

DETERMINING CALIBRATION INTERVALS BY AS-FOUND CALIBRATION

A study of high pressure turbinometers by the
Danish TSO “Energinet”

Rune Hviid / Max Hansen

THE DANISH GAS STEEL PIPELINE NETWORK

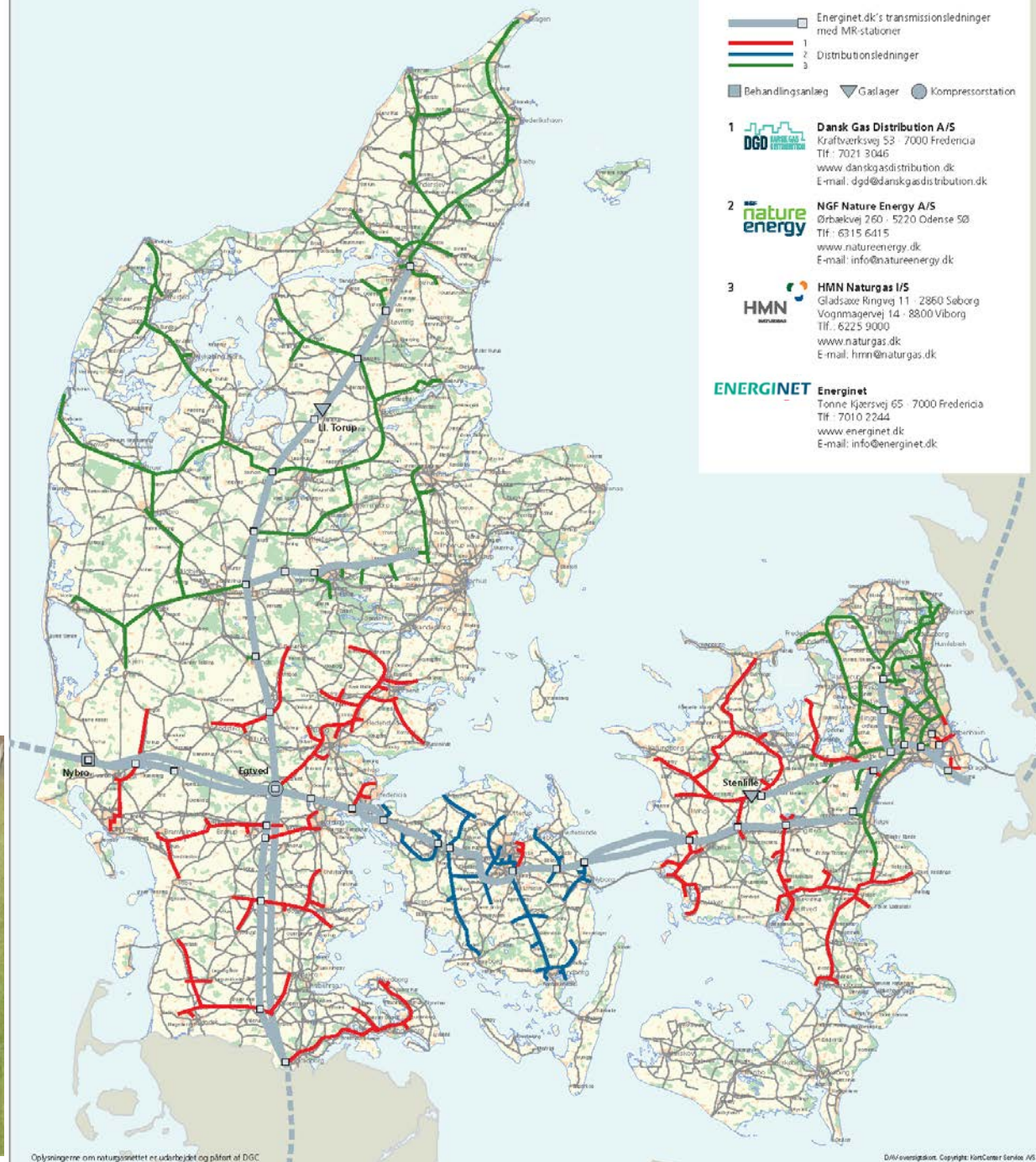
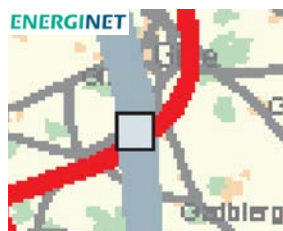
1 TSO – 80 Barg pipeline

