The application of degassed conductivity in DONG Energy Power Plants

SIAPWS Meeting, 12 March 2015

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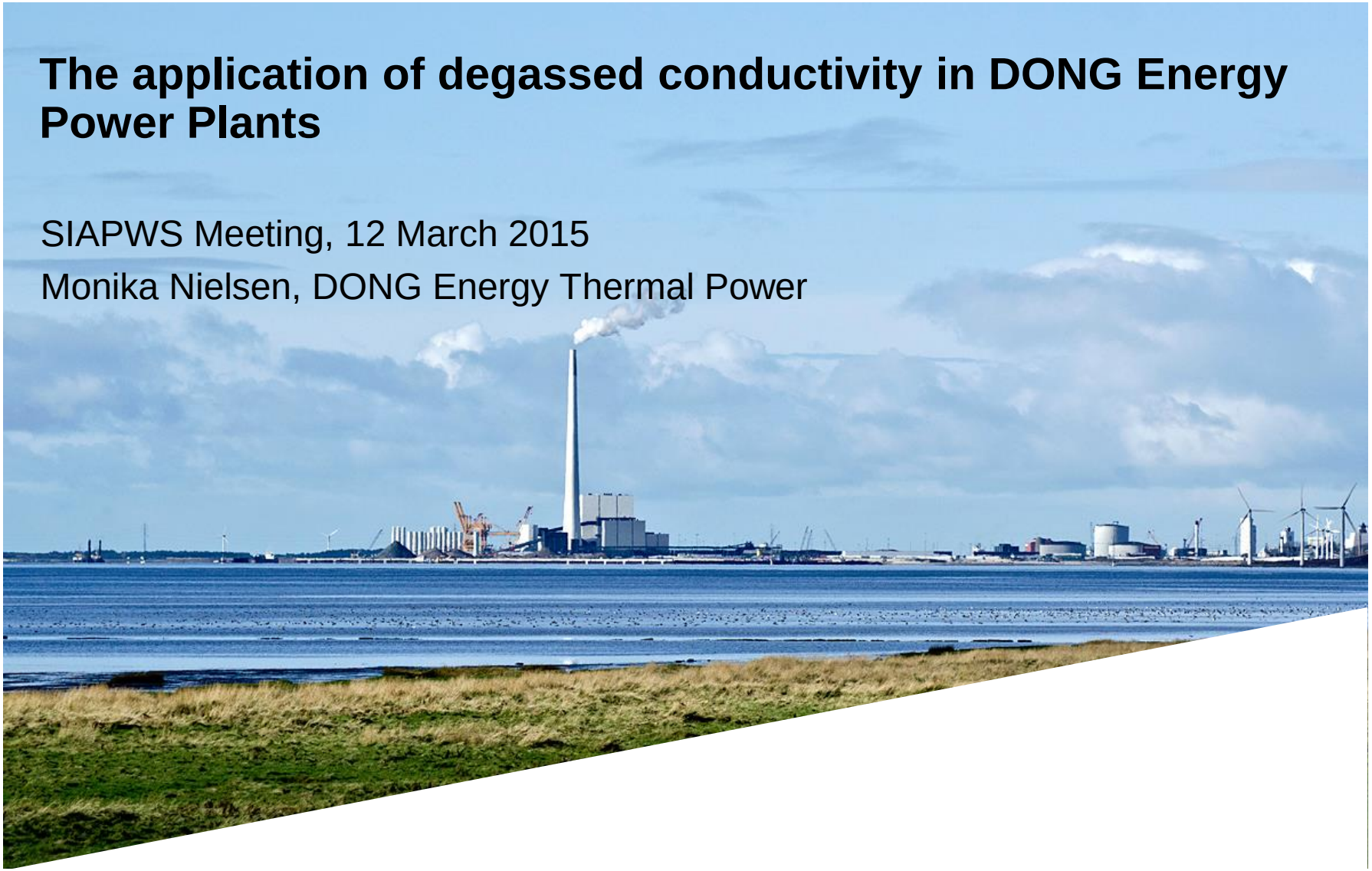

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When do we use degassed conductivity?

