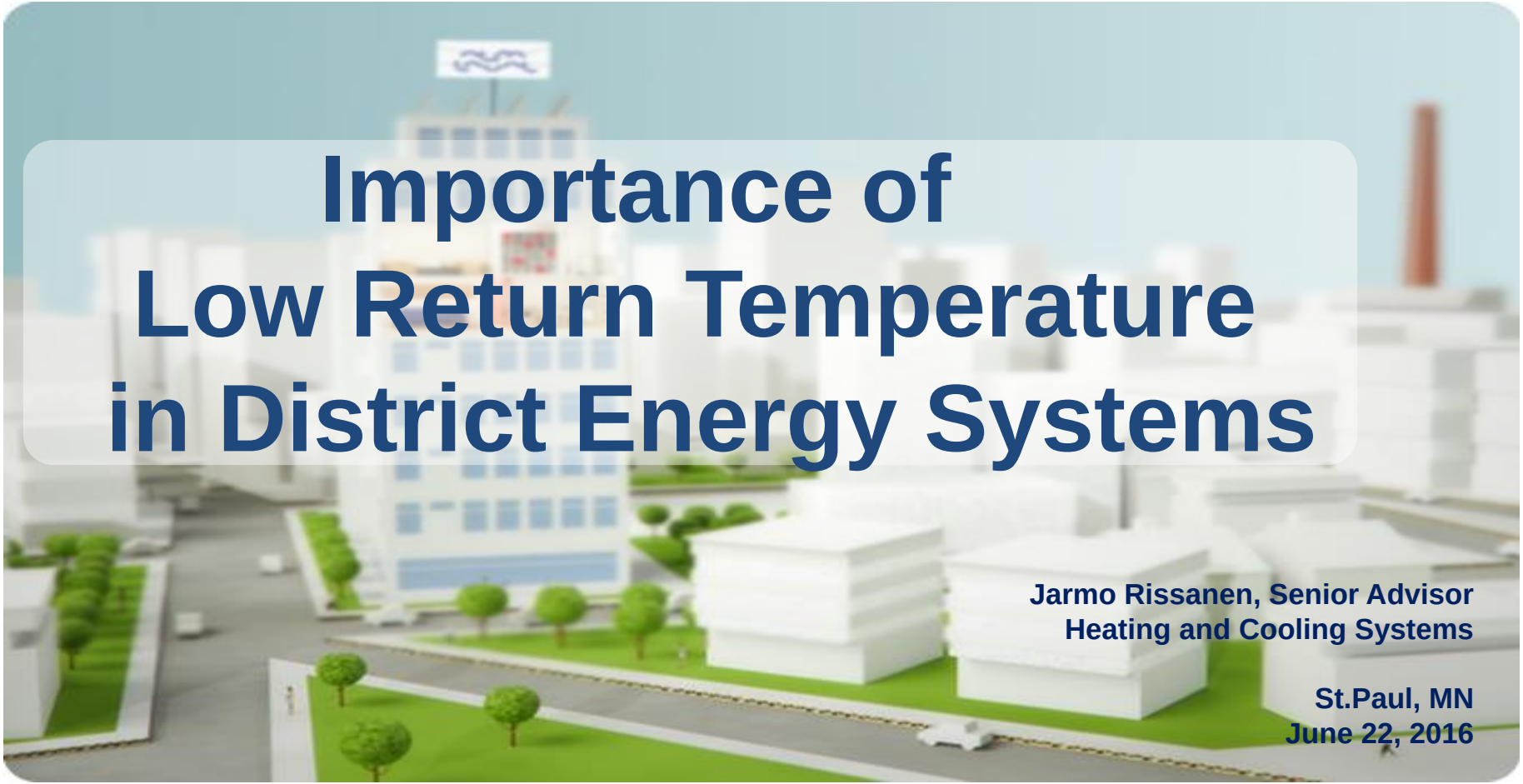

# Importance of Low Return Temperature in District Energy Systems

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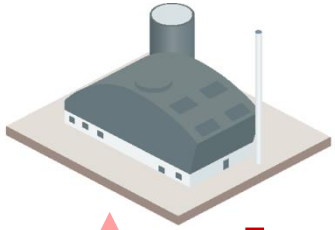
**Heating and Cooling Systems**

**St.Paul, MN**
**June 22, 2016**

**In my hometown Helsinki, our DE Company, HELEN Ltd, saves 1M USD annually if DE return temperature is decreased 1°C (1.8°F)**