3 DSO – 40 Barg pipeline

(DSO 4 barg plastic pipe network not shown)

42 Custody transfer points

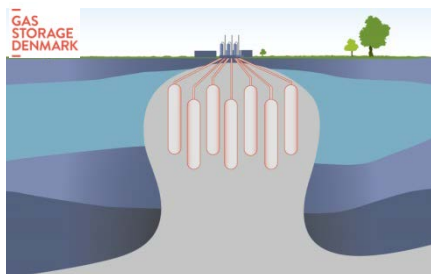
with pressure regulation
and metering (turbine)



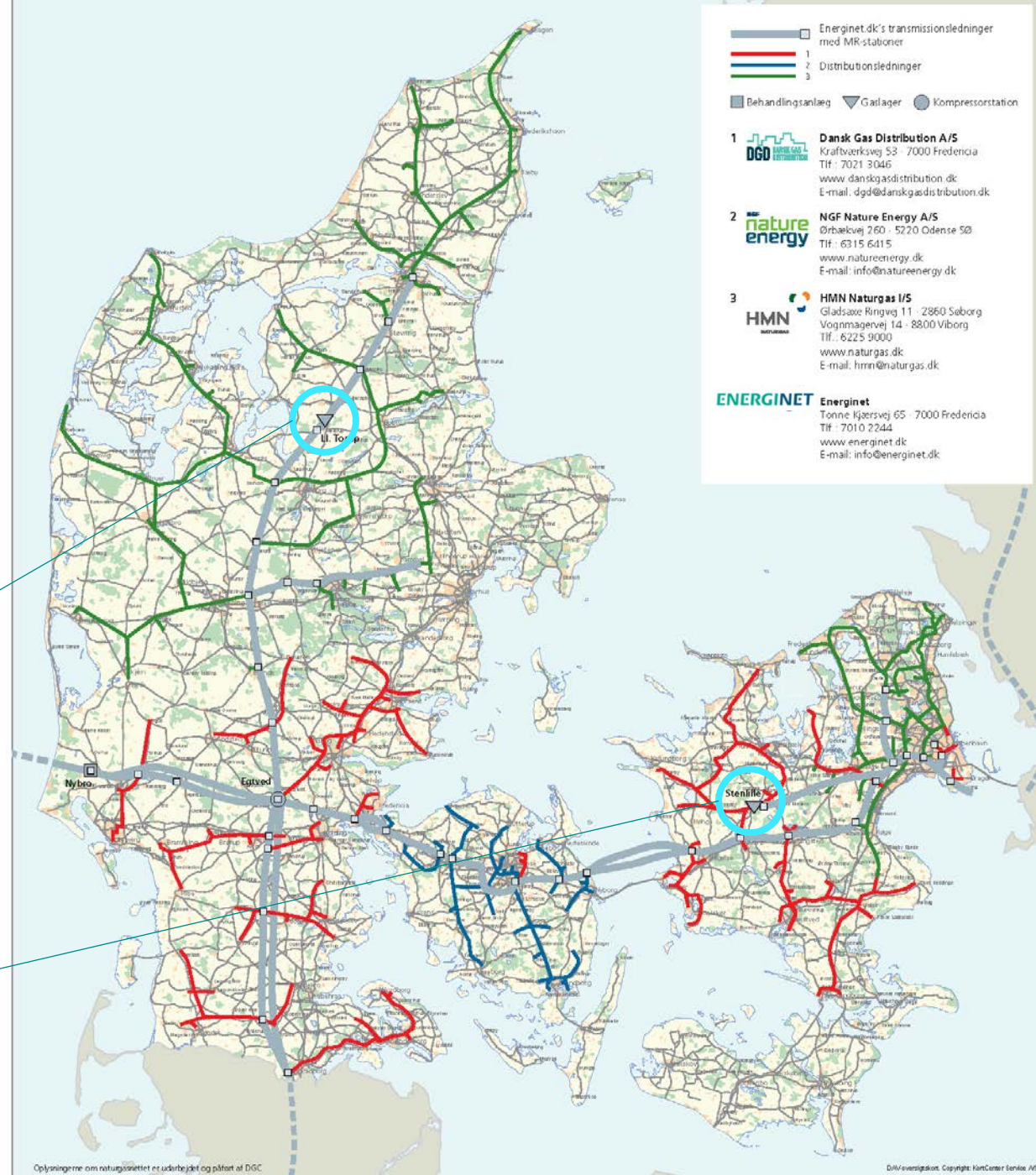
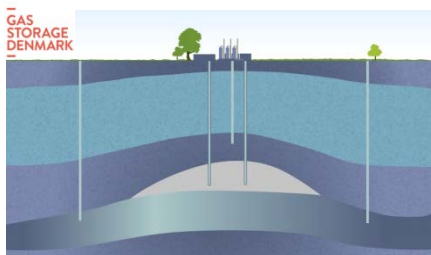
- 1 Dansk Gas Distribution A/S**
Kraftværksvej 53 · 7000 Fredensia
Tlf.: 7021 3046
www.danskgasdistribution.dk
E-mail: dgd@danskgasdistribution.dk
 - 2 NGF Nature Energy A/S**
Ørbækvej 260 · 5220 Odense SØ
Tlf.: 6315 6415
www.natureenergy.dk
E-mail: info@natureenergy.dk
 - 3 HMN Naturgas I/S**
Gadsøvej 11 · 2860 Søborg
Vognmagervej 14 · 8800 Viborg
Tlf.: 6225 9000
www.naturgas.dk
E-mail: hmn@naturgas.dk
- ENERGINET** Energinet
Tonne Kjærvej 65 · 7000 Fredensia
Tlf.: 7010 2244
www.energinet.dk
E-mail: info@energinet.dk

