



CampusEnergy2021

BRIDGE TO THE FUTURE

Feb. 16-18 | CONNECTING VIRTUALLY

WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16





MINISTRY OF FOREIGN AFFAIRS
OF DENMARK
The Trade Council

Site Supervision as a Game Changer for Successful Low Carbon District Energy Implementation projects

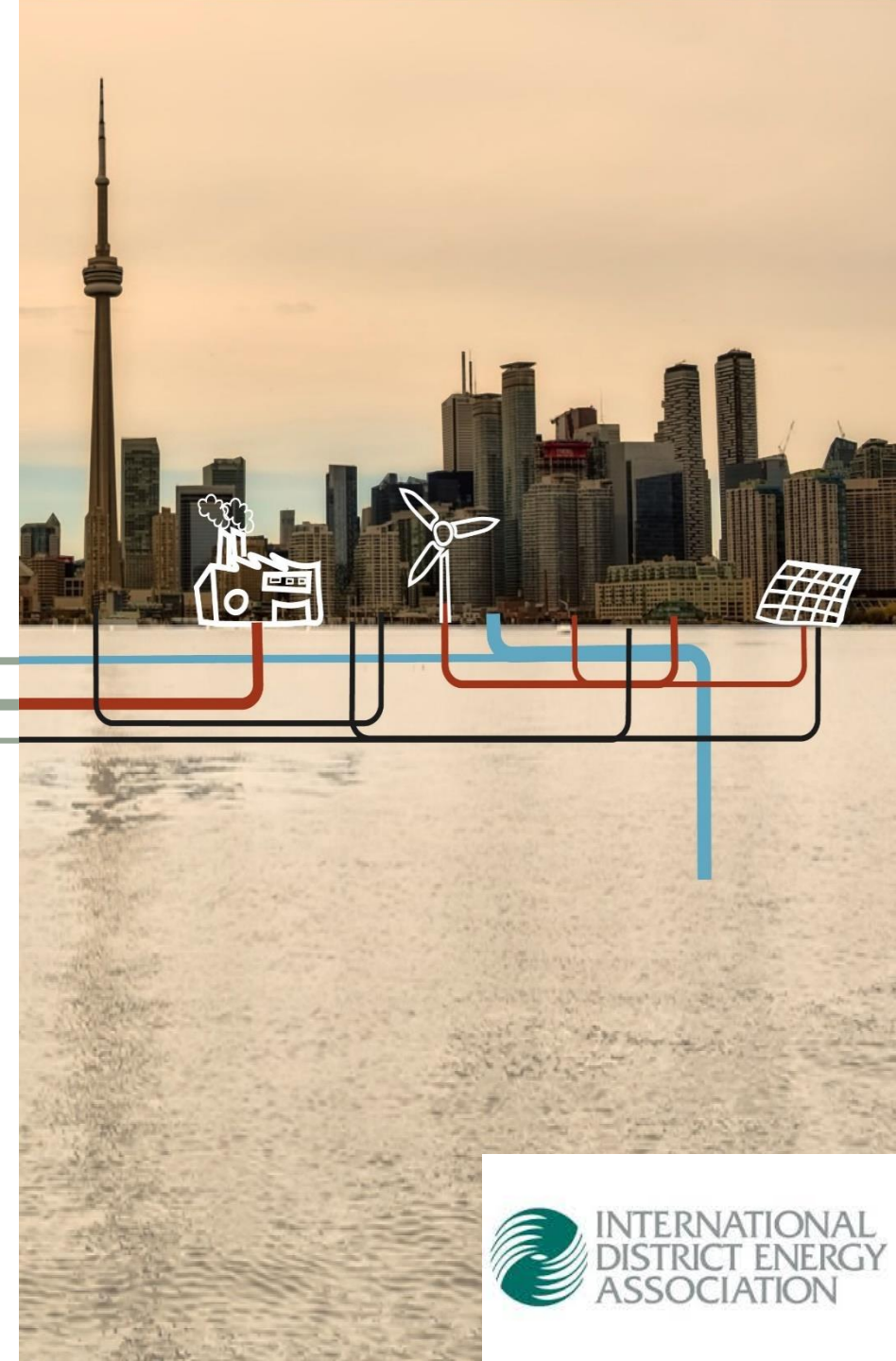
Danish District Energy Advisory
And
Rathco ENG