# Low return temperature, why?



Low return temperature reduces heat loss in pipes and has a positive influence on efficiency in heat production = **$$**

size

ΔT



**Capacity = m * $C_p$ * ΔT**

m = mass flow

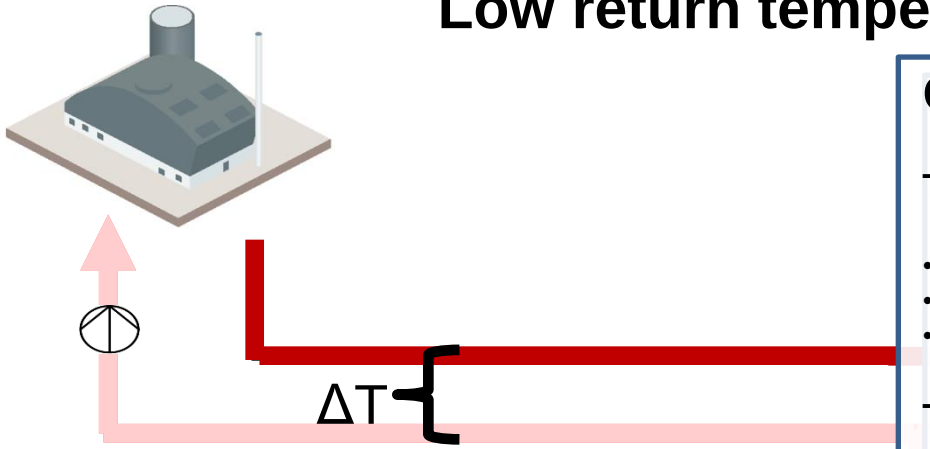
$C_p$ = Constant

$\Delta T = Temp_{supply} - Temp_{return}$

<u>Mass flow influences:</u>

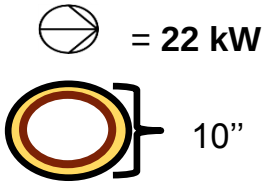
- Dimensions and consumption of electricity (kWh) in pumps = **$$**
- Pipe dimension = **$$**

# Low return temperature, 2 cases



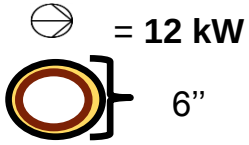

## Case 1

Capacity = 10 MW ( 9.500 BTU/s)
Temp. = **220-165°F (**104-74 °C)
ΔT = **54°F (**30 °C)
m = **1300 GPM** (82 l/s)
Pipes = **10”** (DN 250)




## Case 2

Capacity = 10 MW (9.500 BTU/s)
Temp. = **220-112 °F** (104-44 °C)
ΔT = **108°F (**60 °C)
m = **650 GPM** (41 l/s)
Pipes = **6”** (DN 150 )




## Operational SAVINGS

**The lower return temperature saves because:**

- **Less heat losses in return pipe**
- **Better efficiency in power plant (less fuel etc.)**
- **Less pumping costs**

