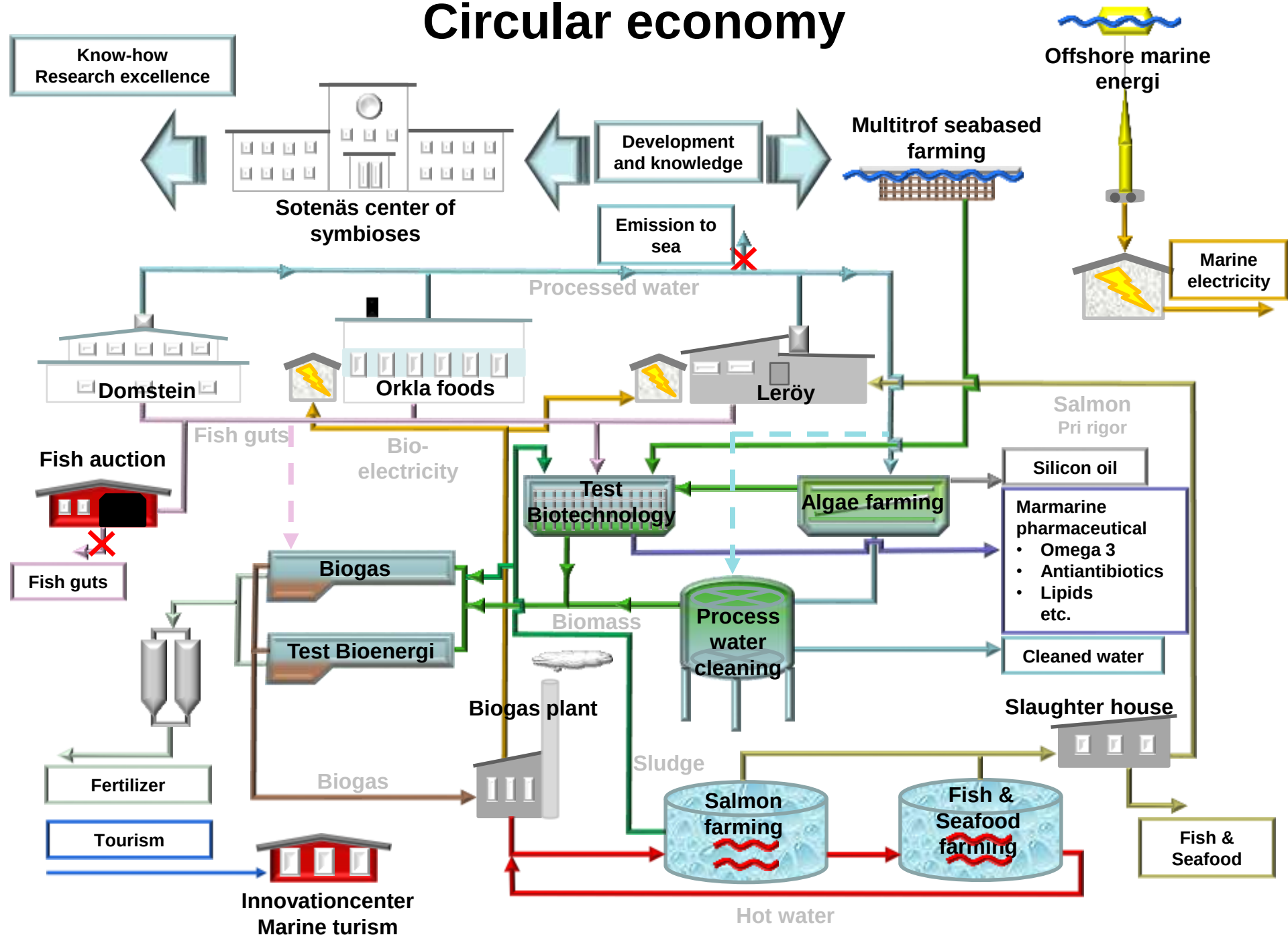

Oslo
Drammen
Fredrikstad
Stavanger
Kristiansand
Karlstad
Örebro
Västerås
Uppsala
Eskilstuna
Stockholm
Södertälje
Norrköping
Linköping
Sotenäs Municipality
Baltic Sea
Gothenburg
Jönköping
Borås
Gotland
Vendsyssel
Klitmøller
Aalborg
Växjö
Halmstad
Randers
Aarhus
Helsingborg
Horsens
Copenhagen
Esbjerg
Denmark
Sjælland
Malmö
Odense