1. To detect the degradation of organic matter in steam
2. To detect air in-leakage in water/steam circuits, and rule out salt impurities.
3. To achieve faster start-up at power plants with known CO_2 contamination

What possibilities do we have to measure degassed conductivity?

- One portable SWAN Deltacon DG for trouble shooting at all our power plants
- One stationary SWAN Deltacon DG at Asnæs Power Plant
- Three stationary SWAN Deltacon DG at Herning Power Plant (delivered, but not yet installed)

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Detection of organic matter i steam at Asnæs Power Plant

- Asnæs Power Plant Unit 2 is a 370 MWth coal fired drum boiler
- Condensate Polishing Plant (CPP) = 3 MB filters (150 %)
- The primary production is process steam to NOVO Nordisk and Statoil and district heat to Kalundborg Forsyning.
- No condensate return when producing process steam
- Makeup Water consumption of approx. 800.000 m^3/year
- Raw water source is surface water

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Detection of organic matter i steam at Asnæs Power Plant

Surface water from Tissø

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Flocculation with $FeCl_3$ and polymer

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Sand filtration

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Scavenger

↓

KAT-ion Exchanger

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CO_2 degasser

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AN-ion Exchanger

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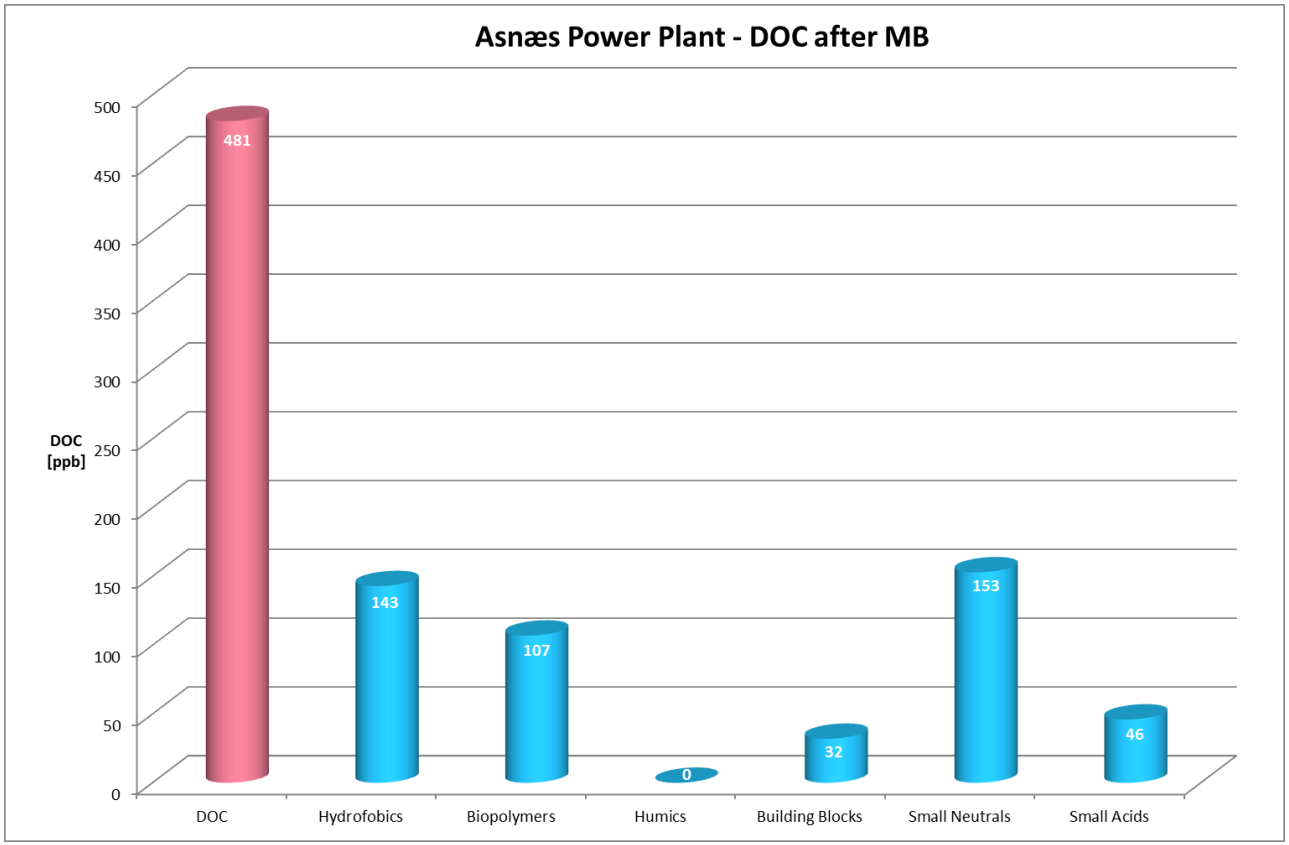
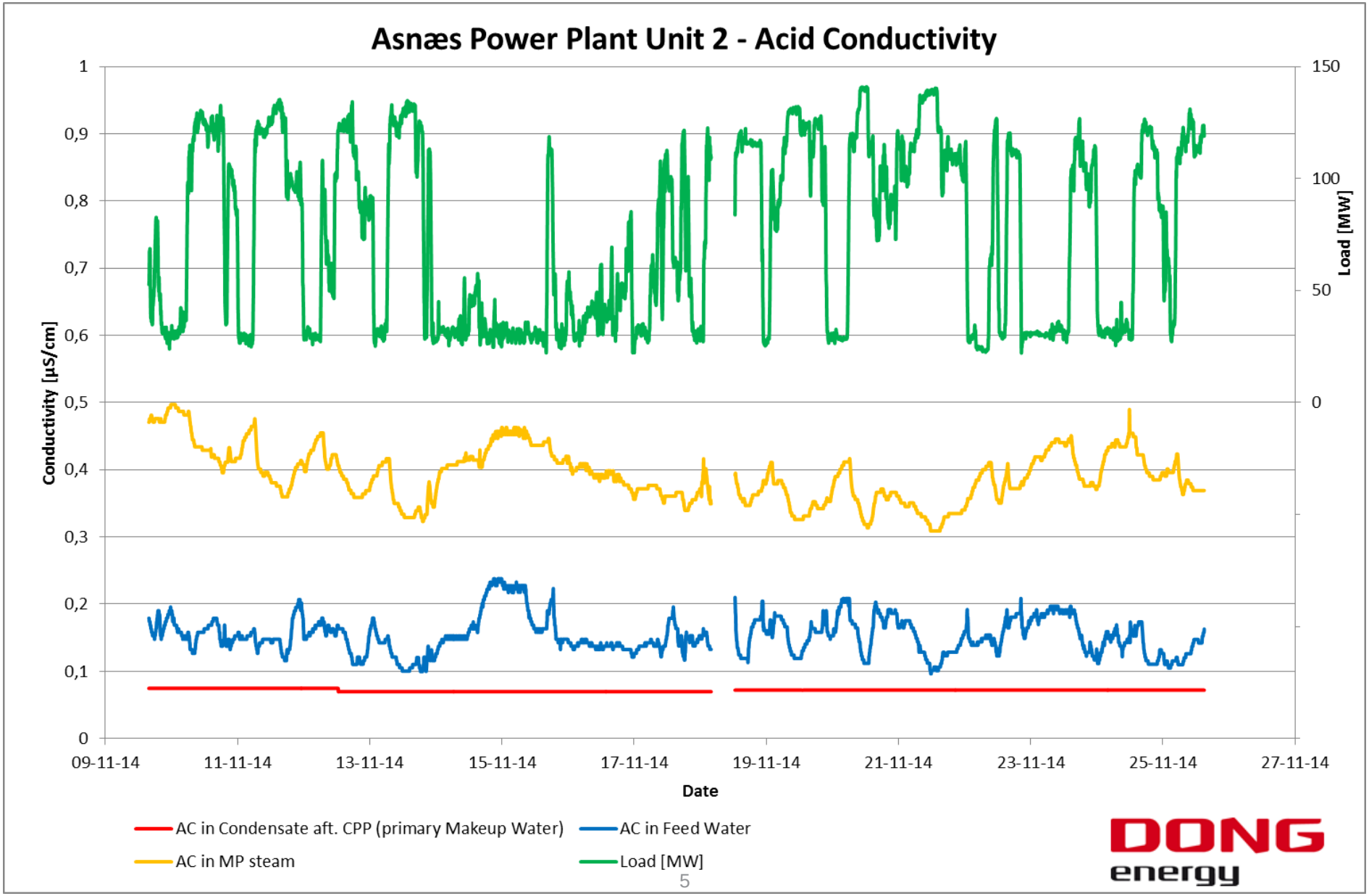
Mix-Bed