THE DANISH GAS STORAGE

Lille Torup – Ultrasonic meters
Salt cavern gas storage



Stenlille - Ultrasonic meters
Auarifer storage



- Dansk Gas Distribution A/S**
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www.danskgasdistribution.dk
E-mail: dgd@danskgasdistribution.dk
- NGF Nature Energy A/S**
Ørbækvej 260 · 5220 Odense SØ
Tlf.: 6315 6415
www.natureenergy.dk
E-mail: info@natureenergy.dk
- HMN Naturgas I/S**
Gladssøvej 11 · 2860 Søborg
Vognmagervej 14 · 8800 Viborg
Tlf.: 6225 9000
www.naturgas.dk
E-mail: hmn@naturgas.dk

ENERGINET Energinet
Tonne Kjærsvvej 65 · 7000 Fredenicia
Tlf.: 7010 2244
www.energinet.dk
E-mail: info@energinet.dk



CASE 1: SITE CONDITIONS

Heavy contamination – short calibration intervals

Meter contamination

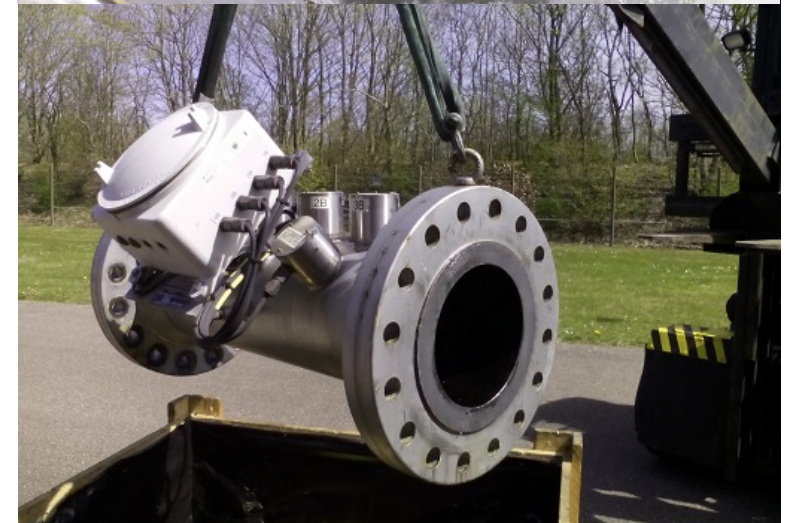
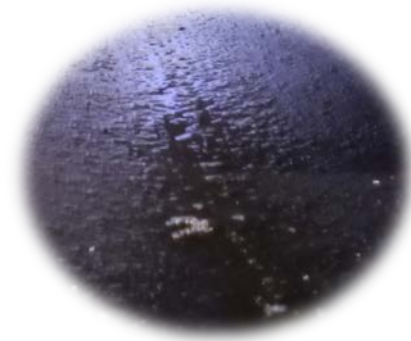
- Coal dust - (from surface plants active coal filter)
- Oil residue - (from underground previous storage use in Lille Torup gas storage)
 - Deposits on Ultrasonic sensors

