4th Generation District Energy

4GDE

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Outline

Evolution of District Energy

Case Studies

Energy Storage – thermal and electric

Woodstock Renewable Heat

Impediments

Key Benefits of 4GDE
4G-DE

Solar thermal

Heat pumps

Wind energy

Waste-to-energy

Geothermal

Cogeneration

Industry surplus heat

Biomass
Jamestown, NY, District Heat System - DCHP

- By-product from power plant
- 80 Customers, 250 apartments
- Hot water system, 250°F
- Municipal ownership
- $14 million saved in 1st 20 years

“130 individual boilers shut down by customers connected to the District Heat system.”
Dr. I. Oliker, P.E.
Stanford University – 4GDE: CHC – Combined Heating and Cooling
Optimum renewable system temperature

Source: Stanford University, Draft Energy & Climate Plan (April 2009)
Figure 4. Greenhouse gas emissions trend, Stanford University, 1990-2017. (Graph reflects actual emissions through 2014 and estimated for 2015-2017.)

Heat Recovery in Other US Regions

1 - Stanford

2 - U of Illinois

3 - UC Davis

4 - Similar at university in New England (62% Cooling, 43% Heating)

Source: Stanford University.
Danish solar district heating map

Dronninglund seasonal solar heat storage, 45 acre feet.

Dronninglund solar hot water panels, 9 acre surface
Proposed Woodstock Renewable Heat Project site.

Woodstock Western Hamlet region.  Woodstock Transition & Town of Woodstock
Proposed Woodstock Renewable Heat Project
- 108 homes, 1,000 sq. ft. av.
- 300 seat theater
- Three restaurants
- Record Studio & radio station
- Fire Dept. building
- Offices and light commercial
- 40 room hotel, planned.

Goal:
Assess and promote municipal 4GDH:
- Heat Pumps: air and ground source
- Solar thermal
- Thermal storage
- Recycled heat

Landsby Naervarme, Denmark
Kingston, NY

- Locking in long-term fossil fuel, $ millions of taxpayer money.
- 1991 District Energy study, two hospitals and two educational facilities.
Energy Storage Comparison
Unit Investment Costs

Electricity

Central
€125/kWh

Decentral
€300/kWh

Thermal

Central
€1/kWh

Decentral
€90/kWh

Credit – David Connelly
Rensselaer, NY. Empire Generating,

14th Street, NY, NY (partial cogeneration to DH)
Random Timeline

• **National Action Plan for DHC/C**: US DOE & NYSERDA (keynote by Eugene McGrath, president of ConEd) – Two day workshop in 1991

• **3rd Global District Energy Awards** in NYC. HELEN – 2013

• **1st Conference** on Smart Energy Systems and 4G-District Heating (4GDH) - 2015, Aalborg, Denmark.

• **Campus Energy 2018**, key shift from steam to hot water
Accelerants needed:

• Clear policy to include 4GDE
• Create utility incentives, IOU’s Coop’s and Muni’s
• Supportive legislative/regulatory framework/tracks (PSC’s).
• Question regulatory silos separating electric, thermal and gas
• Explore 4GDE as a key to decarbonization
• Exergy – as a planning tool
• RGGI – expand reach and add “negatherm” credit
Key Attributes of 4GDE

• Higher adoption/participation rates
• Easier consumer choice
• Lower cost: (density cost curves - Sven Werner, etc.)
• Electric load shedding – with cold storage
• Gas grid load shedding – with heat storage.
• Dynamic capability: harness by-product and ambient heat.
• Medium and low temperature allows combustion free systems
• Integration with “Smart Energy Systems” (electric, thermal and trans.)
4GDE can be an effective key to achieving deep decarbonization over the long term.
Resources

- [www.4dh.eu](http://www.4dh.eu) Aalborg University
- [www.districtenergy.org](http://www.districtenergy.org) International District Energy Association
- [www.euroheat.org](http://www.euroheat.org) DHC+ Technology Platform
- [http://www.iea-dhc.org](http://www.iea-dhc.org) IEA DHC Program

Thank you.

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