↓

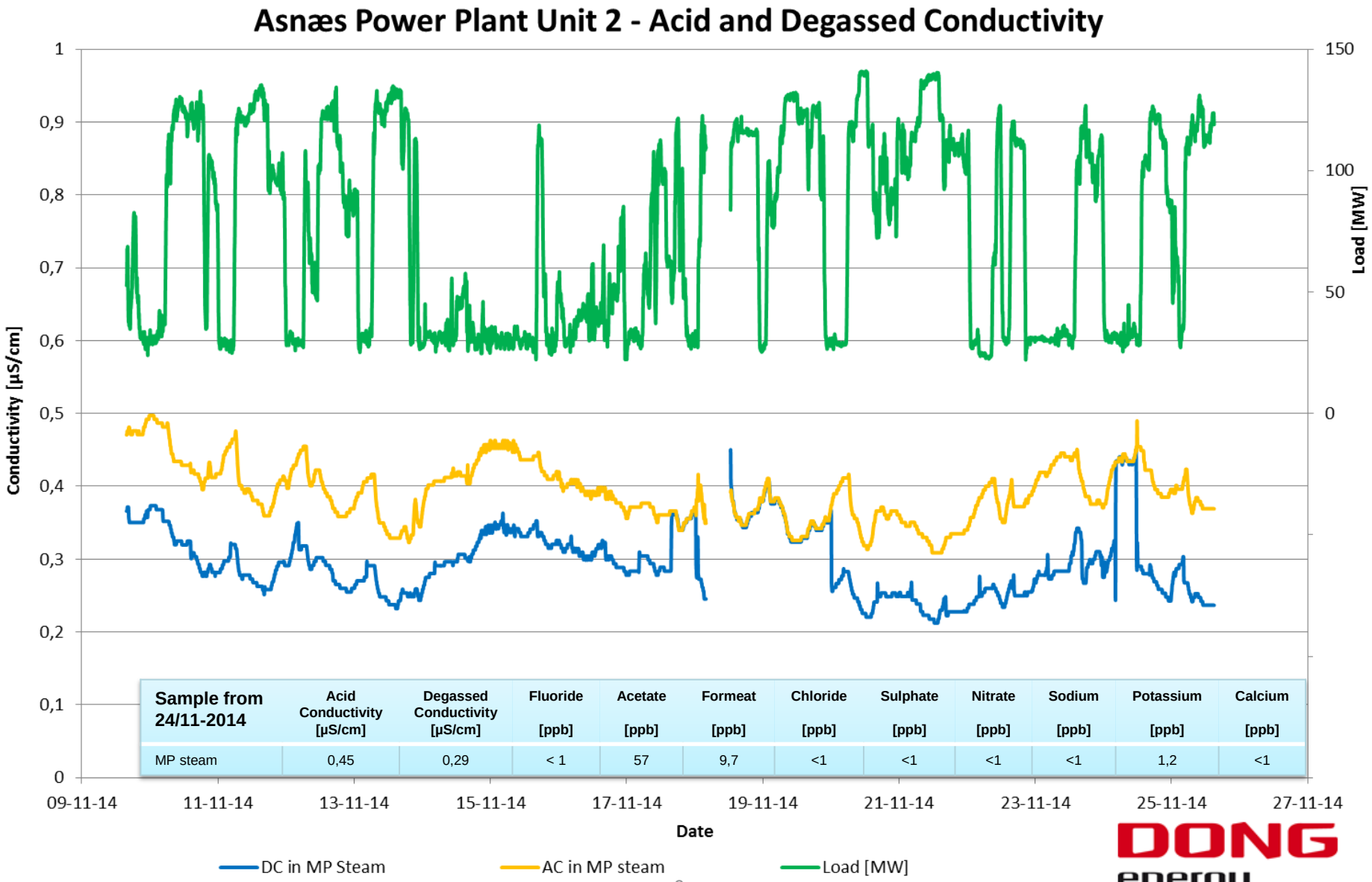
Ultra pure water
Conductivity < 0,1 µS/cm
DOC ≈ 450 ppb