**Total savings for 1°C (1.8°F) is** approximately
**0.16 $ /(°C MWh Year)**

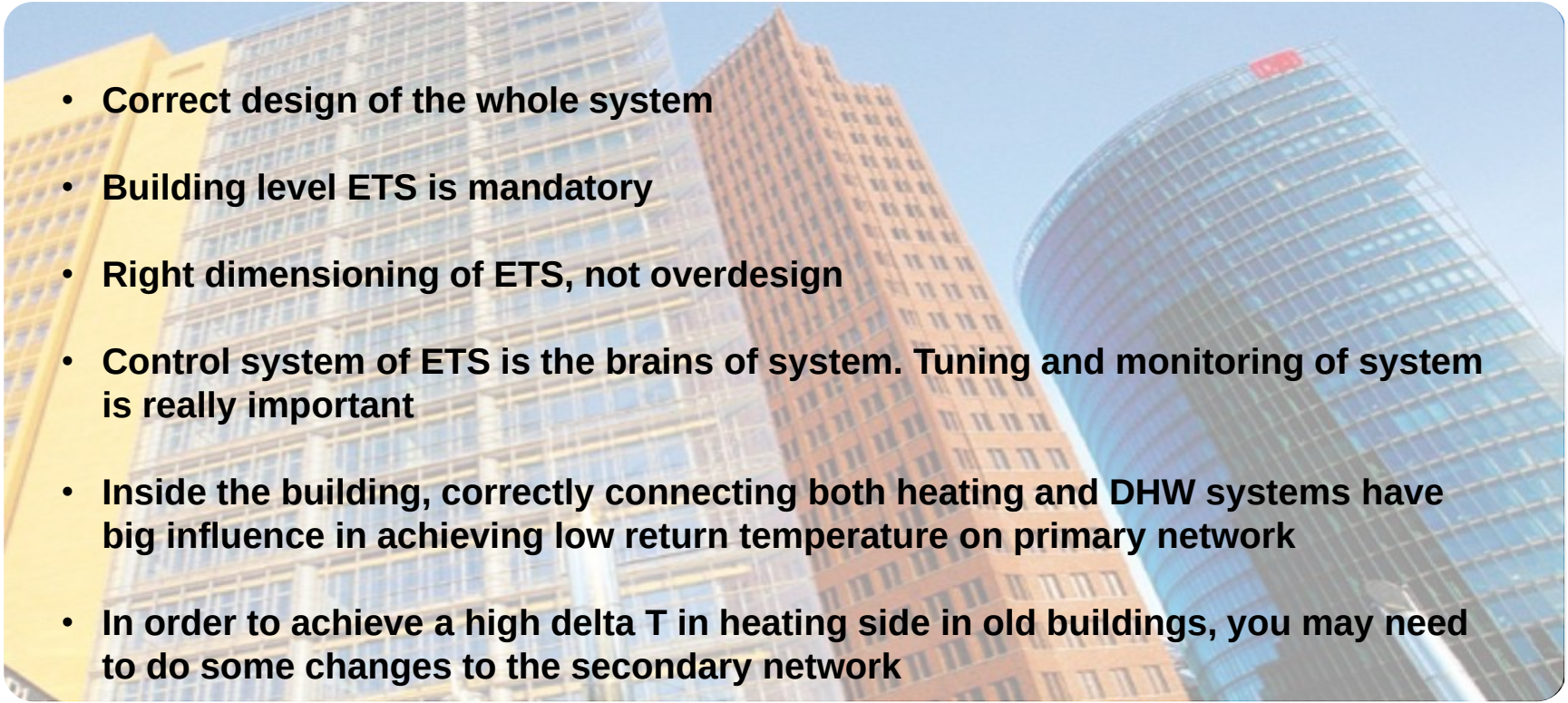
With a yearly production of 25,000 MWh (10MW plant)