Niels Vilstrup i John Rathbone

IDEA Campus Energy virtual Conference Februar 2021

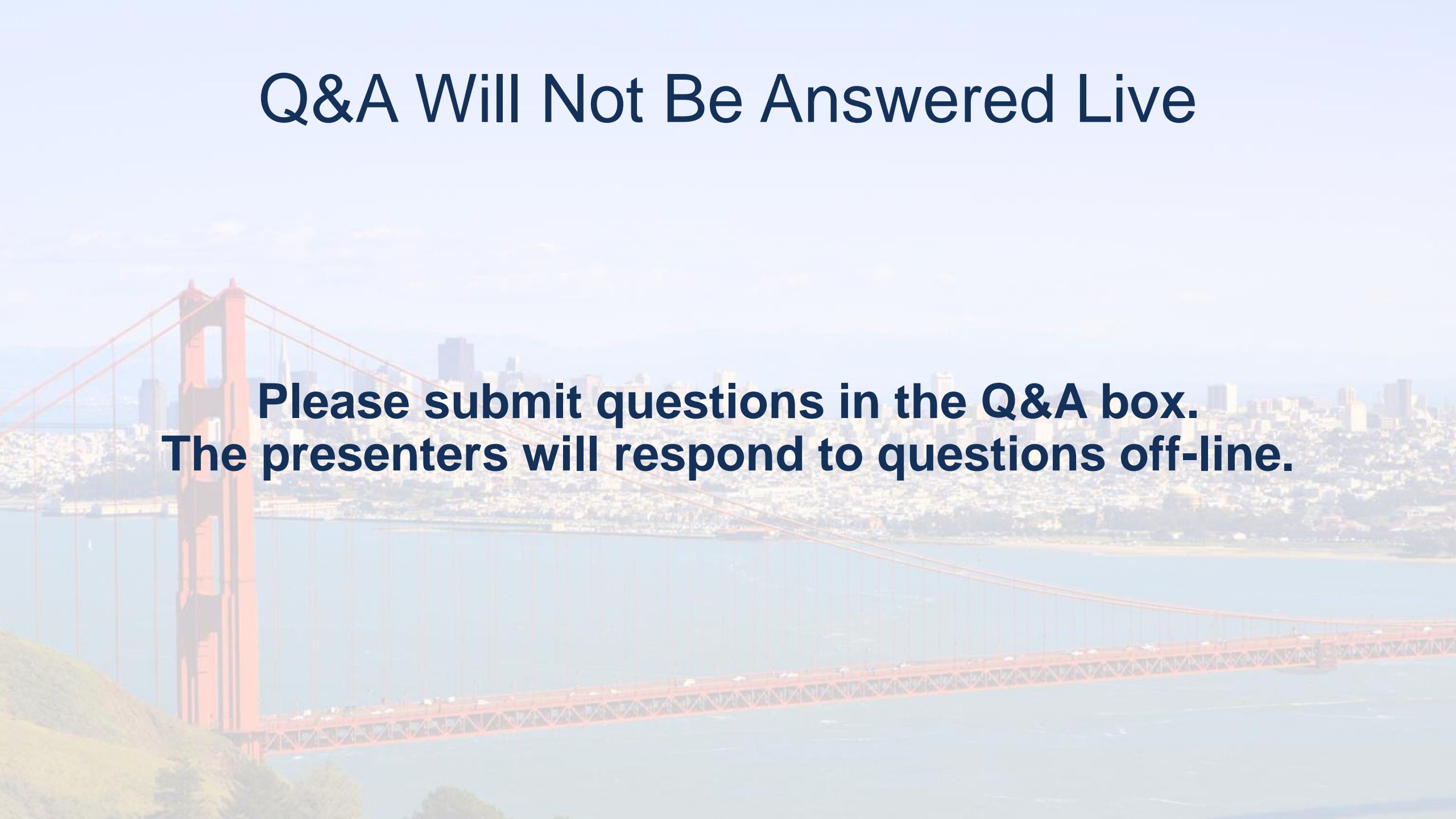


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Q&A Will Not Be Answered Live

**Please submit questions in the Q&A box.
The presenters will respond to questions off-line.**



Agenda

Introduction

Why low carbon EN253 district energy systems?

Setting the right implementation team

The importance of training and proper site supervision

Advantages of EN253 pipe design and implementation

Pitfalls that drives up the cost

Case stories & District Energy Handbook

The Danish District Energy Advisory (DDEA)

- Part of The Danish Trade Council North America
- We mostly work in **Alliances** – a group of Danish companies within same system technologies
 - E.g. from district energy produktion to distribution to end consumers
