WEBINAR SERIES

Investment in large Industrial (Urban) Symbiosis infrastructures

20 March 2024

9:00 CET I Online

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Agenda

Hubs4Circularity
COMMUNITY OF PRACTICE

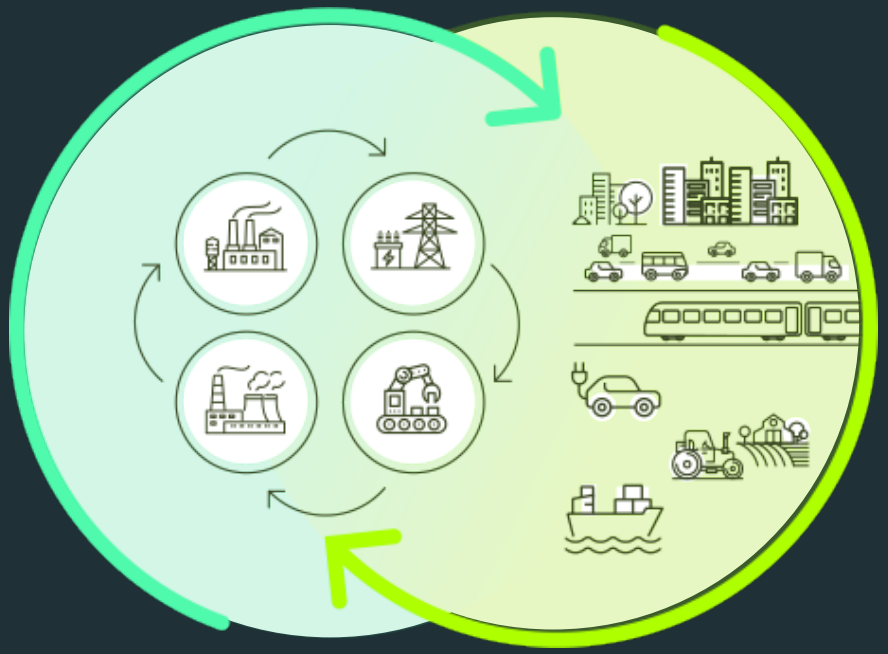
Moderation: Dorota Pawlucka, Covestro Deutschland AG

9:00 **Introduction to the Hubs4Circularity Community of Practice and the White Paper recently in development with A.SPIRE**
Taira Colah, CiaoTech

9:05 **Investment in large (shared) Industrial (Urban) Symbiosis infrastructures**
Per Møller, Kalundborg Symbiosis

9:30 **Discussion**
with webinar participants

9:45 *End of the webinar*



Timely investment in large-scale district cooling infrastructure

– facilitated through PPP in a mature industrial H4C

Ph.D. Per Møller

Symbiosis facilitator and developer
Kalundborg Symbiosis

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Kalundborg SYMBIOSIS
Surplus from circular production

Smart investments in district cooling infrastructure

- Preparing for challenges
- Map and activate the “ecosystem”
- Looking for cascading synergies
- Combining business models
- A partnership model in phases