$0.16 * 25,000 → $4,000 / 1°C / year

**30°C (54°F) lower return temperature**
→
**30°C * 4.000 $ = $120,000 savings per year**

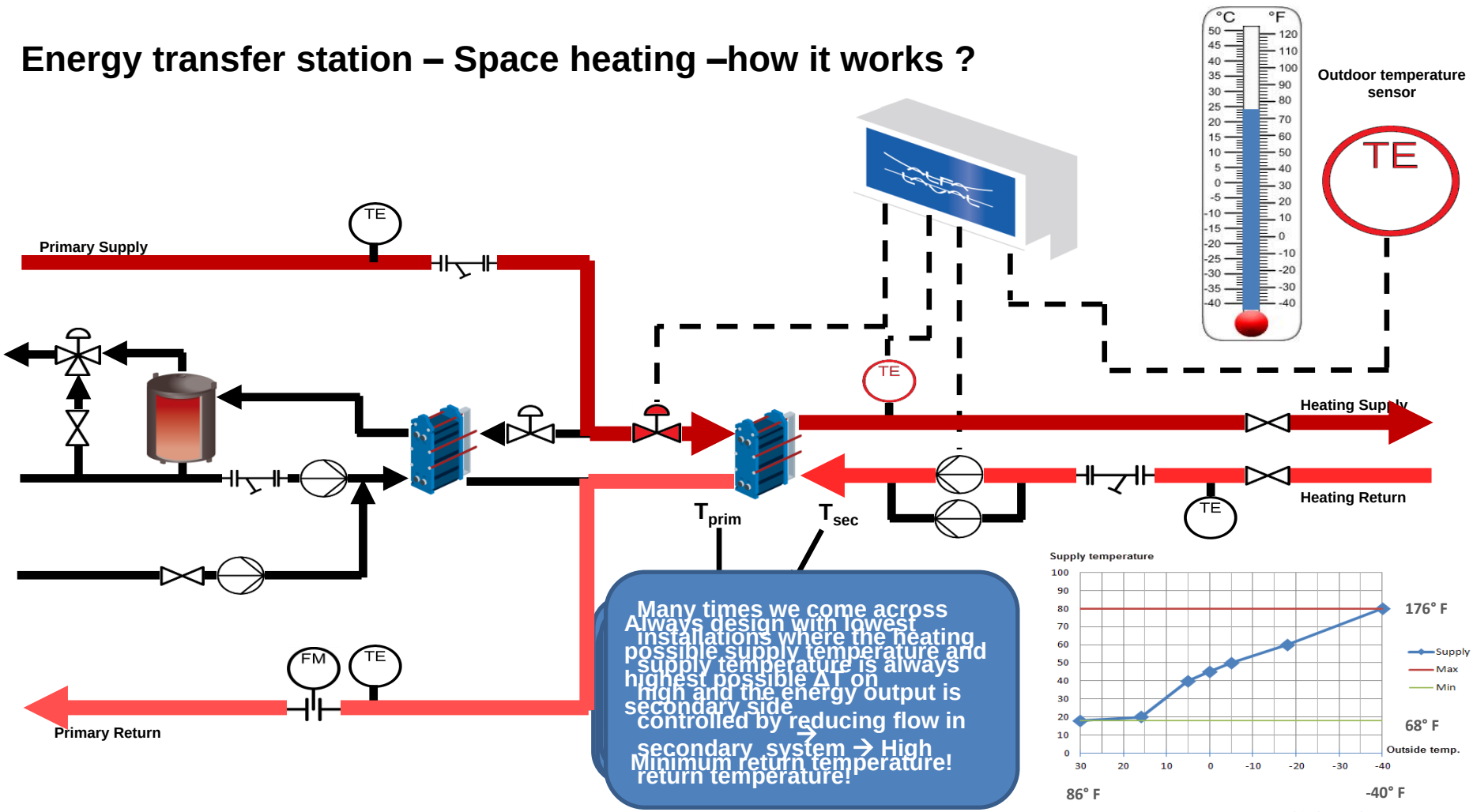
**In 30 years 3.6M USD**

# How to decrease return temperature ?



- Correct design of the whole system
- Building level ETS is mandatory
- Right dimensioning of ETS, not overdesign
- Control system of ETS is the brains of system. Tuning and monitoring of system is really important
- Inside the building, correctly connecting both heating and DHW systems have big influence in achieving low return temperature on primary network
- In order to achieve a high delta T in heating side in old buildings, you may need to do some changes to the secondary network