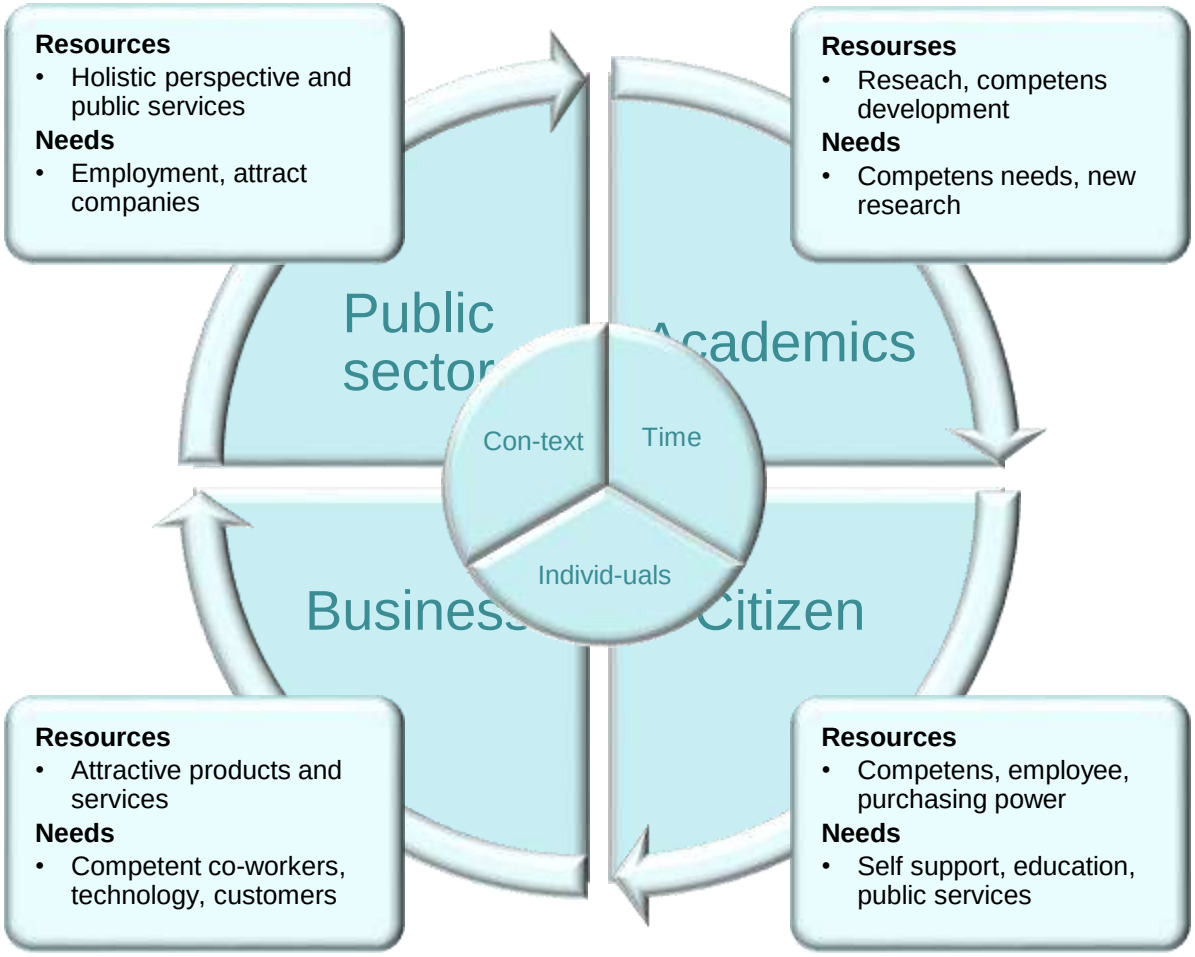
Sotenäs center of symbioses

- Life long learning - Competens development / education
- Business development
- Innovation support
- Project arena – project development, project management
- Communication – informationsspridning maritime business
- Meeting point, office space, software infrastructure, conferens center
- Incubator

Sotenäs kommun

Circular economy




Resources
• Holistic perspective and public services
Needs
• Employment, attract companies
Resourses
• Reseach, competens development
Needs
• Competens needs, new research
Public sector
Academics
Con-text
Time
Individ-uals
Business
Citizen
Resources
• Attractive products and services
Needs
• Competent co-workers, technology, customers
Resources
• Competens, employee, purchasing power
Needs
• Self support, education, public services

MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Session 3

Future challenges and development of district heating

Jonas Norrman

CEO • IMCG

Kerstin Sernhed

Assistant professor • LTH

Marc Puig von Friesen

Project manager• SP

URBANMAGMA

INNOVATING UTILITY SYSTEMS

HypoCity

Jonas Norrman
IMCG – Green Innovation & Strategy

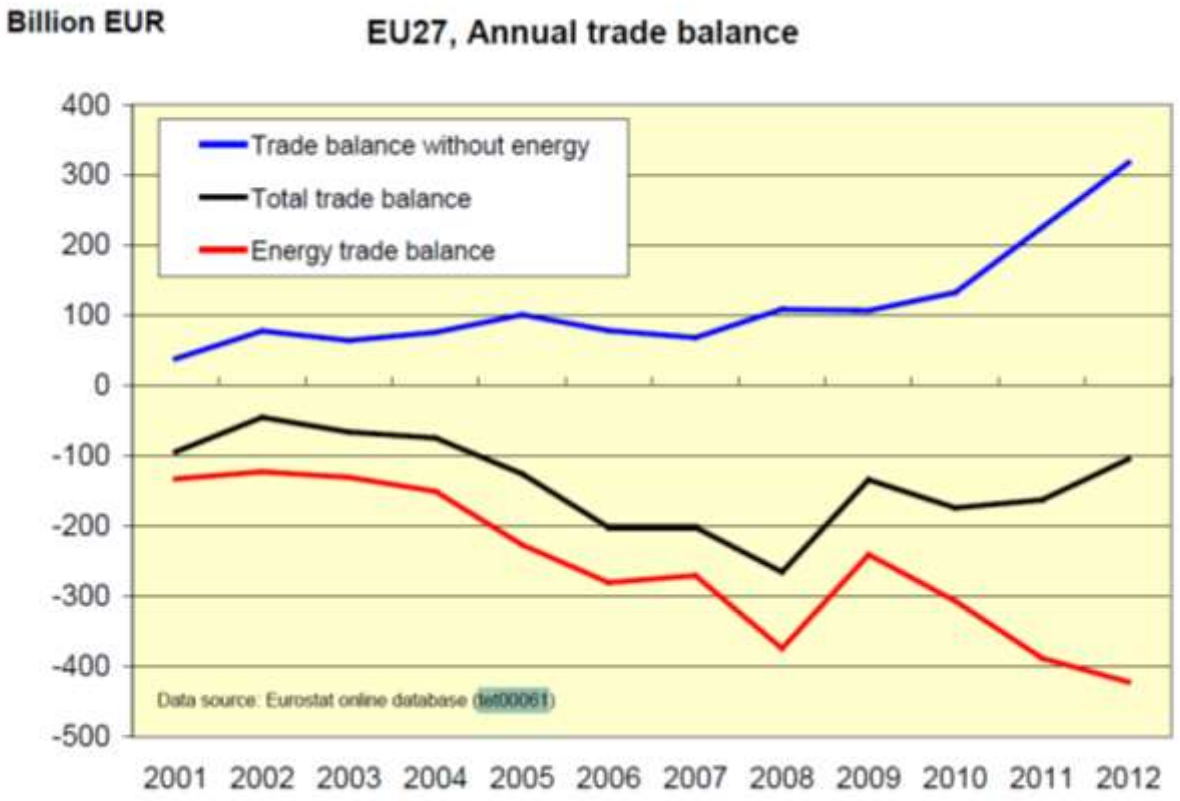
IMCG – GREEN INNOVATION AND STRATEGY

We facilitate new behaviours and transform societal challenges into business opportunities. By assisting companies and organisations reach out to the market with innovative solutions – together we contribute to a sustainable society at the leading edge. Based in Gothenburg and London, we offer strategic consulting services in Project Management, Communication, Expertise and Funding.

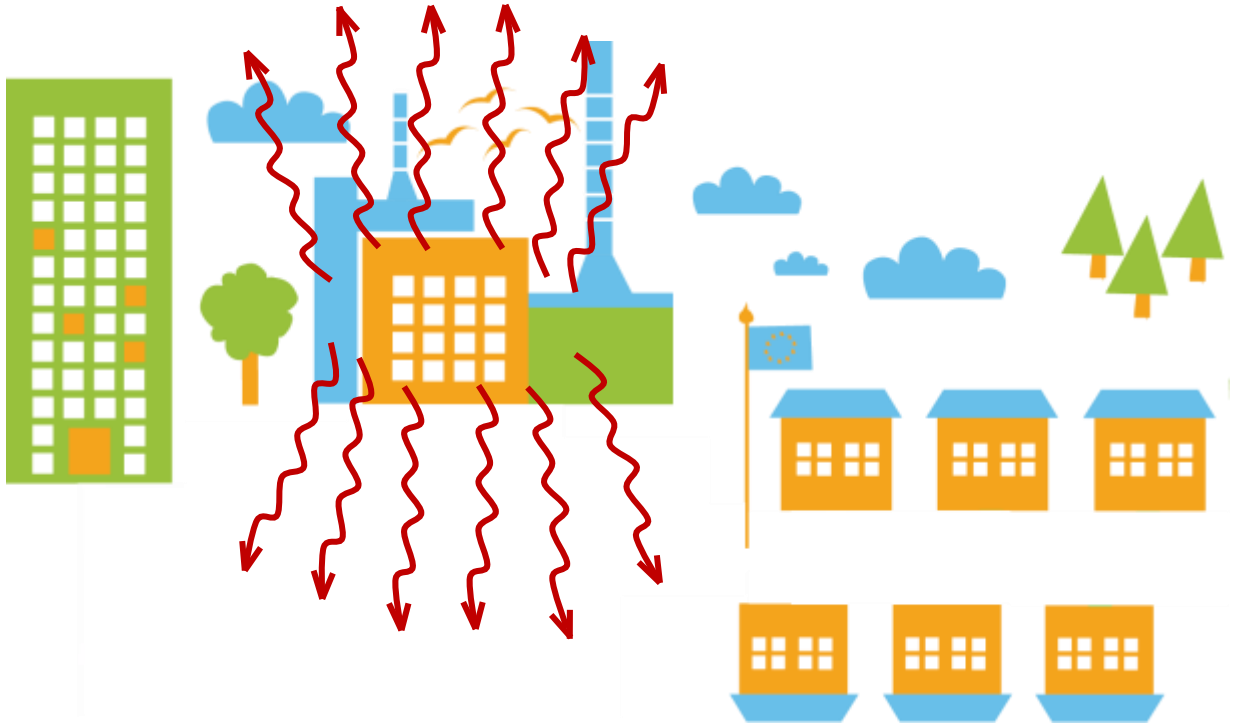
IMCG

URBANMAGMA
INNOVATING UTILITY SYSTEMS

EU27 Trade Balance



Source: Sven Werner; Heat Road Map



There is enough waste heat produced in the EU to heat its entire building stock…

…there is just no distribution network available to transport energy from where it is produced to where it is needed and can be used.

Background

- **5 partner cities:** Gothenburg (lead partner), London, Genoa, Cologne, Rotterdam
- **20 renowned partners**
- **4 years:** April 2013 – March 2017
- **10 new Demonstrators** + 20 existing
- **7 replication cities**
- **50 Celsius Cities**

- District heating and cooling are tools for reaching the energy efficiency targets
- Replicability of district heating and cooling concepts
- **Best practice** to roll-out of smart district heating and cooling
- Total budget MEUR 26, EU Contribution MEUR 14

celsius
smart cities

50 New CELSIUS Cities

1 Early communication
- engaging with potential CELSIUS Cities

2 Status of the city
- fill out New CELSIUS city questionnaire

3 Support need identification
- discussion between project and city

4 Letter of Commitment
- the city commits to become a CELSIUS City

5 Offerings
- demonstrators, toolboxes, workshops and expert group

URBANMAGMA
INNOVATING UTILITY SYSTEMS

A new generation of highly efficient, intelligent district heating and cooling systems, which are capable of integrating multiple efficient generation sources, including different kinds of renewable energy, cogeneration, waste heat from industrial or other sources and storage, and which can be operated at different temperature levels.

hypocity

Swedish expertise leads the way to transform the energy systems in European cities

- International storefront for Swedish district heating & cooling technology
- Sustainable growth and business possibilities
- Sustainable, liveable & smart cities
- Offer to participate

5

Offerings

- demonstrators, toolboxes, workshops and expert group

50 New CELSIUS Cities

URBANMAGMA
INNOVATING UTILITY SYSTEMS

Urban Magma

Cities emerge through intensifications of flows of matter-energy. The term Urban Magma is used as shorthand for this flowing ‘raw material’, drawing on the notion of magma as unformed matter-energy flowing under the crust of the earth’s surface. It draws attention to the logics of assembly that turn these flows of urban magma into structures.