→ Urban-Industrial Symbiosis

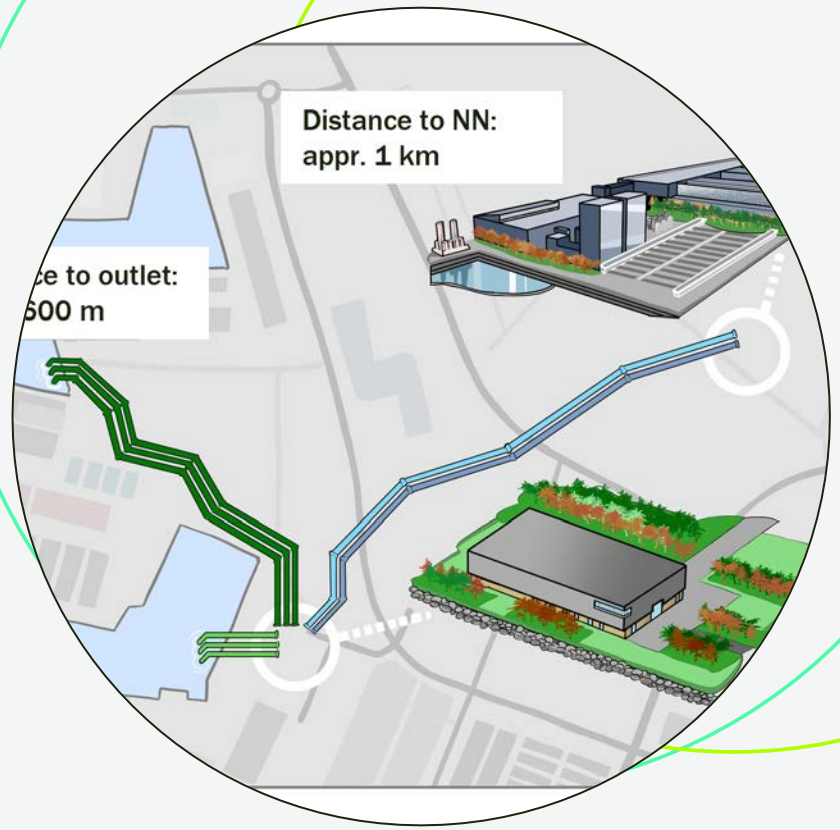
Probably the largest combined industrial cooling and heating central in Europe

Key numbers:

- 2x 1 km underground pipes, 2 m diameter
- In operating: 2025
- Capacity: 166 MW cooling
- Sea water intake: 18.000 m3/h (max)
- Temperatures, water flows:
  - Cooling for Novo Nordisk / Novonesis: 22,5 C
  - Heating from Novo Nordisk / Novonesis: 31,5 C
- Back-up chillers: 10 MW
- Resources saved: water, chemicals, industrial land, heat (replacing natural gas)

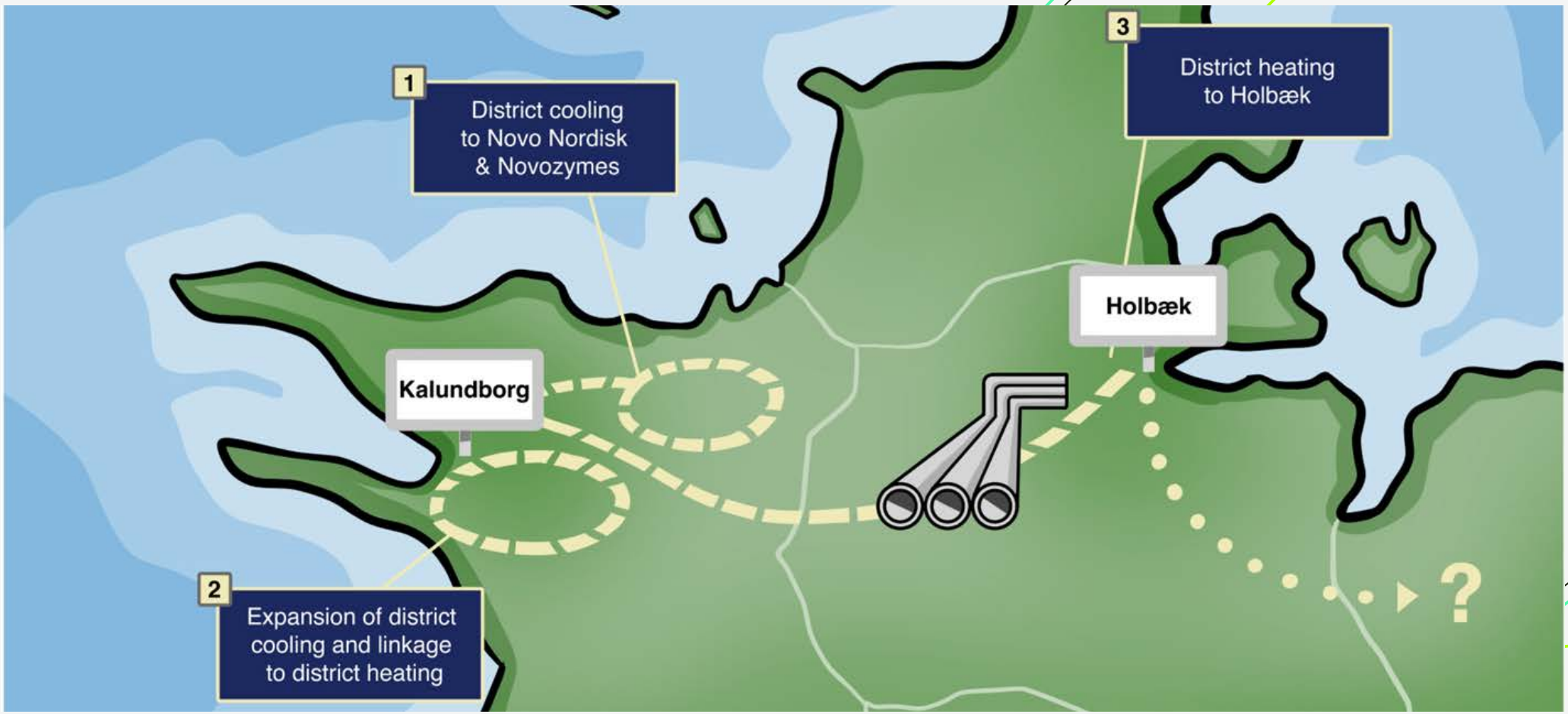
Blended funding:

