



International Organization of Legal Metrology

Organisation Internationale de Métrologie Légale

Smart metrology: the way to test smart meters



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About NMI

- Privately owned
- 100% commercial activities
- Type examinations (MID + standards)
- Accreditation of manufacturers (MID)
- Notified Body 0122
- No 1 issuing OIML certificates
- RvA accredited for testing / verification
- Time to market and acceptance of test reports and certificates



About Jos

- 22 years at NMI
- Fluid dynamics background
- Primary gas and liquid flow standards
- Measurement uncertainty
- Legal metrology: utility and HP gas
- OIML TC8 / SC8 → R137-1
- Training activities: Metrology College
- Project manager certification EuroLoop

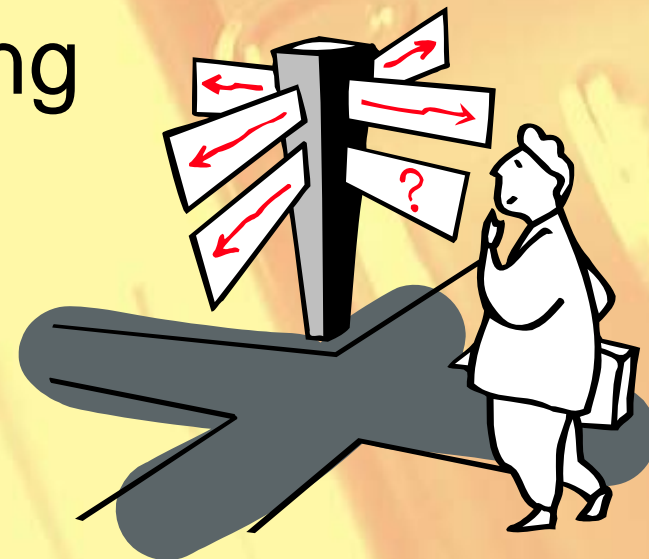


Contents

- What is a smart meter?
- Type testing experiences
- Re-verification of meter populations
- Attributive statistical testing
- Alternative methods
- Conclusions

Objective

- Suitability of OIML recommendations
- Monitoring large meter populations





What is a smart meter?



Utility meter

- Send reading to a central database
- Reduce electricity consumption, shutdown

Interface

- PLC, MUC, GPRS, GSM, InfraRed, ...

Protocol

- SLM, DLMS, ...

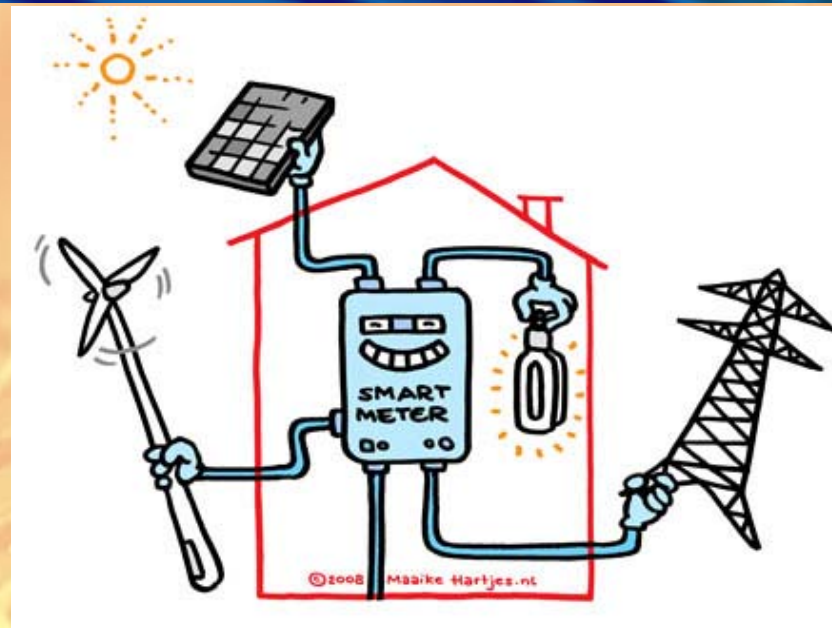




What is a smart meter? – 2

Difference with an ordinary meter?