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INNOVATING UTILITY SYSTEMS

Legionella in domestic hot water

Marc Puig von Friesen

SP Technical Research Institute of Sweden

Potential gain from decreased DHW temperature

Temperature requirement on domestic hot water (DHW)

Consumer use – 38 C for shower and 42 C for washing

Temperature limit 50-60 C is set by Legionella!

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Potential gain from decreased DHW temperature

Decrease in DHW temperature

- NOT lower heat use!
- Lower use of PRIMARY ENERGY – heat pump or district heating
- Decreased heat losses in installation
- Important with consumer behavior – should not lead to flushing to achieve ”warm” water

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Potential gain from decreased DHW temperature

Increased efficiency in heat pumps and solar panels

Heat pump efficiency increases -> lower electricity use (about 10% decrease at 45 C)

Solar panel efficiency increases (about 10% at 45 C)

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Potential gain from decreased DHW temperature

Lower DHW temperature gives possibility to decrease district heating distribution temperature

In modern houses the lower limit of distribution temperature is given by DHW and not for space heating.

Gains with lower distribution temperature

- More waste heat – less fossil fuel
- Lower heat losses
- Longer life time of installations
- Lower capital costs
- Higher efficiency in Combined heat and power plants (CHP)

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Potential gain from decreased DHW temperature

Combine driving forces

Two goals

1. Develop better legionella solutions
2. Potential gain with decreased DHW temperature

Develop methods for better handling of Legionella AND gives the possibility to lower DHW temperature.

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Potential gain from decreased DHW temperature

Innovation procurement?

Three different possibilities

1. Disinfection – kill/remove bacteria
2. Pipes with antibacterial properties – counteract biofilm
3. 3 l rule – instantaneous DHW, low volume

Results (will be published soon)

1. Some disinfection methods possible for innovation procurement
2. Not mature enough
3. Not suitable for innovation procurement; other development projects.

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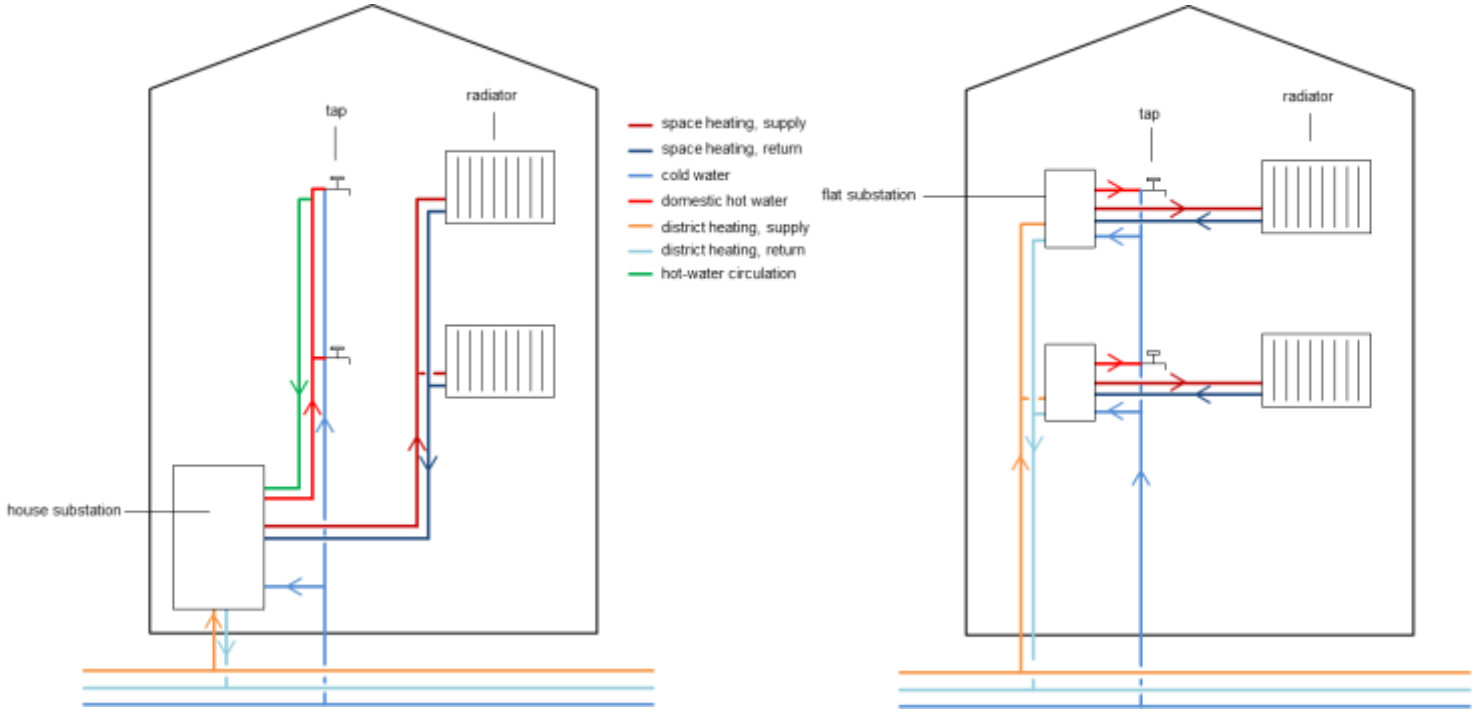
Potential gain from decreased DHW temperature

3 liter rule – instantaneous DHW and low volume



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Potential gain from decreased DHW temperature

3 liter rule – instantaneous DHW and low volume

Problems with Legionella appear when DHW is stored – in tanks or in complex systems such as warm water circulation.