- Shared between utility and companies



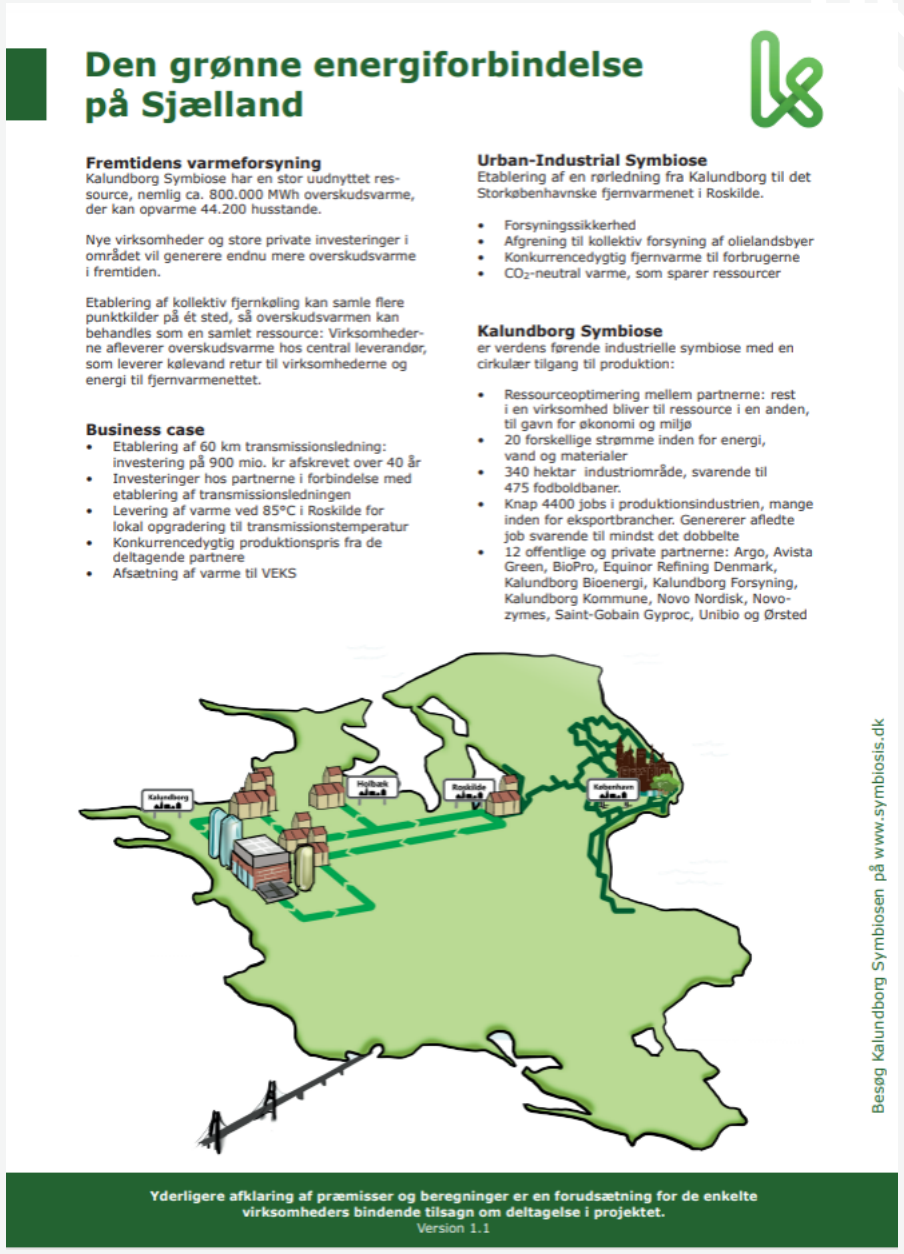
Sector coupling & Urban-Industrial Symbiosis