- For metering: none



Smart mechanical meters possible?

- Yes
- Gas, electricity, water, heat





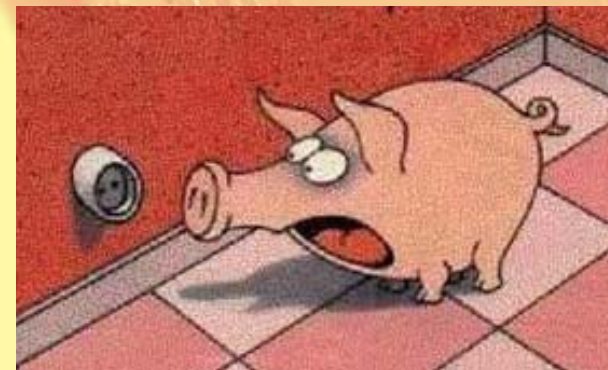
What is a smart meter? – 3



Dutch Government:

Smart meter = solution for

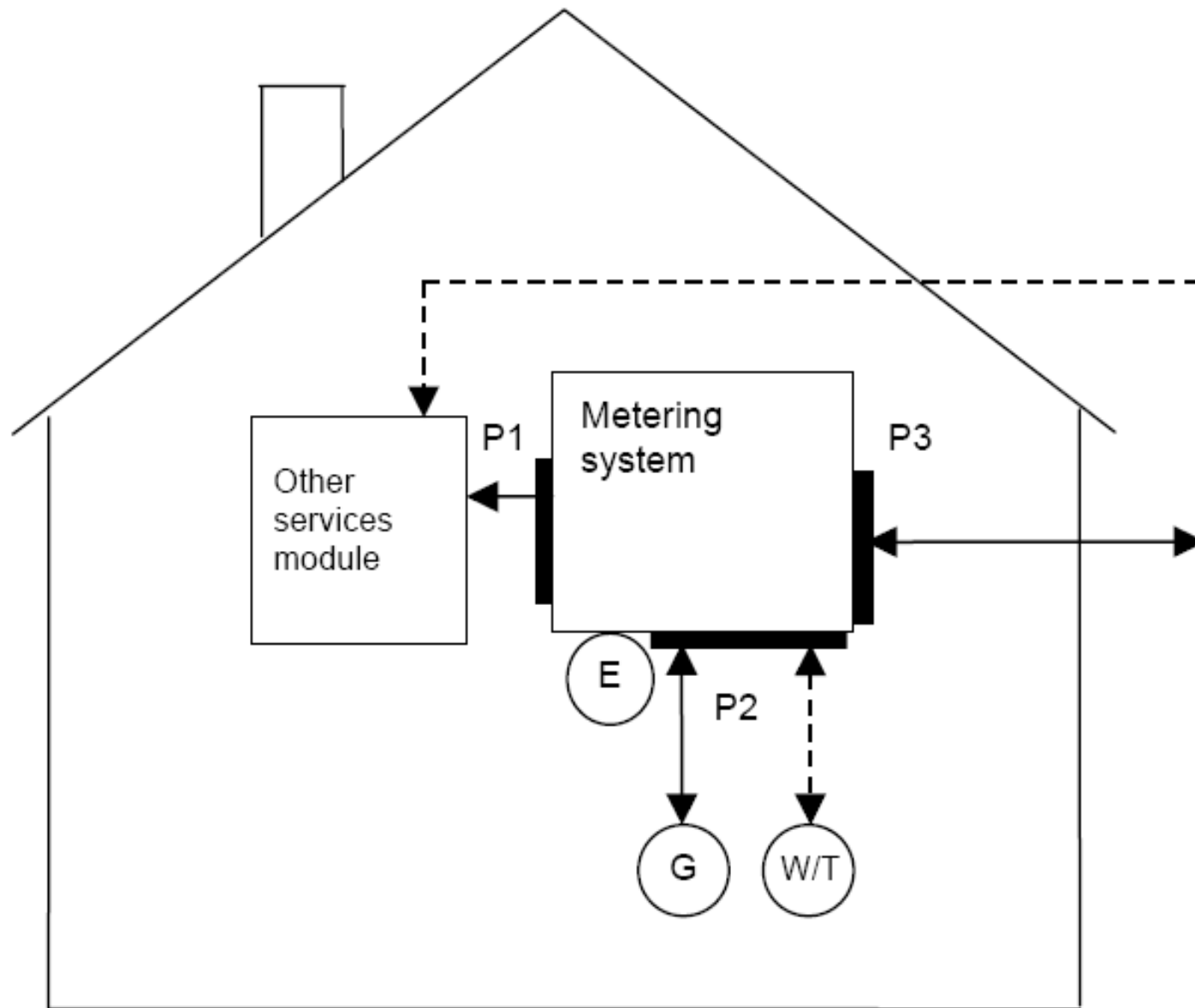
- Liberalized energy market
→ easy change of supplier
- Saving energy → CO₂ ↓
→ more frequent invoices
- Funded NTA 8130
→ exchange complete meter populations
6 million Watt-hour meters in 6 years
- Blocked in parliament