Deterioration by operation conditions - Rapid pressure change

- Compressor start
- One-way valves
 - Damage to turbine blades

Calibration interval:

Gas storage uses ultrasonic meters with 2 year due to heavy contamination



CASE 2: FOLLOW GUIDELINES

Danish gas companies have common guidelines for calibration of flow meters.

Text from guidelines:

“flowmeters are to be recalibrated with 5 year intervals”.

“However, if calibration history study or test is available, year 10 interval is possible for new meters”.



LEGISLATURE

BEK number 1037 - 17/10/2006

English translation

§ 18. Network companies that uses measurements made in accordance with section 1, § 1, section 3, is required, upon request, to inform the buyers of the measurement uncertainty of the amount of gas (energy) that is settled. The network companies concerned are also obliged to provide, at the request of the customers, the required documentation of the information provided by calibration certificates, cf. 3, as well as any additional calculations and statistical information to document the total measurement uncertainty.

Sec. 2. There must be a sound measurement technique for the information provided. The measuring equipment in question must be calibrated at such a frequency that there is a sufficient likelihood of compliance with determined or agreed measurement uncertainties during the period between the calibrations. Regardless of the calibration intervals determined, renewal calibration must be performed if the measuring equipment has been damaged or subjected to interference that affects its target accuracy.

Sec. 3. Calibration shall be performed as accredited calibration or foreign calibration recognized in this country and shall be documented in calibration certificates with traceability to recognized international primary



CASE 3: STUDY STABILITY OF METERS

Scope: Reevaluation of Calibration Interval (set in 1984 to 8 years)

Flowmeter guidelines allow extended calibration intervals if studies or tests of flow meters are made which prove what the metering error is below the allowable limit in time period of the extended calibration interval.

22 turbine meters were studied by Energinet by recalibration to show this in 2005,

Last similar study was in 1984.