Advantages

- Simple solution
- Robust
- Easy to isolate infected tap

Open questions

- Principle sufficient to minimize Legionella growth?
- Is it possible to implement in practice?
- Is it cost efficient?

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Thank you for your attention!

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The role of district heating in a sustainable Lund

Project group:
Matz Hagberg, Roger Gartsjö (Lunds kommun)
Fredrik Luthman, Jonas Persson, Ulrika Bergström, Alma Hess (Kraftringen)
Kerstin Sernhed, Annamaria Sandgren (Grontmij)
Patrick Lauenburg (LTH)

Kerstin Sernhed, Presentation 20150318

The new city hall of Lund - Kristallen. Photo: Lund municipality

A public building, owned by the municipality, located in the middle of the district heating grid…

…heated by ground source heat pumps

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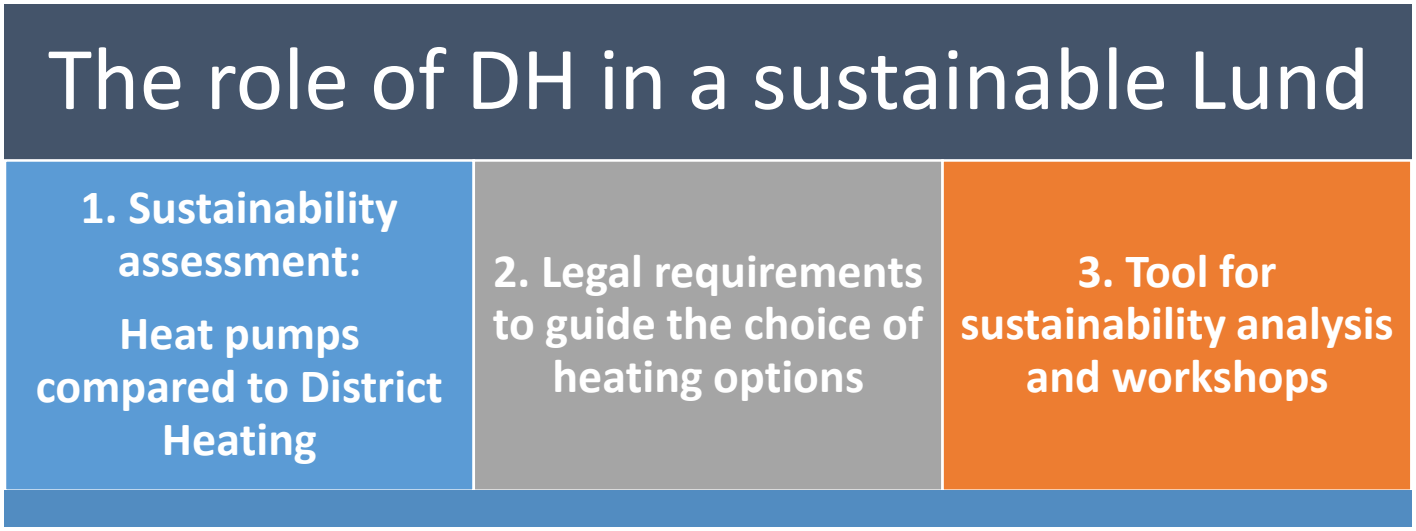
The project – three parts



- The goal was to develop a basis which will serve as guidance to municipalities, property owners and developers that should be able to make a conscious and sustainable choice for heating systems

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Legal requirements

"What is permissible for a municipality to do when it comes to promoting district heating?"

- Method:
  - classical legislative interpretation
  - studies of the preparatory works to the relevant legislation, for lack of legal cases and literature

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Expansion of Swedish DH

- The expansion of district heating in Sweden can be seen as a result to achieve four major social objectives:
  - An early local municipal interest for CHP led to the creation of the first district heating systems in the 1940s and 50s.
  - A national housing policy that produced one million new dwellings between1965 and 1975 expanded the system
  - The oil reduction policy in the 1980s continued the expansion
  - District heating market was consolidated by climate change mitigation policy in the 1990s