Combining efforts, large scale impact and new opportunities



Potential 2020

- 800.000 MWh excess heat
  - enough to heat ca. 42.000 houses
- Infrastructure needed: 60 km tail pipe
- CO_2 reduction: ca. 40.000 tons



Den grønne energiforbindelse på Sjælland

Fremtidens varmeforsyning
Kalundborg Symbiose har en stor uudnyttet ressource, nemlig ca. 800.000 MWh overskudsvarme, der kan opvarme 44.200 husstande.

Nye virksomheder og store private investeringer i området vil generere endnu mere overskudsvarme i fremtiden.

Etablering af kollektiv fjernkøling kan samle flere punktkilder på ét sted, så overskudsvarmen kan behandles som en samlet ressource: Virksomhederne afleverer overskudsvarme hos central leverandør, som leverer kølevand retur til virksomhederne og energi til fjernvarmenettet.

Business case
- Etablering af 60 km transmissionsledning: investering på 900 mio. kr afskrevet over 40 år
- Investeringer hos partnerne i forbindelse med etablering af transmissionsledningen
- Levering af varme ved 85°C i Roskilde for lokal opgradering til transmissionstemperatur
- Konkurrencedygtig produktionspris fra de deltagende partnere
- Afsætning af varme til VEKS

Urban-Industrial Symbiose
Etablering af en rørledning fra Kalundborg til det Storkøbenhavnske fjernvarmenet i Roskilde.

- Forsyningssikkerhed
- Afgrening til kollektiv forsyning af olielandsbyer
- Konkurrencedygtig fjernvarme til forbrugerne
- CO_2-neutral varme, som sparer ressourcer

Kalundborg Symbiose
er verdens førende industrielle symbiose med en cirkulær tilgang til produktion:

- Ressourceoptimering mellem partnerne: rest i en virksomhed bliver til ressource i en anden, til gavn for økonomi og miljø
- 20 forskellige strømme inden for energi, vand og materialer
- 340 hektar industriområde, svarende til 475 fodboldbaner.
- Knap 4400 jobs i produktionsindustrien, mange inden for eksportbrancher. Genererer afledte job svarende til mindst det dobbelte
- 12 offentlige og private partnerne: Argo, Avista Green, BioPro, Equinor Refining Denmark, Kalundborg Bioenergi, Kalundborg Forsyning, Kalundborg Kommune, Novo Nordisk, Novozymes, Saint-Gobain Gyproc, Unibio og Ørsted

Yderligere afklaring af præmisser og beregninger er en forudsætning for de enkelte virksomheders bindende tilsagn om deltagelse i projektet.
Version 1.1