- Represent all aspects of district energy from planning, feasibility, design, production, distribution, implementation, commissioning and equipment supply
- We also work individually with Danish companies solely or within the Alliances – also competitors!



Rathco ENG



- Canadian Engineering Company
- We work for public and private organizations helping them conceptualize, evaluate, and develop business models for district energy systems.
 - District energy systems range from 3rd generation (80C supply) to ambient (30C supply)
 - Energy source technology is all low or zero carbon
 - Geothermal
 - Biomass
 - Solar thermal
 - Supplemental gas boilers
- Provide detailed engineering designs for tender and construction.
- **Provide 3rd party inspection services for QA/QC of EN253 piping installations.**



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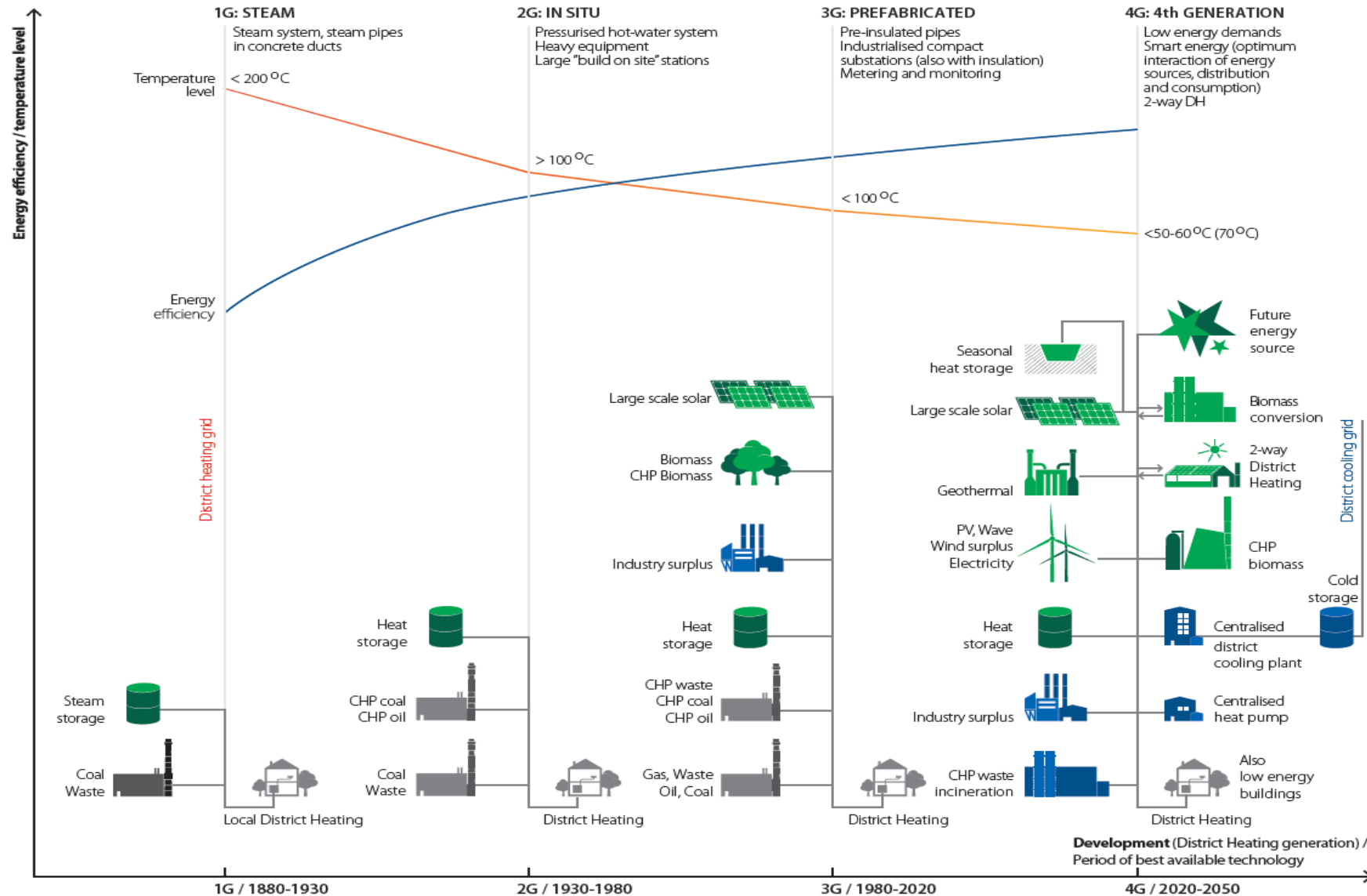
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The evolution of low carbon DE systems