# Energy transfer station – Space heating –how it works ?

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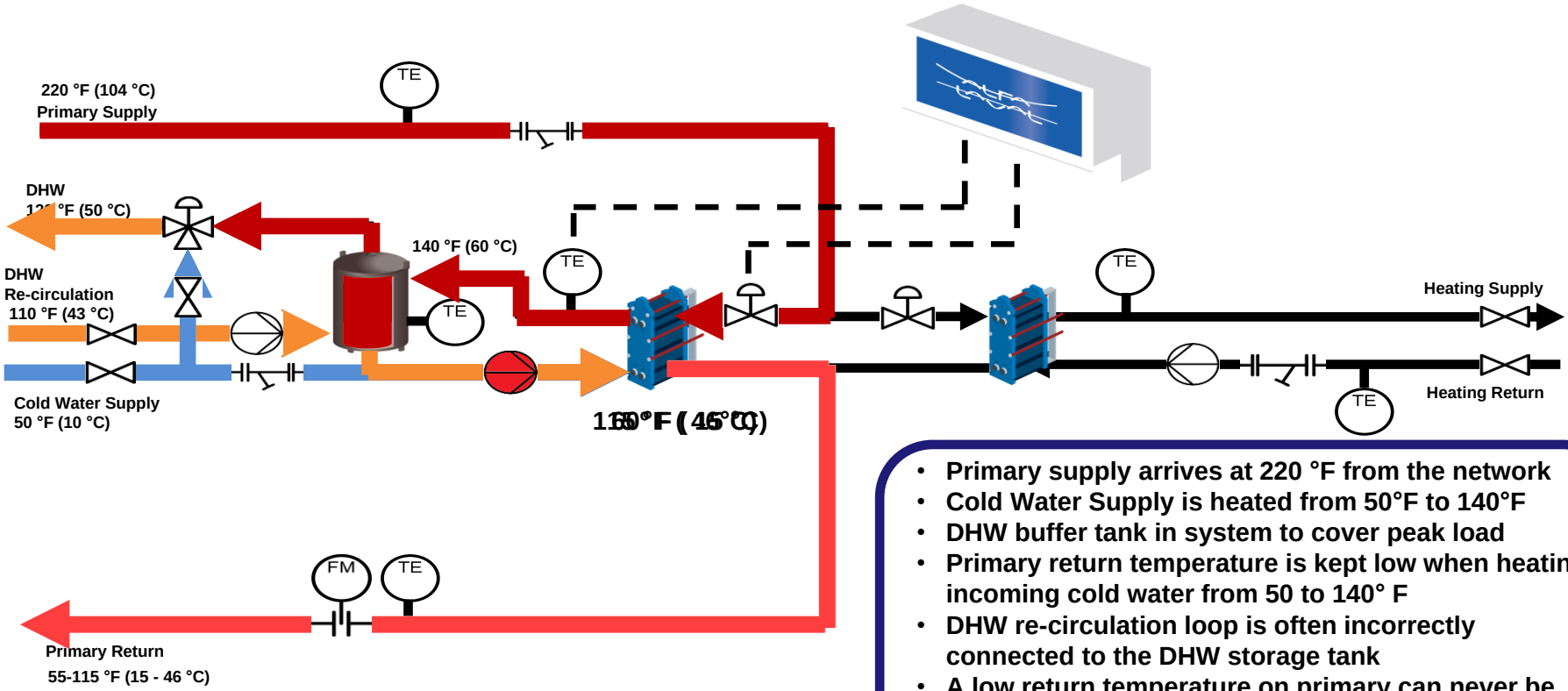
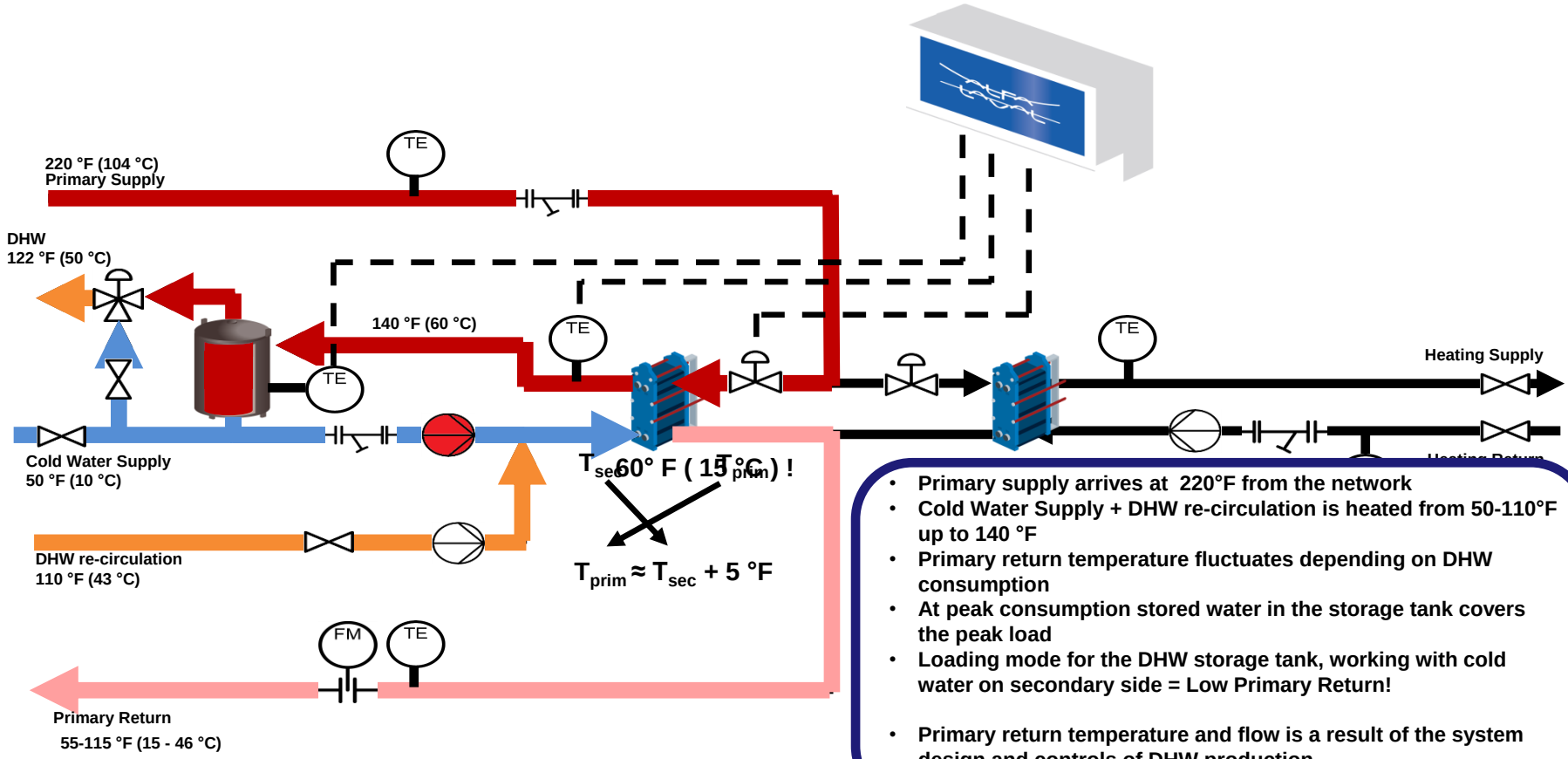
# Energy transfer station - Domestic Hot Water with Accumulation #1