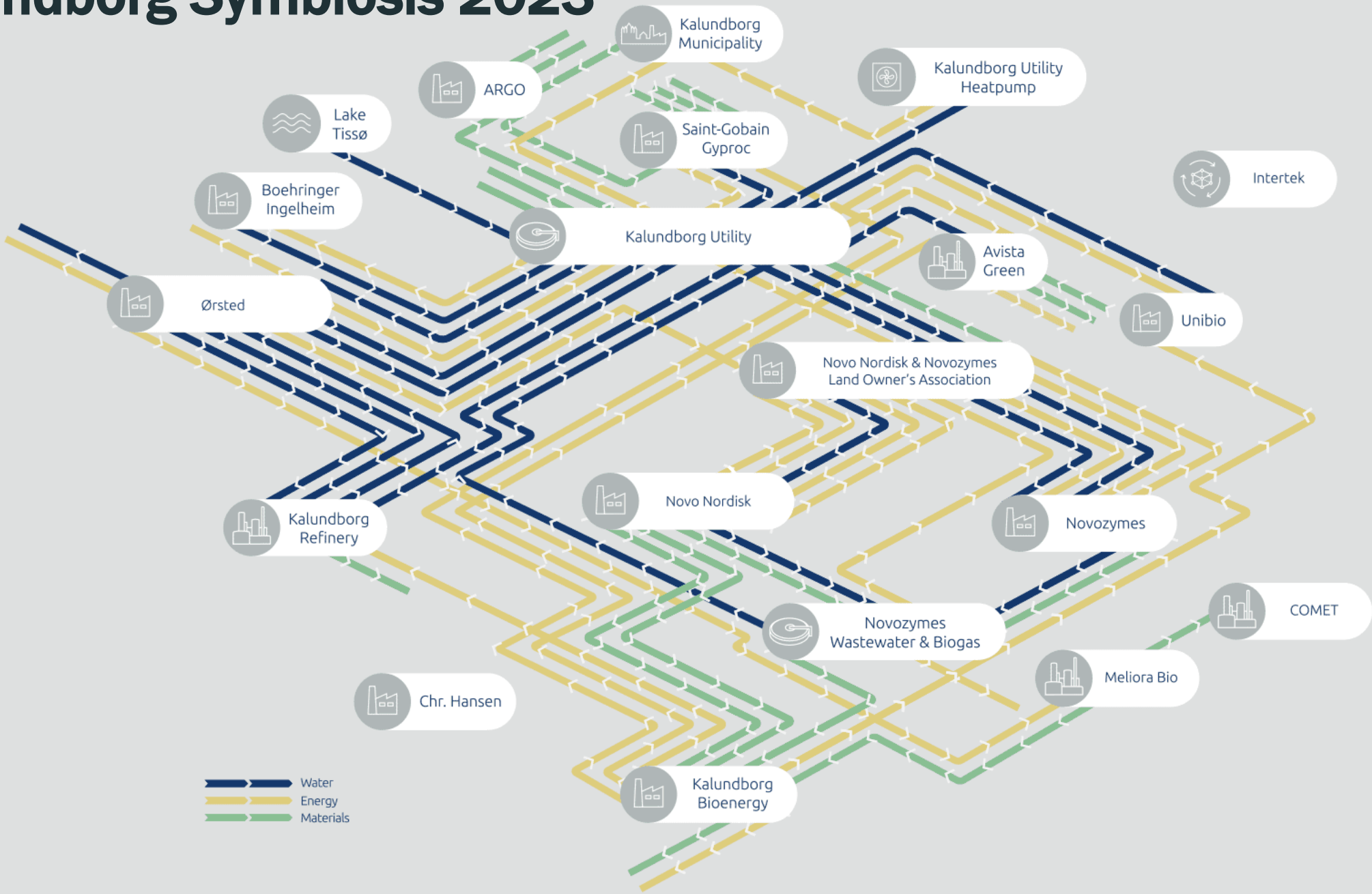
Besøg Kalundborg Symbiosen på www.symbiosis.dk

Large scale investments ...