What is a smart meter? – 4

In house
meter cabinet





What is a smart meter? – 5



- Consumers
 - Data security
 - Power consumption
 - Self produced energy
 - Complex tariff structures



- Manufacturers
 - Interfaces and protocols are developing
 - Standardization



What is a smart meter? – 6



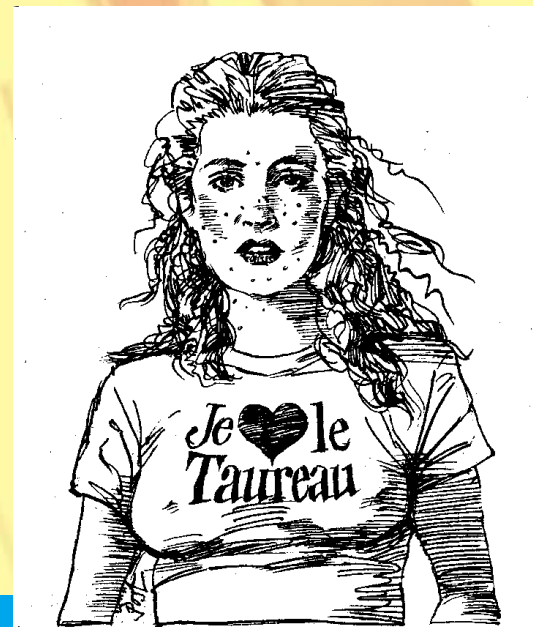
- Utility companies
 - Reliability of new technology
 - Giant data flow
 - Replacement of large populations
 - Depreciation of installed meter populations
 - Lack of standardization



- NTA 8130 (August 2007)



- M/441 initiative
 - open standard





Type testing experiences

Electricity meters

- Since MID has come into force (30 oct 2006)
- 70 Watt hour meters type examined
 - MID + MI-003
 - EN 50470-1..3 / IEC 62053-11 / -21 / -22
 - Majority smart
- Additional functionality
 - Not part of MID