National measures: High taxes on fossil fuel

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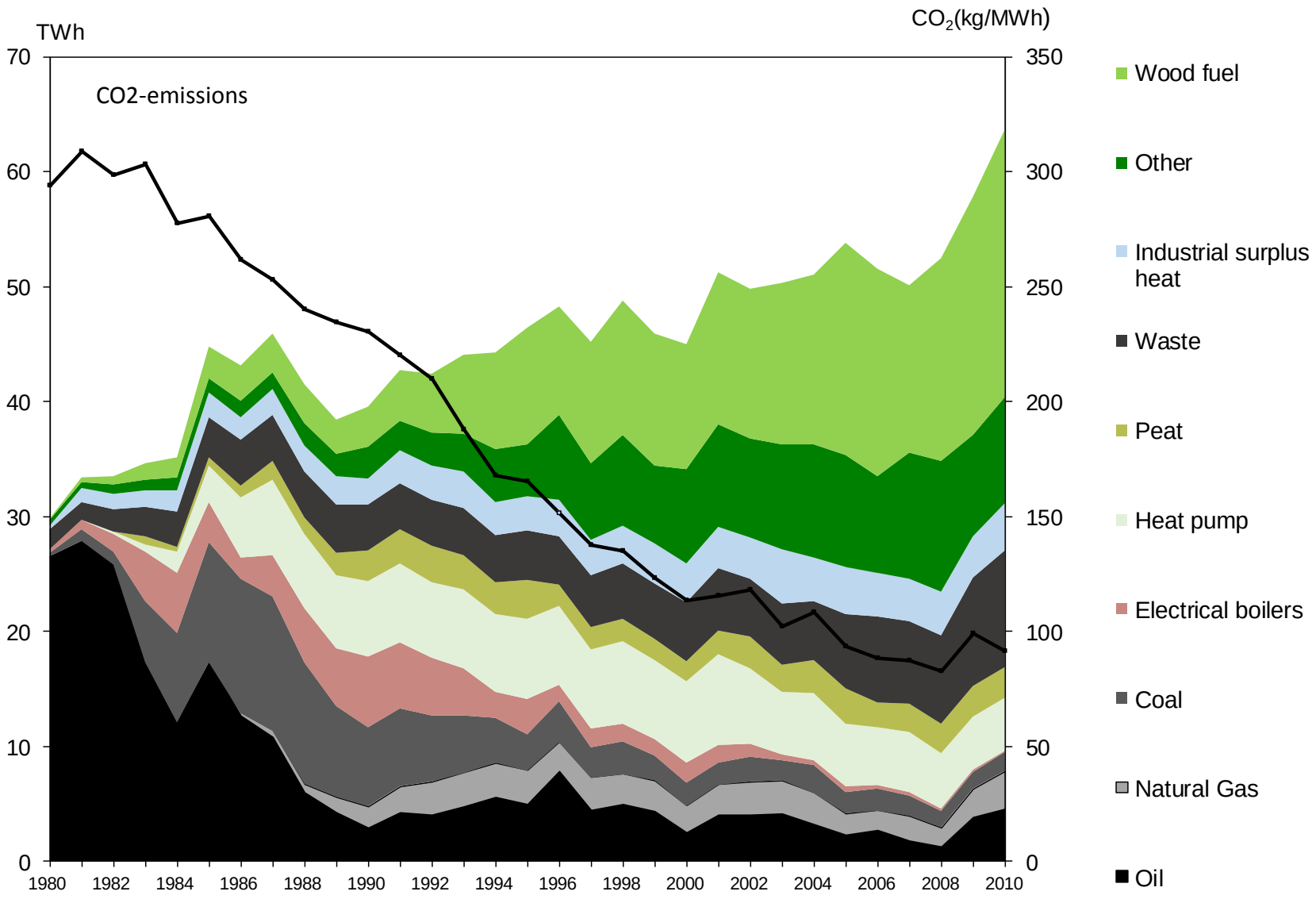
Fuels used in Swedish district heating systems