Why Low Carbon Hot Water District heating?

- ✓ Heat losses and thereby fuel consumption to be significantly reduced up to 50%
- ✓ For heating of residential housing (with internal water born heating loops), DH supply temperature do not need to be higher than **140-158 F** (3rd generation DH in DK)
 - ✓ The same goes for domestic hot water (legionella eliminated at >113 F)
- ✓ With the newest building codes in Denmark DH supply temperature can be as low as **122 F** (4th generation DH in DK)
 - ✓ In such residential area DH return water from 3rd G DH area can be used as supply water for 4th G DH area
- ✓ Introducing electricity in hot water DH system is energy efficient, and is part of the next generation DH in DK (5th generation w 104 F supply temp)

The pre-insulated hot water EN253 pipes is essential

- Supply temperature below 185 F – the lower the better
- Return temperature down to 122 – the lower the better
- Pre-insulated prefabricated DH pipes, valves and fittings with different insulation classes 1 to 3 (3 is highest insulation class)
- Pre-insulated pipes delivered to site is typical lengths of 40 feet up to size 14"
- Steel pipes schedule 10 according to European standards
- Pipes direct buried (3-4 feet) and flexible to implement



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Implementation team essentials

- ✓ Need to select the correct and most experienced engineers to know and understand how best to design and implement EN253 piping.
- ✓ Need to ensure that engineer, 3rd party inspector, installer, and owner are **ALL** properly educated and trained.
- ✓ Encourage question asking and seeking knowledge.
- ✓ Mistakes will be made. We need to know about them.



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Elements of successful EN253 pipe installation

- ✓ Independent inspector
- ✓ Weld inspections
- ✓ Joint inspections
- ✓ Leak detecting the welds
- ✓ Install and check a leak detection system
- ✓ Documentation
- ✓ Accountability



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Shallow burring and limited excavation work

- The trench depth can be as little as 2-3 feet
- For a EN253 pipe system the trench only need to be 6-8 feet wide
- If the crossing of obstacles in the trench is limited, then 3-6 lengths of 40" feet pipes can be welded and finished on the ground and lifted down in the trench in one lift



Flexibility....