Study 22 meters calibrated at 4500 euro, total 100.000 EURO

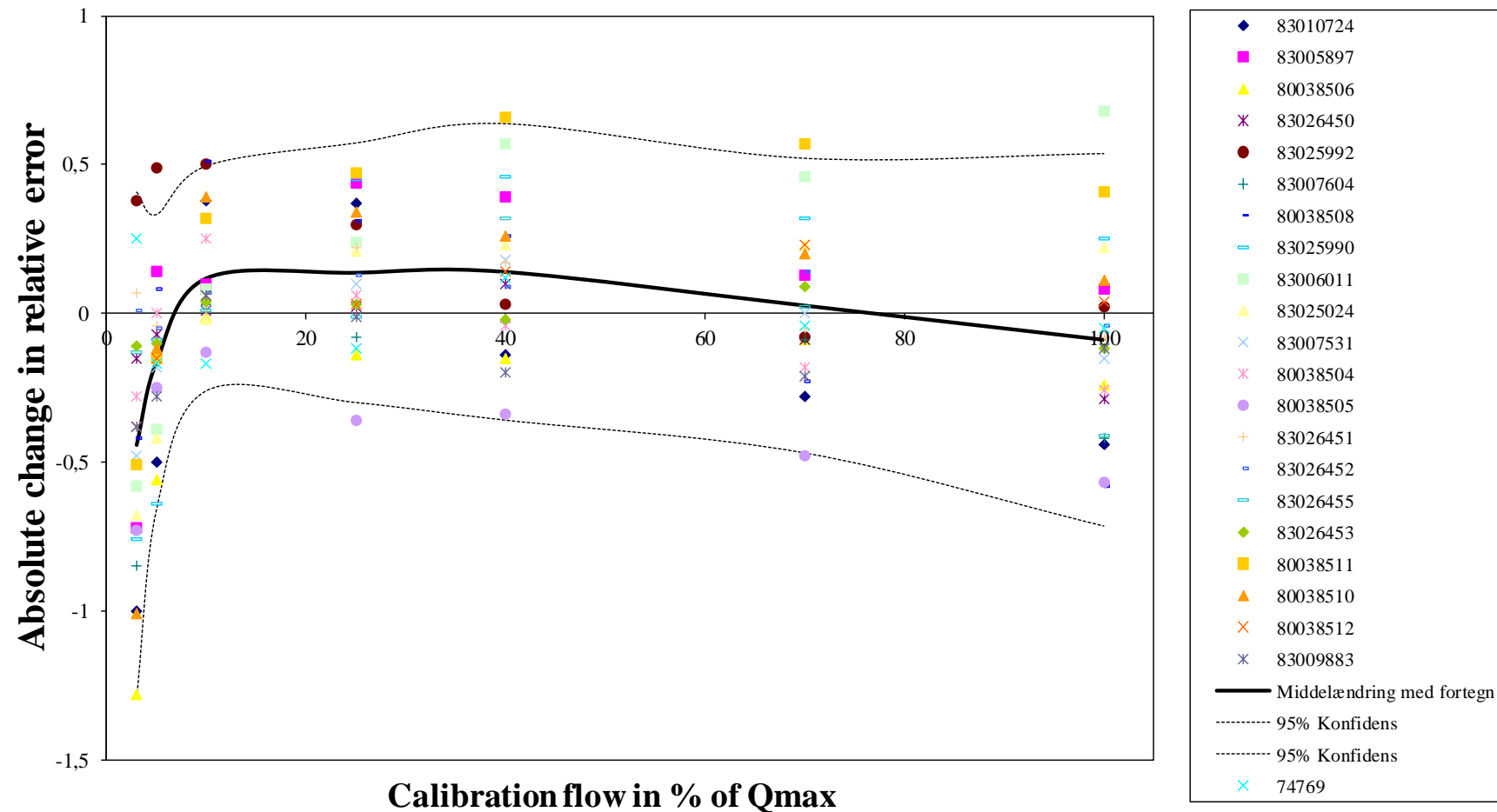
Calibration interval extended from 5 to 8 years saving 30.000 EURO per year for all 84 meters (custody), in calibration alone, add on-top saving on fewer new meter purchases, Study payback time 2 years.