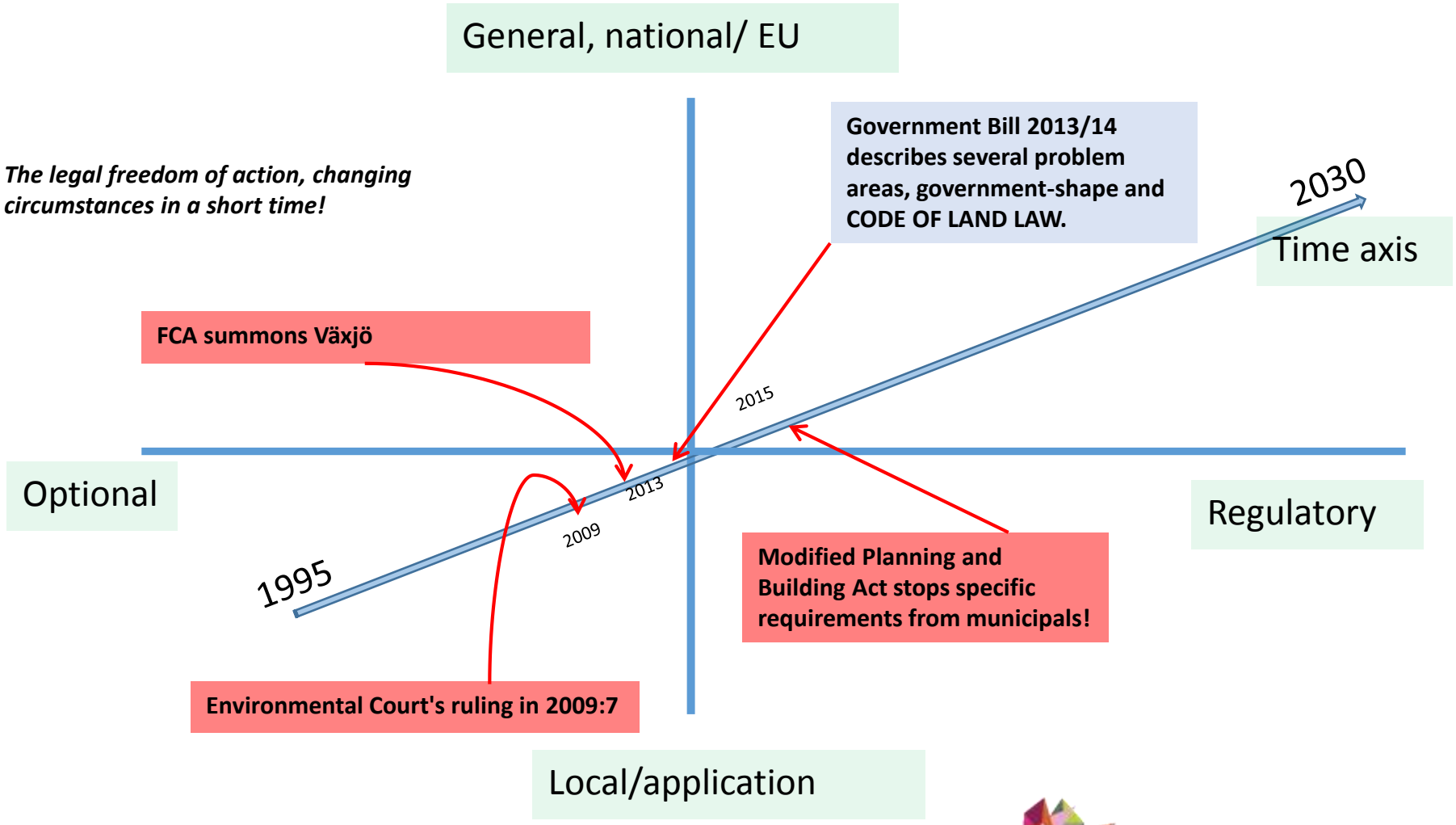


Source: The Swedish District Heating Association

Development of regulations

- Historically, district heating has been a communal affair
  - The Municipal Act with its basic principles was the framework, which the State did not present themselves in
  - However, some guiding elements of the legislation: Government housing subsidies with local requirements for district heating, municipal energy planning in the 80's with distinction from heat pumps, energy policy with investment grants and municipal land policy.
- Basically, Swedish district heating evolved through bilateral agreements and its own set of rules with general and technical delivery provisions and a target price agreement 1958-1993.
- New District Heating Law from 1 July 2008 with the requirement for separate accounting, pricing information and more.
- There are requests from many different market players that market rules for district heating to a higher extent should take into account the Swedish district heating high and dominant market share.
  - Examples of such market regulations are price controls and third party access.

Legal investigation



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Municipality as owner

Yes!

- The municipality may decide heating system for buildings owned by the municipality
- As the owner of a municipal company (i.e. municipal housing company), the municipality has potential to influence the choice of heating system

Unclear/yet to be investigated

- It is unclear if the municipality can make demands on what heating systems should be used if the municipality rents out land which someone else colonize and act on
- Terms of the purchase agreement relating to the building/area requirements appear to be in conflict with the Land Code and/or competition laws.

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Municipality as seller of land

Yes!

- Upon transfer (sale) of land to be built, the municipality has possibilities to influence the choice of heating systems through dialogue and voluntary agreements.

No!

- When the municipality sells land to be developed with single-family homes, the municipality can not require that the houses will be connected to the district heating grid.

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Municipality as a public authority

No!

- At trial, supported by the PBA, a municipality is not to set requirements on *what heating technology should be used.*

Unclear/yet to be investigated

- It is unclear whether municipalities in their role as public authorities may set requirements of *the environmental performance* of the heating systems in other ways than in the planning process.

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Competition law versus environmental law

As the regulatory system in the environmental field and the field of competition on a European level shows signs of incompatibility, it would be interesting to investigate if this is the case and what the consequences are.

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Thank you

Contact information:

Kerstin.Sernhed@energy.lth.se

Link to master thesis:

http://www.kraftringen.se/Master-Gemensam-info-har/Press1/2014-Q4/141113-vinnande-exjobb/

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Sustainability assessment – local investigation of Lund

"How does a property owner's choice of heating system affect the sustainability within the municipality?"

- Comparison: **District heating** versus **ground source heat pump** and **air/water heat pump**

- The alternatives were evaluated based on
  - Economic,
  - environmental,
  - and socio-economic sustainability.

- Master thesis
  - Students: Jonas Persson & Erik Bergman
  - Supervisor: Patrick Lauenburg, LTH
  - Thesis work was nominated for this year's thesis in the category of economics/social sciences by the Swedish District Heating Association!

- Method:
  - forward-looking perspective – what alternative will be best over a time period?
  - Based on predications and scenarios
  - The choice situation, i.e. 'a new customer in the system', means that the marginal production in the energy system affected

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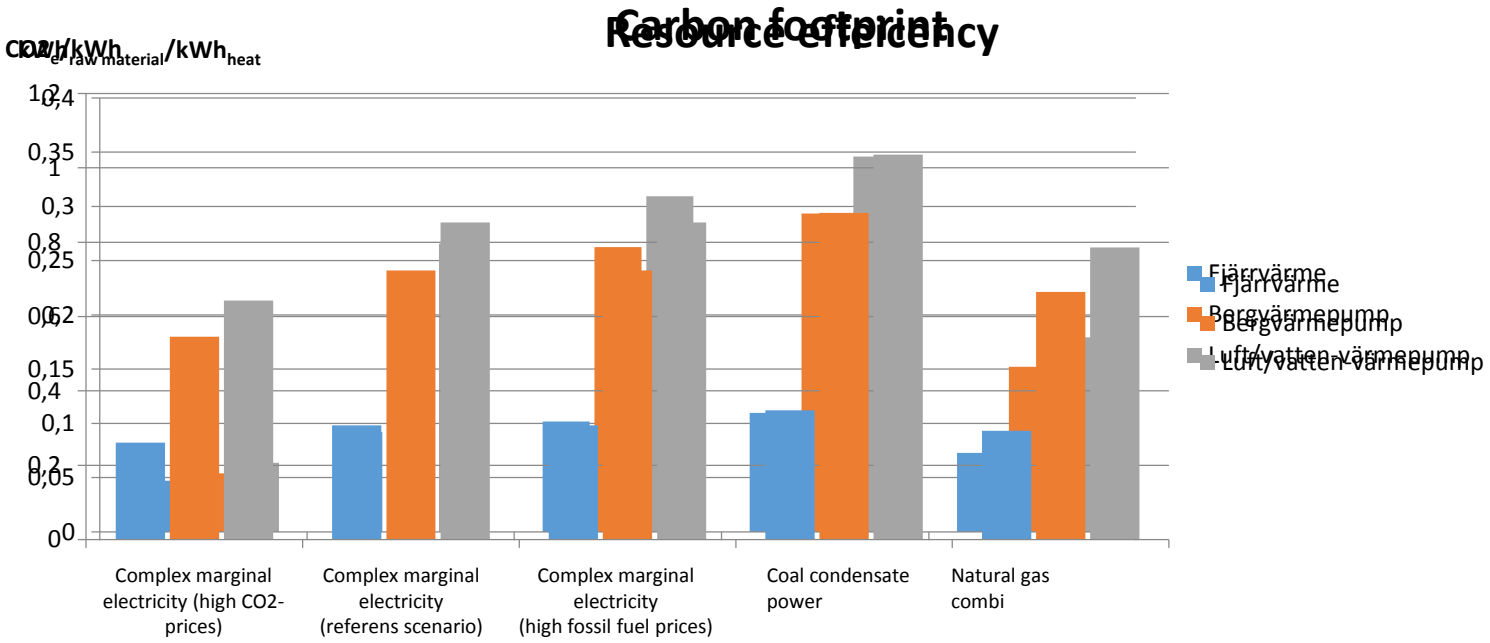
Environmental sustainability