- Primary supply arrives at 220 °F from the network
- Cold Water Supply is heated from 50°F to 140°F
- DHW buffer tank in system to cover peak load
- Primary return temperature is kept low when heating incoming cold water from 50 to 140° F
- DHW re-circulation loop is often incorrectly connected to the DHW storage tank
- A low return temperature on primary can never be achieved when charging the storage tank in this configuration.

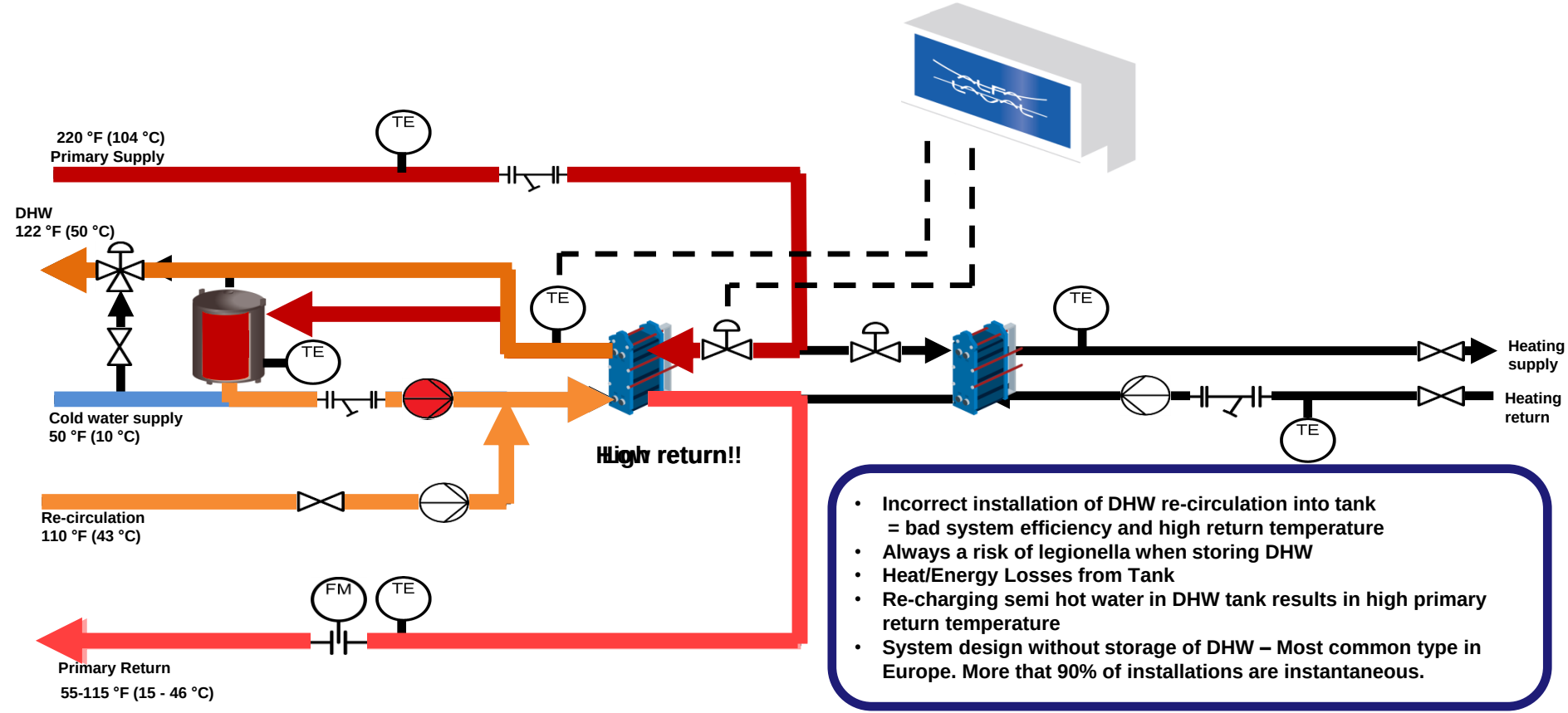
# Energy transfer station - Domestic Hot Water with Accumulation #2




- Primary supply arrives at 220°F from the network
- Cold Water Supply + DHW re-circulation is heated from 50-110°F up to 140 °F
- Primary return temperature fluctuates depending on DHW consumption
- At peak consumption stored water in the storage tank covers the peak load
- Loading mode for the DHW storage tank, working with cold water on secondary side = Low Primary Return!