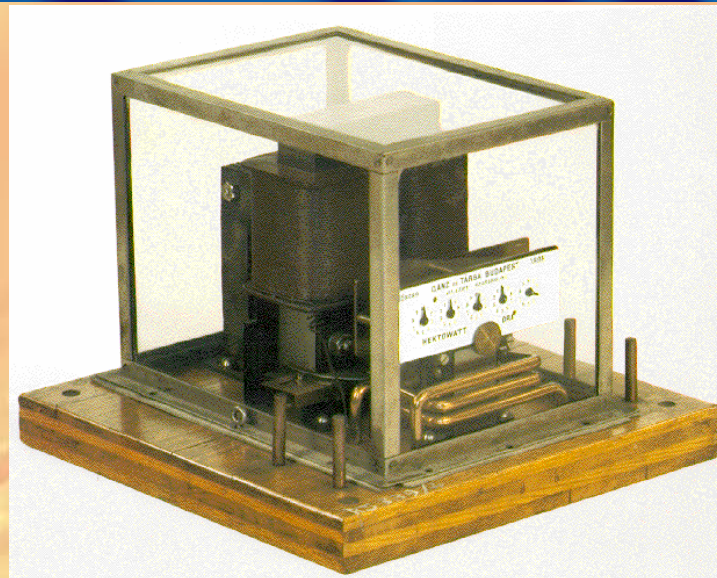




Type testing experiences – 2

Additional functionalities

- Pre-payment
- Telemetry
- Power / demand
- Load profile
- Software changes
- Excess power
- Integrated clock / timer
- Modem
- Ripple control receiver
- Remote disconnection
- Power limitation
- Anti tamper indication
- Export metering



(Welmec WG 11)



Type testing experiences – 3

Smart = software

- Testing according Welmec 7.2 / OIML D31
- Manufacturer decides on modules
 - D: Download
 - S: Separation
 - T: Transmission (custody transfer data = legal metrology)
 - L: Logger
- Smart = fast
- Reduced duration → Expansion of facilities





Type testing experiences – 4

Gas meters

- Generally not smart
- Lot of new technology
- OIML R137-1 works very well
 - Technology independent



Water meter

- OIML R49 adequate



Heat meters

- OIML R75 adequate





Type testing experiences – 5

- OIML D11: Influence testing
 - PLC with Internet Protocols
- OIML D31: Software testing
 - Welmec Guide 7.2
 - Implemented in future revision of OIML Recommendations





Re-verification of meters

Individual

- Japan

Attributive statistical inspection

- Netherlands every 5 years
- Germany after 8 years and then every 5 y
- ...
- Consequences ...



Attributive statistical testing

- Production is very reproducible
- Limited number of instruments tested
 - Utility meters
 - Length measures
 - Volume capacity measures
 - Taxi meters
 - Exhaust gas analysers
 -
- Homogeneous lot
- Random sample, all samples tested





Attributive statistical testing

- Standards and documents like
 - ISO 2859, IEC 60514,
 - OIML TC3 SC4 (CD2): in-service inspections
- Prescribe
 - AQL and LQ
 - How many meters shall be tested
 - Acceptance and rejection numbers
 - Single and double sampling plans
- But nothing about the associated risks





Attributive statistical testing

MID Annex F art. 5, Annex F1 art. 7

Attribute testing → Accept / reject

- a level of quality corresponding to a probability of acceptance of 95%, with a non-conformity of less than **1% [AQL]**; *i.e. a **manufacturer's risk** of **5%** of non-acceptance.*
- a limit quality corresponding to a probability of acceptance of **5% [consumer's risk]**, with a non-conformity of less than **7% [LQ]**.