... through facilitation

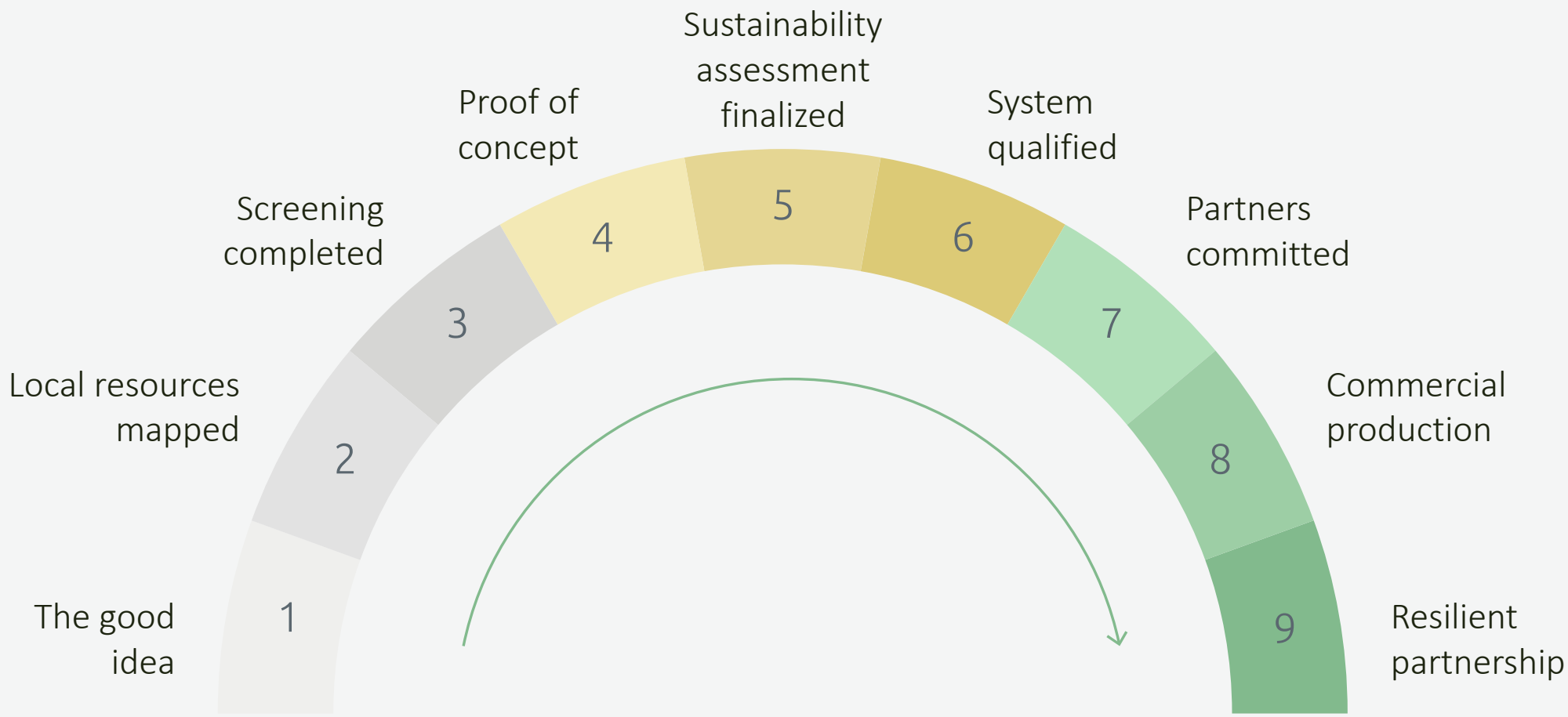

Kalundborg Municipality
Kalundborg Symbiosis
Novozymes
Avista Green
Novo Nordisk
Chr. Hansen
Boehringer Ingelheim
Kalundborg Utility
Unibio
Intertek
Saint-Gobain Gyproc
COMET
ARGO
Meliora Bio
APM Terminals
Ørsted
Kalundborg Bioenergy
Schultz Shipping Group
Kalundborg Refinery

Kalundborg Symbiosis 2023



Governance structure

Symbiosis Readiness Level



Roadmap for Kalundborg Symbiosis version 2 / 2023

Action plan 2023

Action plan 2025

Action plan 2030

2. Resource streams associated with CO2 reduction	3. Strategic plan for water consumption and discharge	4. Mapping of residual resource streams	5. Roadmap for Kalundborg Symbiosis 2030	6. District cooling, Phase 2	7. The Green Energy Highway	8. Socio-economic frame agreement	9. Renew and promote	10. Hub4Circularity (H4C)
Project 2.1 CCS	Project 3.1 Strategic waterplan	Project 4.3 Reuse of plastic waste	Strategic work in progress	Project 6.1 Extension of district cooling, phase 2	Project 7.1 Green energy connection on Zealand	Project 8.1 Socio-economic entrepeneur-ship	Project 9.1 Systemic Approach to Clean Industry	Project 10.1 Hub4Circularity
Project 2.2 CCSU	Project 3.2 Water recovery and digitalization of wastewater treatment (Ultimate)	Project 4.4 Mapping potentials in IS (GIA)			Project 7.2 Surplus heat for local communities			
Project 2.3 Power2X					Project 7.3 Local infrastructure for excess heat			
Project 2.4 Residuals from PtX	Project 3.3 Restoration of key water areas				Project 7.4 Gørlev: from natural gas to district heating			
Project 2.5 PtX Zealand								