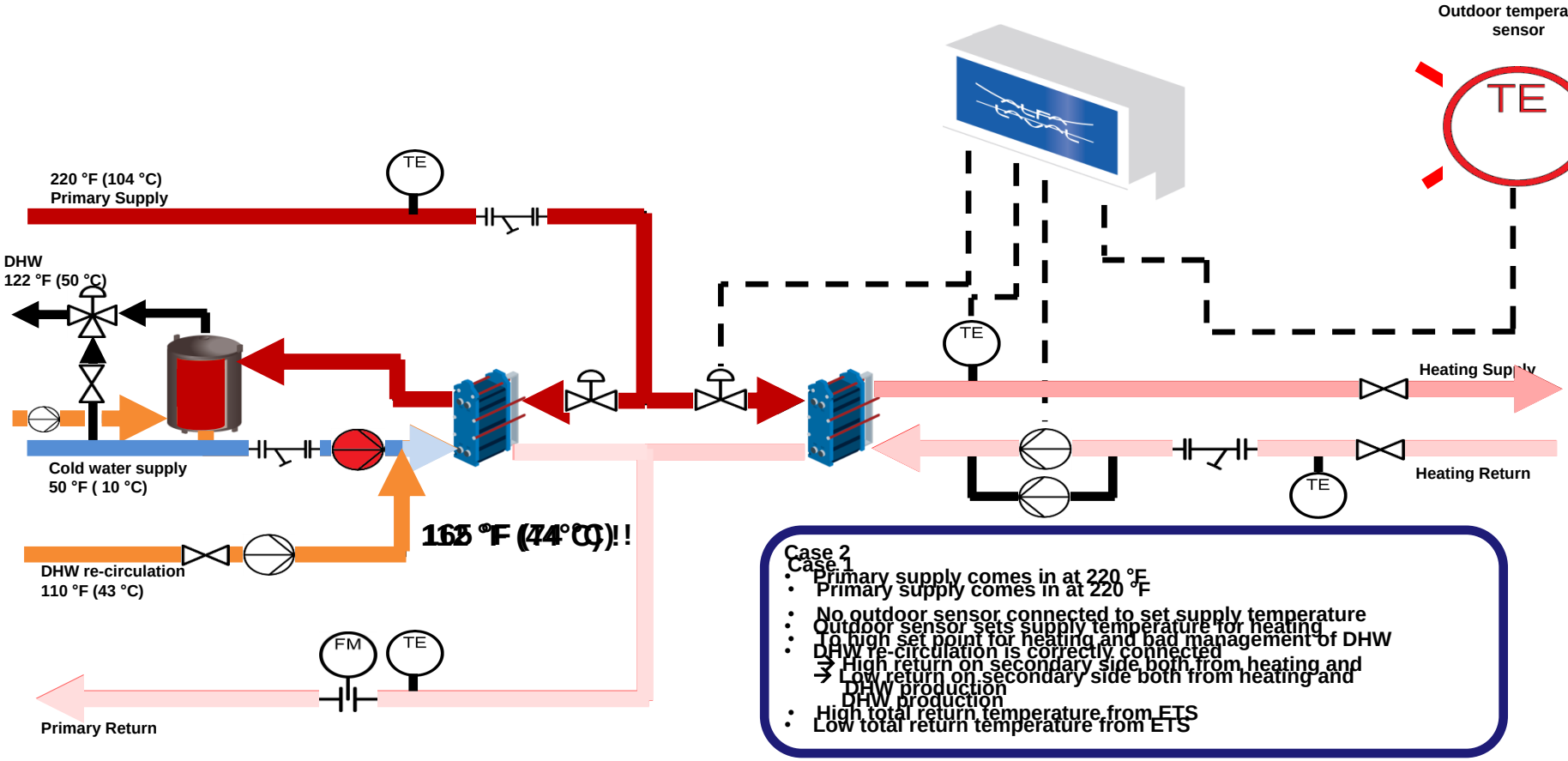
- Primary return temperature and flow is a result of the system design and controls of DHW production

# Energy transfer station - Domestic Hot Water without DHW storage




- Incorrect installation of DHW re-circulation into tank
  = bad system efficiency and high return temperature
- Always a risk of legionella when storing DHW
- Heat/Energy Losses from Tank
- Re-charging semi hot water in DHW tank results in high primary return temperature
- System design without storage of DHW – Most common type in Europe. More that 90% of installations are instantaneous.