But no number of meters specified





Attributive statistical testing

What is the difference between

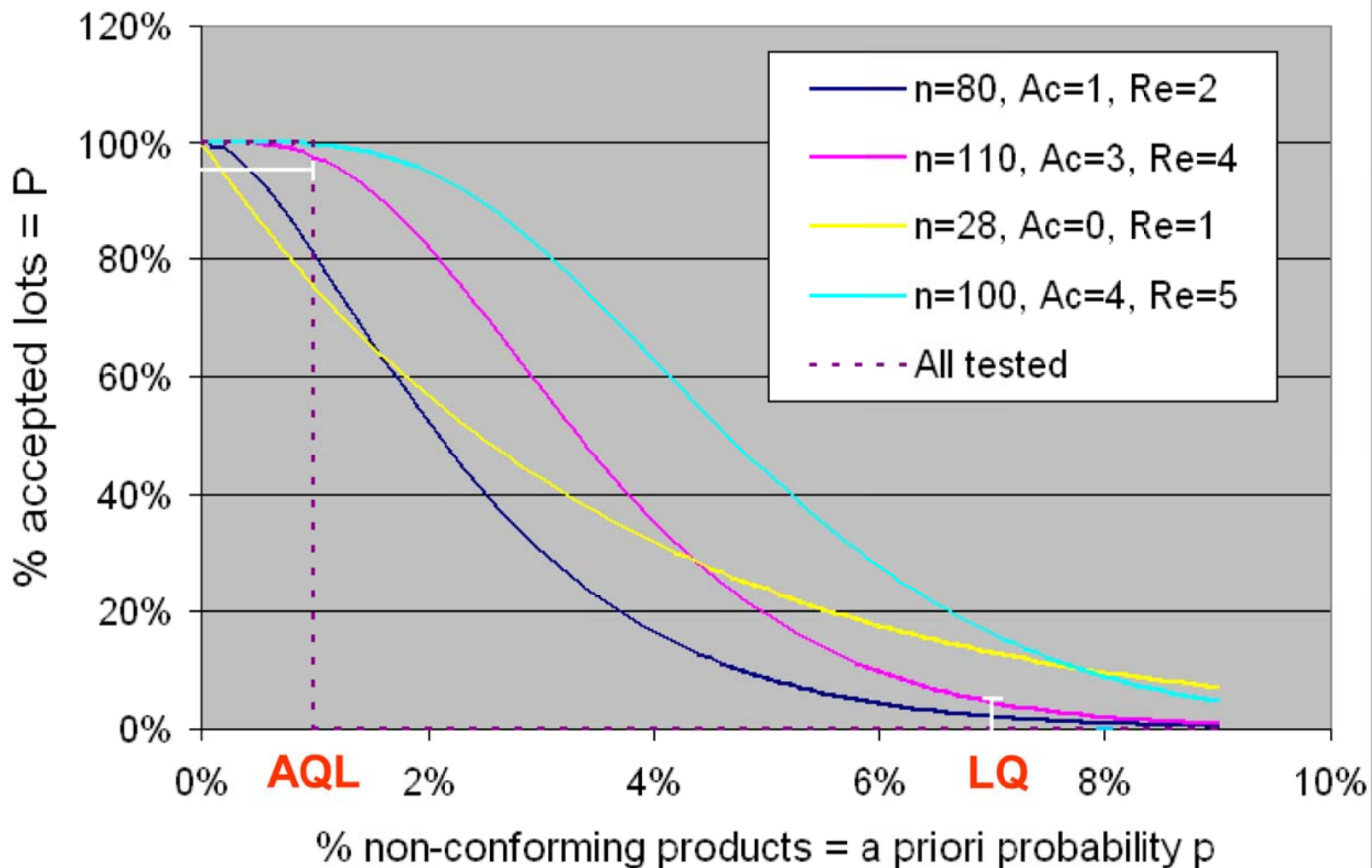
- Flipping a coin
- Tossing dice
- Testing utility meters?





Attributive statistical testing

Operating Characteristics (Type B)





Alternative methods

Create sub-populations

- Criteria?
 - Geographically
 - Last digit of serial number
 - ...

Replace populations after .. years

Yearly attributive inspections

- Trends



Alternative methods – 2

Variable inspections

- Meter error
 - Average and standard deviation
- Trends of a population
- Yearly inspection