Detection of organic matter i steam at Asnæs Power Plant



Detection of organic matter i steam at Asnæs Power Plant



Sample from 24/11-2014	Acid Conductivity [µS/cm]	Degassed Conductivity [µS/cm]	Fluoride [ppb]	Acetate [ppb]	Formeat [ppb]	Chloride [ppb]	Sulphate [ppb]	Nitrate [ppb]	Sodium [ppb]	Potassium [ppb]	Calcium [ppb]
MP steam	0,45	0,29	< 1	57	9,7	<1	<1	<1	<1	1,2	<1

Detecting air in-leakage at Herning Power Plant

- 290 MWth wood chip, wood pellet, gas fired drum boiler
- CPP = Mechanical filtration only
- The plant is initially operated in two different modes
  - 100 % turbine operation
  - 100 % turbine by-pass operation
- In 2014 a new mode of operation was introduces
  - Partial turbine by-pass operation
- The new mode of operation gives quite big disturbances in the water/steam chemistry
- We used the SWAN Deltacon DG to detect an air in-leakage

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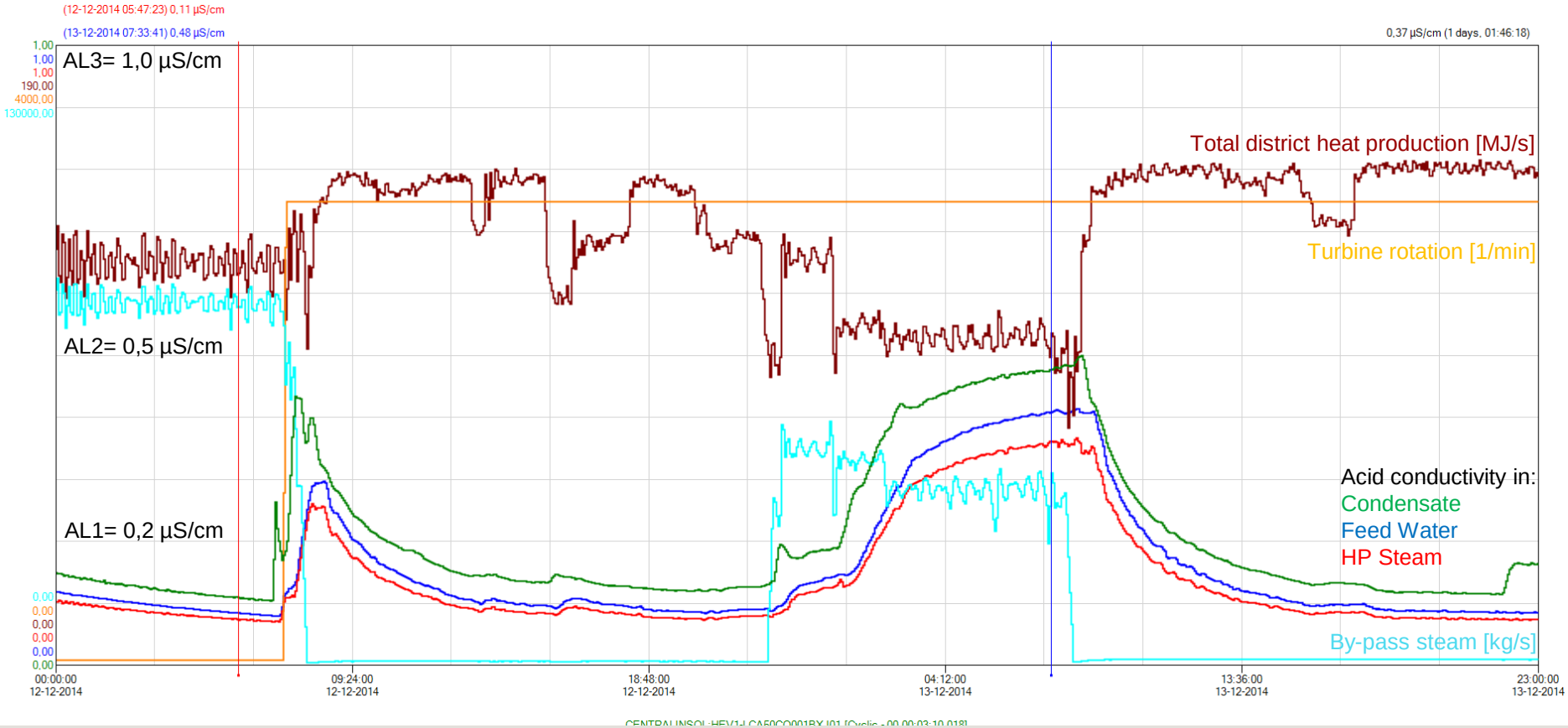
Herning Power Plant – disturbances in water steam chemistry when operating in partial turbine by-pass mode