CASE 3: STUDY STABILITY OF METERS

Meter error in comissioning calibration and recalibration compaired

Recalibration of 22 turbinemeters

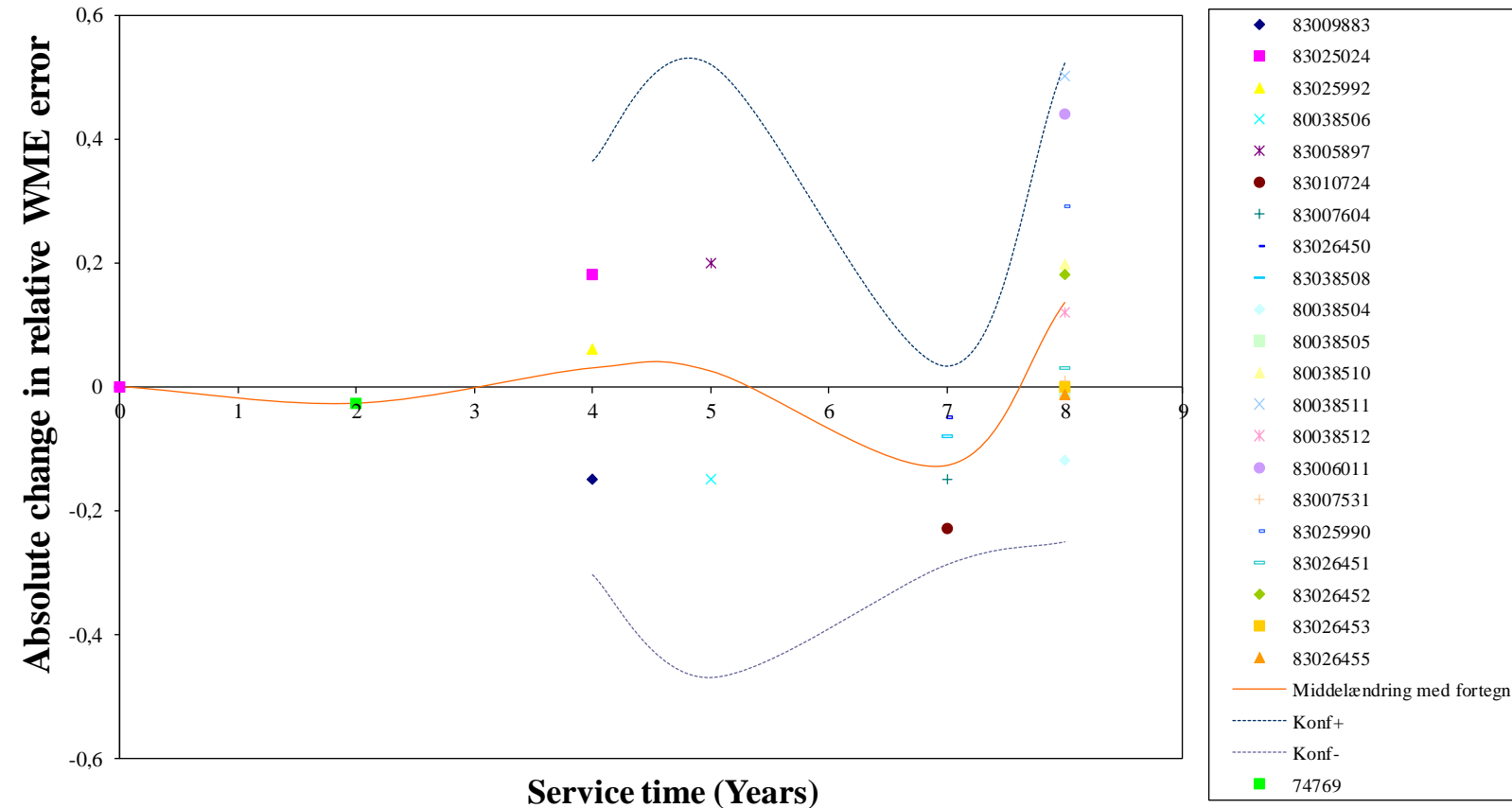




CASE 3: STUDY STABILITY OF METERS

Meter error in comissioning calibration and recalibration compairet

Evolution of metering error over time



STUDY CONCLUSIONS

2005 study conclusions compared with 1984 study

Calibration interval of 8 years is well chosen – change in spread of WME equal to 4-5 year of service life

Change in WME over 8 years were found to be $\sim 0,72\%$

Allowable change is set to 0,9 % in guidelines

Previous studies have shown a change of 0.03-0.08% per year [1,2] (0.64 per 8 years)

1. *DS/EN 1776:1999: Gasforsyningssystemer – Målestationer for naturgas –Funktionskrav.*
2. *Time dependent performance of turbine gas meters (FLOMEKA maj 2003)*



RECALIBRATION, NEW METER OR REFURBISHMENT

Guidelines Energinet uses on meter change

Considerations:

- Price of new meter

- Price of refurbishing of meter (Refurbishment is a meter rebuild with some/all internal parts changed)

- Price of (re)calibration

- Meter size

Recalibration if: Turbine Requirement 1: Turbine was dismantled with no failures since last calibration (8 years)
Turbine Requirement 2: Examination report of turbine revealed no points of concern.
Set turbine recalibration interval: 5 year.

New meter if: Price of refurbishing \leq 70% of new meter. (Turbines above G1000 fulfill this)
Set calibration interval: 8 years

Refurbished if: Old meter is in storage (and savings over new metes as described above)
Set calibration interval: 8 years

Energinet: 65% new meters , 30% refurbished meter, 5% recalibrated meters



DETERMINING CALIBRATION INTERVALS

The 3 ways

Case 1: Site conditions to determining calibration intervals.

Case 2: Follow guidelines – Common for Danish gas companies

Case 3: Study stability of meter - by recalibration to determine calibration intervals

ENERGINET

DECENTRAL POWERPLANTS