Project 5.1 Date: 2020.11.24

Green energy connection on Zealand

Kalundborg SYMBIOSIS

Background & strategic rationale incl. risks & benefits

Appr. 800.000 MWh/y exces heat is avaible in Kalundborg Symbiosis, temperatures vary between 25°C og 110°C. With the conversion of Asnæsværket and the heat pump at Kalundborg Utility, there is not a demand for extra district heating locally, but new technologies like low temperature district heating could make an attractive business case to use the surplus heat outside Kalundborg Municipality.

- Opportunity: Holbæk Municipality is about to redesign energy supply for Holbæk city, as a transition from natural gas to renewable sources. Extension to Roskilde is also an opportunity.
- Benefit: Usage of excess heat will reduce CO2 emission in Holbæk (natural gas). Note: Surplus heat is CO2-neutral
- Risk: Political ownership, across several municipalities and utilities.

Measurable benefits

To be analysed precisely, in terms of saved CO2 both for companies and municipalities involved.

Priority
High

Risk level
High

Vision paper

Internal and external partners involved in the project

Participant list:

A proposal, estimating the societal value for municipalities involved must be made to seek political consensus about the idea.

Dialogue with Holbæk Municipality about their future heat plans.

Project organisation

Owner:
Kalundborg Utility and Municipality

Funding:
To be found

Project manager:
Hans-Martin Friis Møller

External Spokesperson:
Hans-Martin Friis Møller

Project description

Loop Connection:
The proposal is to transfer surplus heat from the industry in Kalundborg to Holbæk and deliver district heating to villages along the route. The conduit could advantageously be established as "cold district heating", laid as a water pipe without significant heat loss. The temperature of the conveyed water is boosted by heat pumps, decentrally located.

The route could conceivably be laid along the upcoming highway (route 23) and could be established in connection with it. Such a connection has the potential to halve the costs compared to the previous studies that have been drawn up as traditional district heating solution.

Strategic goal
Connect

SDG
7

Milestone plan, key deliverables incl. gate approval dates

- Consultation on Strategisk energiplan Holbæk: 2022, Q2
- Political chartre: 2020, Q3
- Contribution to heating plan for Holbæk: 2021, Q1-3
- Societal analysis on benefits as a project application (ELENA first draft): 2020, Q4
- End of project: 2021, Q4
- Application for Innovation Fund on cold district heating infra structure: 2022, Q1
- Expected date of announcement: 2022, Q3
- Operational; 2025

Link to Roadmap

(in order of priority)

7. The green energy highway
3. Strategic water plan

Project 5.2 Date: 2020.06.20

Surplus heat for local communities

Background & strategic rationale incl. risks & benefits

With the recent conversion of ”Asnæsværket” as a biomass heated district heating plant and a large heat pump situated at Kalundborg Utility, there is no demand for additional heat sources within the city of Kalundborg. However, new low temperature district heating solutions could enable the usage of surplus heat for collective green heating solutions for local communities surrounding the city of Kalundborg. Local villages and hamlets are today still primarily heated with oil, natural gas, electricity, and inefficient wood stoves.
Opportunity: Collective green heating solutions for local communities in rural areas close to the city of Kalundborg

- Benefit: Usage of surplus heat will reduce CO2 emissions of KS and secure green energy transition for local rural communities.
- Risk: Political ownership, many stakeholders.

Priority
High

Risk level
Medium

Measurable benefits

Elimination of fossil fuel heating of local rural communities

Internal and external partners involved in the project

Participant list:

A proposal, describing one or several specific local business cases to be conducted as test- and demonstration solutions on usage of surplus heat as show case for rural sustainable energy solutions.