Advantages

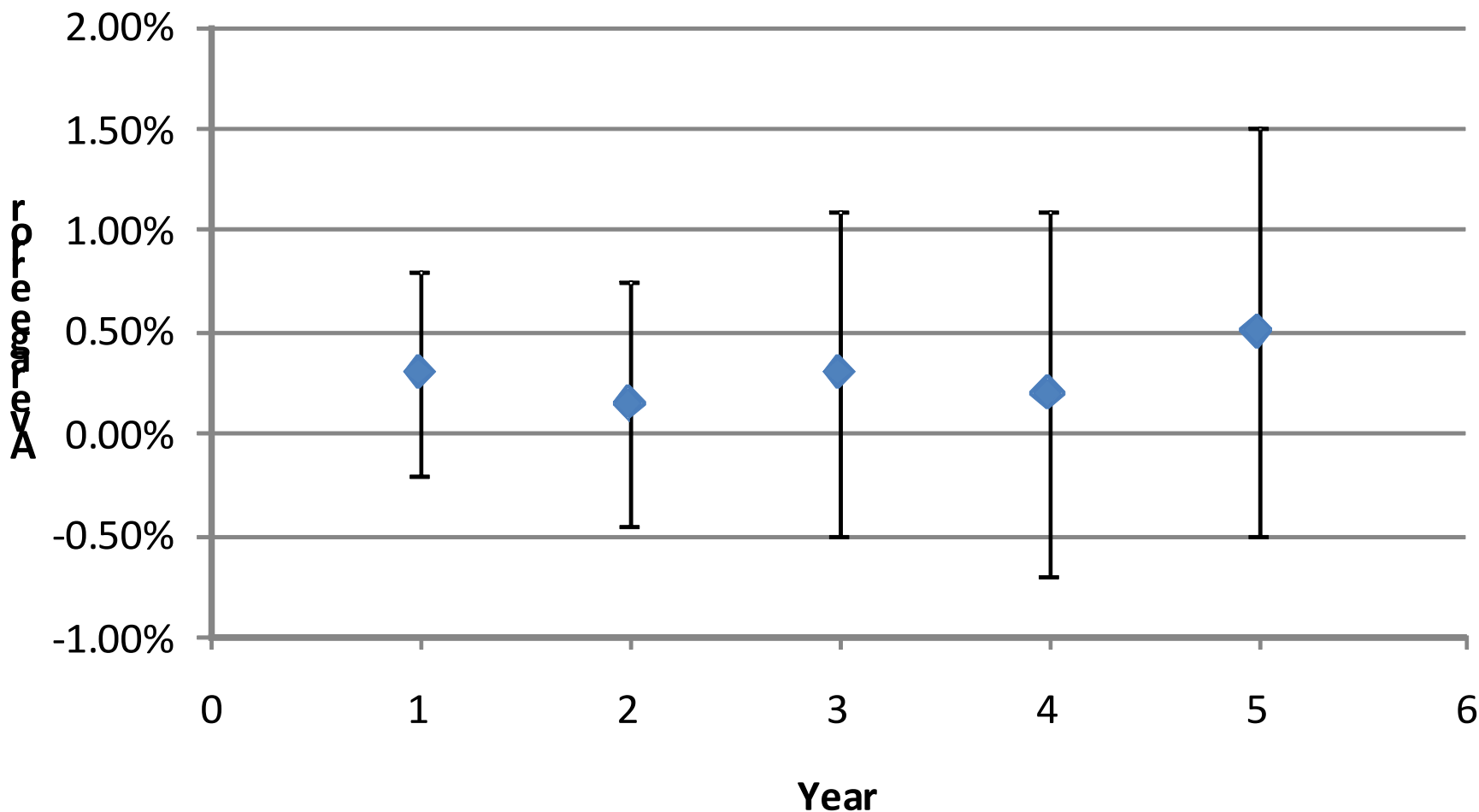
- Much more information
- Smaller samples



Alternative methods – 3



Population trend





Conclusions

- Most OIML recommendations work
 - Implementation D31
- OIML TC3 SC4 (CD2) → show risk
- Smart meter → larger meter populations
- Advanced statistical methods
 - Monitoring populations by attribute
 - Better by variable → Trends
- Risk management
 - Utilities and Manufacturers



Smart voting



Verbraucher schützen – aber wie?
Deine Entscheidung. Europawahl 7. Juni.

www.wahlen2009.eu

EUROPAISCHES PARLAMENT

7. Juni 2009
Europawahl
DEINE ENTSCHEIDUNG



Thank You