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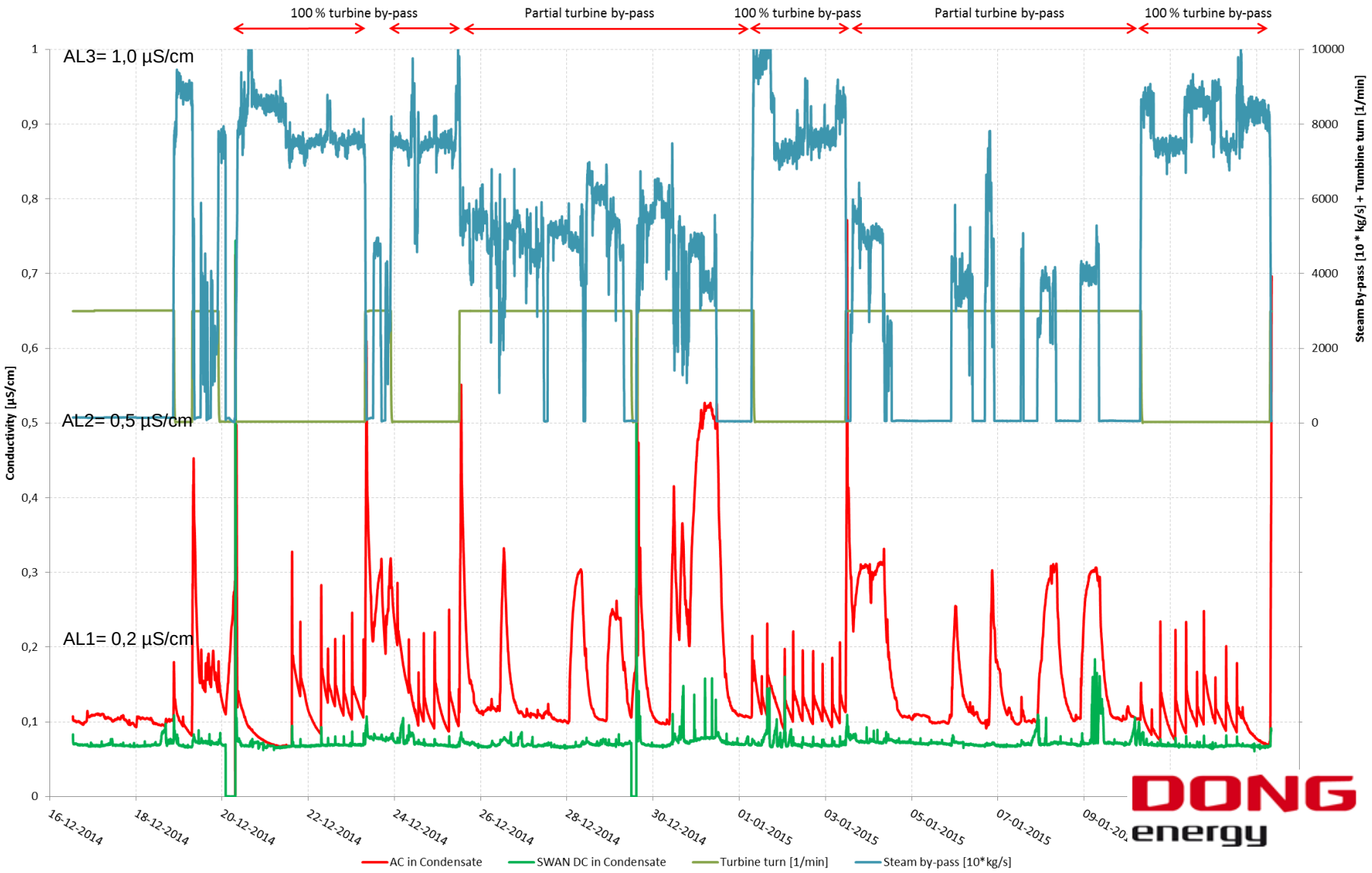
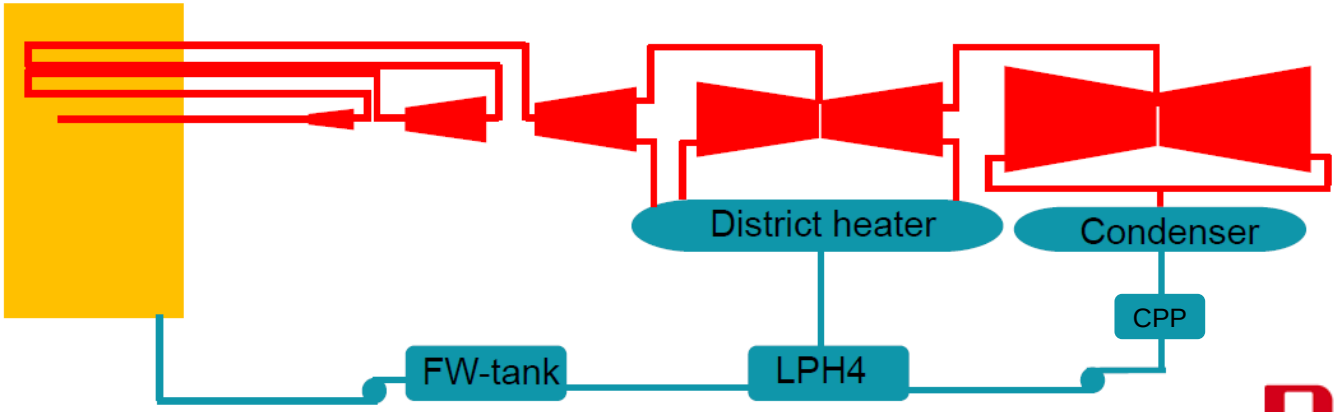
Herning Power Plant – disturbances in water steam chemistry when operating in different modes