Project organisation

Owner:
Kalundborg Utility

Funding:
Public funding

Project manager:

External Spokesperson:
Hans-Martin Friis Møller

Project description

Show case on combined industrial surplus heat, low temperature district heating solutions and heat pumps to local villages: the proposal is to supply nearby communities with low temperature surplus heat in uninsulated water pipes, significantly lowering the costs for pipe construction. The heat must then be boosted either at the individual customer or in minor cooperatives with individual or shared heat pumps.

The project entails massive local community involvement implementing and future-proofing collective heating solutions, ensuring attractive dwelling, hence also contributing positively to the municipal housing policy.

The business case has been calculated in different projects, for instance "Grøn Kollektiv Varme" and is described in Strategisk Energiplan 2035 (the strategic energy plan) for Kalundborg Municipality.

Strategic goal
Connect

SDG
7

Milestone plan, key deliverables incl. gate approval dates

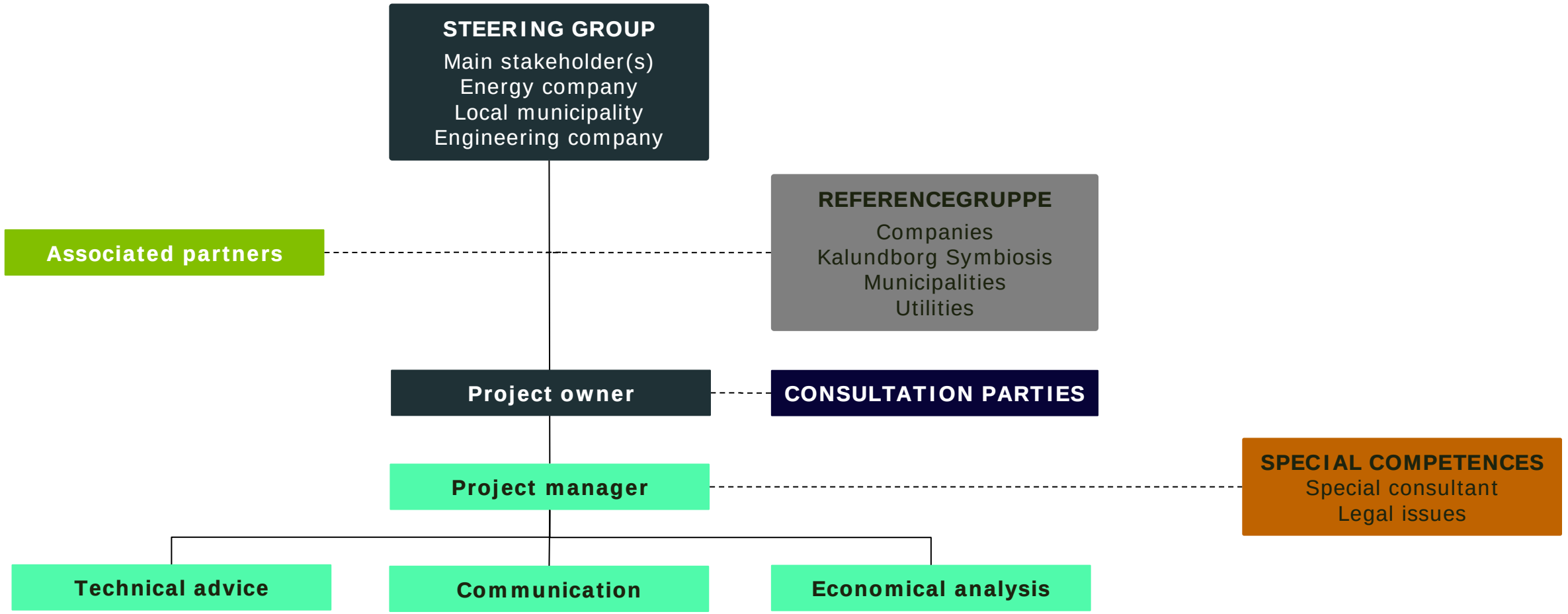
Stop-and-go for business case: 2021, Q1

Link to Roadmap

(in order of priority)

7. The green Energy Highway

Organisation: Pre-face



For more information:

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Thank you!

Join the Hubs4Circularity Community of Practice

https://www.h4c-community.eu/#form

Please visit our website to for more information:

www.h4c-community.eu

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