District heating in Lund-Lomma-Eslöv has both lower carbon emissions and are more resource efficient than heat pumps in a forward-looking perspective in all scenarios

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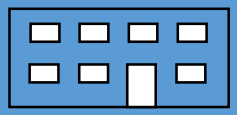
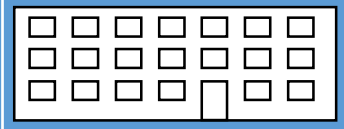
Results – local investigation Lund

						
	Heat Pump	District Heating	Heat Pump	District Heating	Heat Pump	District Heating
Economy	It depends		It depends		It depends	
Environment	Worse	Better	Worse	Better	Worse	Better
Socioeconomy	Worse	Better	Worse	Better	Worse	Better

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MEETING POINT

URBANMAGMA

MARCH 18-19 2015

Session 3

Underground pipes – management and technology to save billions

Maria Rindelöv

Project assistant • Sydvatten

Liisa Fransson

R&D manager • Kraftringen

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Underground pipes – management and technology to save billions

Maria Rindelöv, Sydvatten
Liisa Fransson, Kraftringen

Background

- 64000 km pipes for drinking water
- 97000 km pipes for waste water
- 21000 km pipes for district heating

4,5 laps around the earth!

- Replacement costs of approx 750 billion SEK (80 billion Euro)
- Very litte R&D on the topic
- Unique collaboration - for innovation!

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Organization

Focus group within Urban Magma

Project leaders:
Kenneth Persson, Sydvatten
Liisa Fransson, Kraftringen

Project assistant:
Maria Rindelöv, Sydvatten

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We bring together and catalyze the work!

ÖRESUNDS KRAFT

kraftringen

VASYD

e·on

SYDVATTEN

VINNOVA

NSVA
NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP

This is an important topic..

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19th Century: Life without water- and wastewater infrastructure

- Industrialization
- Crowded cities
- Stockholm, water wells
- London,The Great Stink

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Without functional pipingsystem, no functional society!

Society depends on pipingsystems to deliver clean water to uphold good hygien and good health.

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Our Project

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- Meeting and conversation with every participant

- Agening pipes and condition assessment is a current challenge

The Situation Today

District Heating Concrete Culverts 1950-60

Watersystem Cast iron 1800-1970

Ductile iron 1967-

Concrete 1950-

PVC, PE 1955-

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How to make Condition Assessment ?

- Excavation? Too expensive and disruptive to traffic
- No dig and disruptive methods
- Which pipes to prioritize?

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Condition Assessment

Trenchless and non invasive methods

- Delta-t. Ultrasounds, Jensen AB
- Ground Penetrating Radar. Possible? Brainstorm with Roberto,Gradar

  →create a new radar?

- Pure Technologies, Smartball
- Pipe Inspectors Camera, leakage
- Swerea, Electrochemical method

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Condition Assessment

- Data analysis, statistical models? Lund´s University
- Big Data and using sensors? Sigma Connectivity
- Management and documenting
- Bild på ledning eller sensor

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Condition Assessment:

A new system of combined technical methods, data analysis and management

August 2014: Appliaction to Vinnova: Asset Management of Pipelines

Application was granted for step 1 out of 3.

Current state of this project 2015

- Kick Off meeting, January
- New interviews in March
- Two meetings in April
- Submitt new application for step 2 in August.

Positive outcome of the Vinnova application!

Vinnova → greater awareness of the problem

Norrvatten and Sydvatten granted money to investigate the existing technology in the oil- and gasindustry

The aim: to create a new NDT device for status assessment

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The Mini Exhibition

Mini Exhibition, September 2014

Opportunity for companies with innovative ideas to present their work to the projectparticipants

Breivoll, Inspecta, Primozone, Widecco, Bauer Watertechnology,

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The Future Pipingsystems
- dreams about pipes with selfhealing properties

Seminar in December 2014, discussions about futuristic pipingsystem

- Prof. Ivan Maximov, Lund NanoLab and Lund´s University, Nanotechnology for intelligent self-diagnostic pipes
- Sigma Connectivity, Big Data and online measurements
- Max IV laboratory for material analysis

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Future Ideas for Urban Magma

- Create new pipes for the future
- Real time monitoring of bacterial growth in pipes
- Use of Big Data and sensors
- Rehabilitation, reparation of pipes, relining

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