- High level of flexibility to pass over/under obstacles in the trench
- Easy to fit on site for change in trench directions and/or in trench curves
- Pipe pieces for sudden changes in trench directions/-depth can be ordered as pre-fab



Easy welding and muffing of insulation



- The schedule 10 EN253 pipes only need 3-4 welding seams to weld together
- The insulation of the weld ends is easily done with a liquid two component insulation mixed on site
- The EN253 comes with leak detection wires fitted in the insulation which is a huge advantage if installed correctly for maintaining lifetime of a EN253 pipe system to >30 years

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District Energy in Denmark vs NA

Why is it 3-5 times more expensive to bury 1 foot of pre-insulated pipe 3-4 feet down in the ground in US than in Denmark?

- Lack of knowledge of the technologies and especially best practices
- Contractors and sub-contractors tend to put high contingency on the price estimates due to uncertainty of the technologies and best practices
- The advantages with the thin walled pre-insulated steel pipes is not utilized in full
- The cost of not spending enough money up front on proper education, training and especially site supervision & QA/QC procedures is underestimated



District Energy in Denmark/EU vs NA

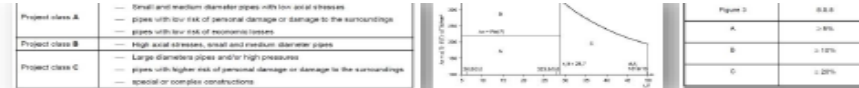
European standards in NA – really??

- In general standards and regulations is measures to avoid fatal system and design failures, accidents, design mistakes etc. and to give guidelines for best practices and good design praxis.
- If you dive down in the difference between the standards it can actually be filtered down to not too many major differences.

ASME B31.1 vs. EN13941 ...

Regulation: ASME B31.1 – Power Piping

- **X-Ray not required**
- **Alignment to be within 2mm**
- **Hydrostatic pressure test to be 1.5 times the design pressure, held for 10 minutes, then reduced to design for leak test**



Standard: EN 13941 – Design and installation of pre-insulated bonded pipe systems for district heating

- **X-Ray required on 10% of welds**
(X-ray % depends on project class)
- **Alignment to be within 1 mm**
- **Pressure test is not required, but weld leak tightness test of all welds is mandatory**

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Some good case stories

- **Sheridan College, ON, Canada**
- Complete steam to hot water conversion:
 - Danish pre-insulated pipes and Danish unit based ETS
 - Proper planning and phasing
 - Proper training of contractors, welders and site supervisors
 - Demonstrating significant heat loss reduction!
- **Copenhagen, Denmark – First Carbon Neutral Capitol by 2025**
- The backbone of carbon neutrality is low carbon district energy (heating and cooling)
 - By 2021 100 % of all households will be connected to district heating
 - Heating and cooling production from biomass, geothermal heating, heat pumps, municipal waste, straw, surplus heat and sea water heat pumps to come
 - Danish pre-insulated EN253 pipes

Some good case stories

- **Zibi-project, Ottawa, On, Canada**
 - 5 million sqft of net zero carbon, mixed use development
 - 4th and 5th generation district energy systems (60C supply & 30C supply)
 - EN253 piping used exclusively on 4th generation system included inter-provincial bridge crossing
- **District Energy St. Paul**
 - NA largest low carbon district heating system
 - Danish pre-insulated pipes
 - Have been in operation since the late 80's!
 - District heating production mainly from biomass
 - Demonstrating the long lifetime of the pre-insulated thin walled DH pipes in NA!!

DDEA - District Energy Handbook As a Tool

Support the development of district heating, cooling and energy distribution in the North American market

Thank you!!



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