Herning Power Plant – detecting air in-leakage by degassed conductivity



Achieving a faster start-up at Skærbæk Power Plant

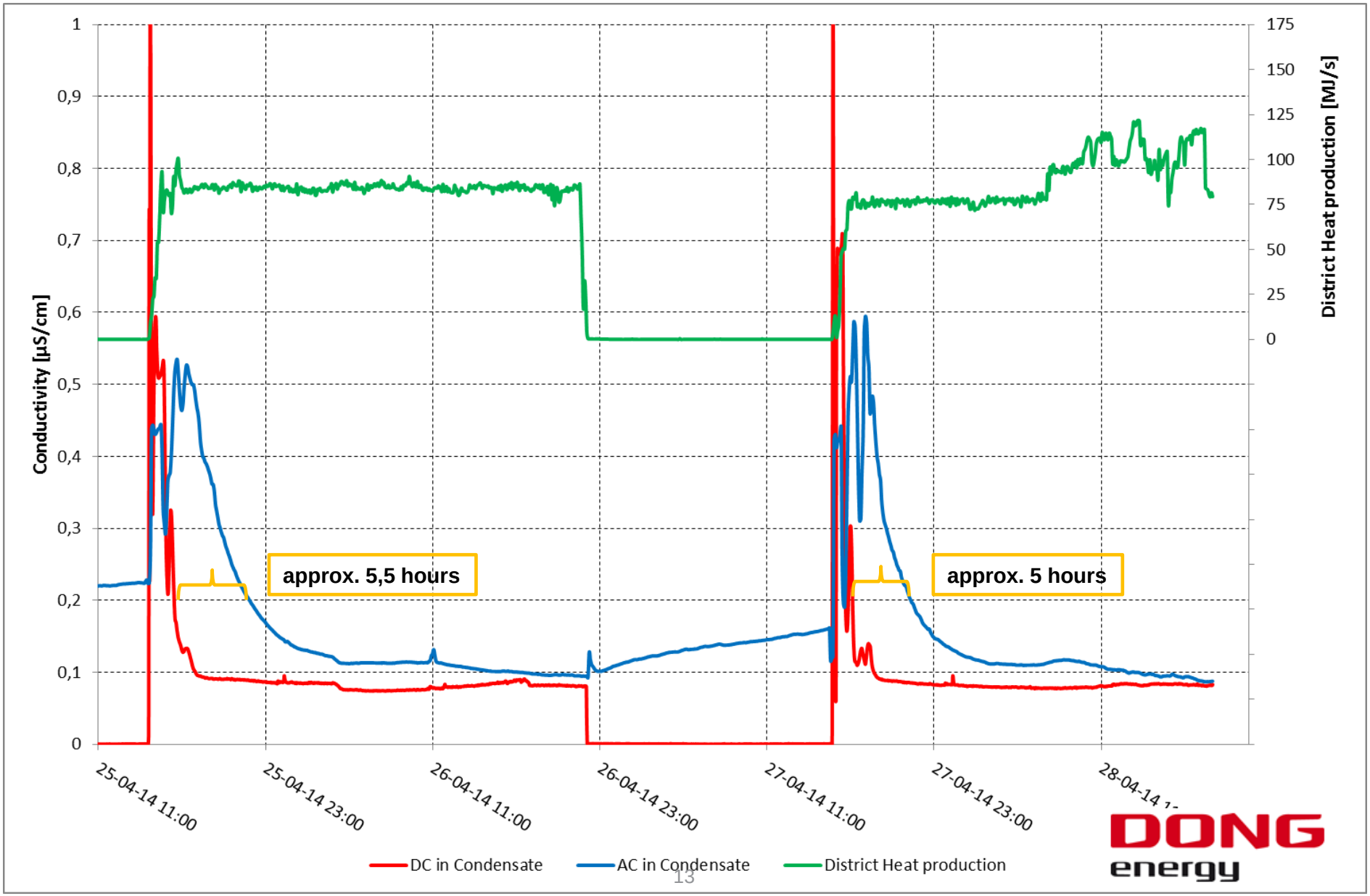
- Skærbæk Power Plant Unit 3 is a 830 MWth gas fired once-through boiler
- The unit is build with a LPH4 tank, in which CO_2 leaks in at stand still.
- During start up the water in the LPH4 tank is polished in the CPP until the AC is below 0,15 µS/cm.
- When using a degassed conductivity measurement, we could achieve a DC below 0,15 µS/cm very fast, and a faster start-up is accomplished.



Achieving a faster start-up at Herning Power Plant

- The unit has two turbine heat exchangers, in which CO_2 leaks in at stand still.
- During start up the CO_2 contaminated water in the heat exchangers is cycled in the water steam circuit, causing elevated acid conductivity.
- When using the degassed conductivity measurement, we very fast achieve DC below 0,2 µS/cm, and a faster start-up is accomplished.

Achieving a faster start-up at Herning Power Plant



Thank You!