# Energy transfer station – Space heating + DHW



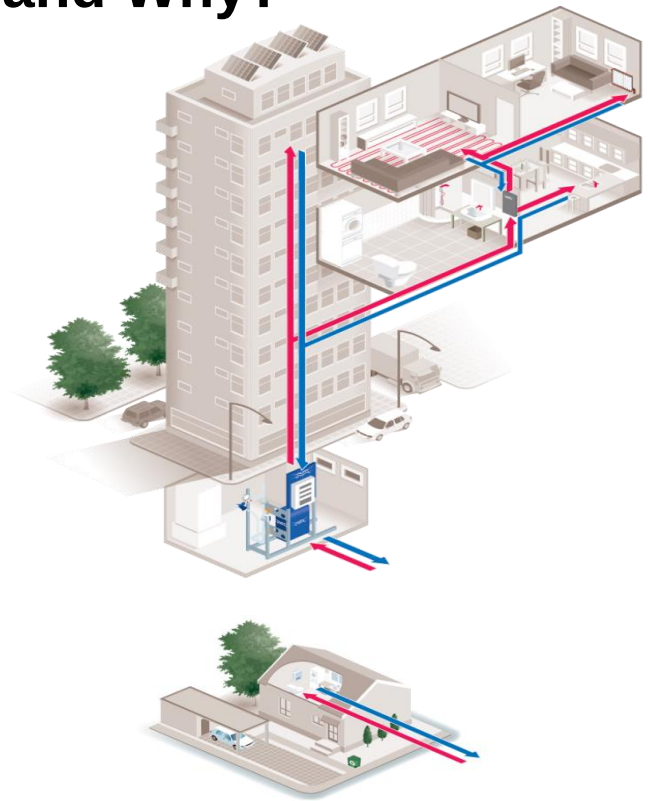

Case 1
- Primary supply comes in at 220 °F
- No outdoor sensor connected to set supply temperature
- To high set point for heating and bad management of DHW
- DHW re-circulation is correctly connected
  → High return on secondary side both from heating and DHW production
- High total return temperature from ETS

Case 2
- Primary supply comes in at 220 °F
- Outdoor sensor sets supply temperature for heating
- DHW re-circulation is correctly connected
  → Low return on secondary side both from heating and DHW production
- Low total return temperature from ETS

# Low Return Temperature: How and Why?

**HOW:**

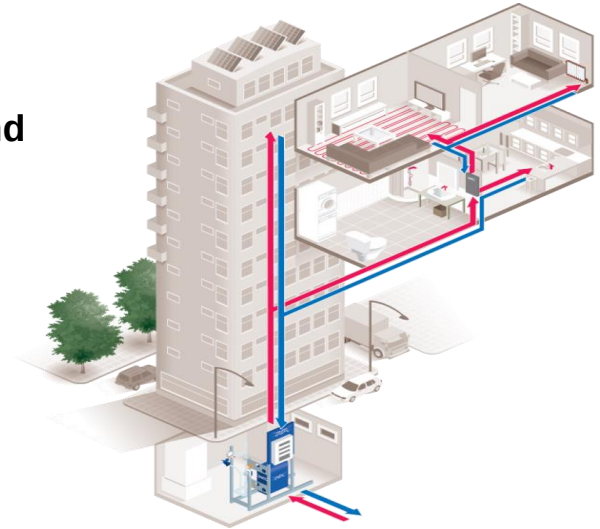
- Correct design of whole DE system
- Correct connection types in DHW and Space Heating side
- Modern ETS with intelligent controller, tuning and monitoring of systems



# Low Return Temperature: How and Why?

## WHY:

- High delta T and low return temperature **reduces the mass flow and heat loses** in the distribution system.
- A low mass flow in the distribution system **reduces the pipe and component sizes and significantly reduces investments** in infrastructure
- Less mass flow to circulate means smaller pumps and **less use of electricity** for pumps.
- Increased energy efficiency in power plant
- Even one degree matters, and a lot in the long run!
- **IT'S A QUESTION ABOUT MONEY $$$**
- And at the same time we reduce carbon emissions and save the planet for future generations !



# Thank you !

Questions?

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