

Eric Peterson

District heading = break through for geothermal commercialization

District heading studies by DOE (Demonstrations, POWS)

Klamath Falls

Monroe

El Centro

Boise

Elk ~~City~~

Madison Kernburg Ed

Keno

Payson

Susannah

Future emphasis:

Technical Professional Assoc. Support

Trade Assoc.

Engineering Tech. Support - INEL + OIT 100 hrs. Engineering support

Community Support

Public Awareness

L. LARSON

400 District heating schemes in Denmark  
Range from 500 users to 20,000-30,000 houses  
per system

35% of all houses in Denmark on District Heating  
mostly SFR  $\approx$  700,000 dwellings  
10,000 miles double mains  
 $2.48 \times 10^{12}$  BTU/yr.

Started district heating schemes in 1960's

- 1) economic reasons
- 2) air pollution reasons

4 Types  
Cogeneration  
Refuse Incineration

### NW Denmark

Geothermal potential

Already have district heating scheme  
so can use geothermal water  $\neq$  heat exchanger  
will use w/ an oil burner  
will re-inject cold water  
pumped to users  $\rightarrow$  back to plant  $\rightarrow$  re-inject  
"Hot water conducting porous rock"

oil-fired burners as supplements to geothermal

sizeable decrease in air pollution

## Measuring

- 1) measure consumption of  $H_2O$  in  $ft^3$  or  $m^3$
- 2) measure consumption of heat (BTU)

Longest distance from generating plant to consumer:  
500 miles of mains (this example is from  
radius distance  $\approx$  12 km coal-fired)

~~at~~ 3,000 to hook up a house to district heating system

3 km -  $100^\circ C$

KJMER

## District heating

"most economical source of energy available"

pump hot  $H_2O$  / steam used for only 2 distinct heating schemes  
space conditioning, heating domestic  $H_2O$

45% of total energy consumption in Denmark  
used for space heating & heating  $H_2O$

Typical power plant: 40% of energy dissipated  
to atmosphere

could combine some of this in  
cogeneration plant for district heating  
Using  $100^\circ C$   $H_2O$

WASTE  
TUES

5 tons refuse  $\approx$  1 ton oil

takes special plant to burn it  
produce hot  $H_2O$  for district heating  
75,000 tons/day waste burned

WASTE  
HEAT

Hot water from industry  
use for district heating rather than evaporating  
to environment as waste heat

Harmer - Sourenson

Geothermal in Germany + Denmark

N + NW Jutland (Denmark)

discovered in borehole drilled for other purposes

Expect  $212^{\circ}\text{F}$   $\text{H}_2\text{O}$

Denmark well  
3,000 meters deep

Drilling still in progress

found hot  $\text{H}_2\text{O}$

$212^{\circ}\text{F}$  flow ~~200~~  $\approx 150$   $\text{ft}^3/\text{min}$

$4 \times 10^6$  BTU/hr

$100^{\circ}\text{C} \rightarrow 53^{\circ}\text{C}$   $\Delta T$

~~30~~

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N. part Rhine Valley in southern Germany

must create distinct heating scheme

drilling in graben

hoping to intersect Rhine Graben fault

water circulating to depth

3000-5000<sup>#</sup> meters get hot  $\text{H}_2\text{O}$

getting  $90-120^{\circ}\text{C}$   $\text{H}_2\text{O}$

could w/ heat pump Spring-Fall

Approx cost \$7M

~~M. Larsen~~

Harmer - Jonsson

Corrosion of ductile casting pipes  
largely due to external g.w.