CEMs
The situation in the EU and USA

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www.iea-coal.org

Emissions monitoring

- For compliance with emission standards and norms
- For inventory production and “compliance” with reduction targets international conventions

Compliance monitoring

- Emission limits and norms require compliance monitoring
- This can be achieved through CEM systems, through regular periodic monitoring, and, occasionally, the application of emission factors
- This involves regulators, approvals bodies and standards organisations

Comparison of requirements

Europe

Monitoring specified in:

- Directives (IED)
- BREFs

IED	Industrial Emissions Directive
BREFs	Best available technology reference

USA

Monitoring specified in:

- NESHAP standards
- MACT standards

NESHAP	National Emission Standards for Hazardous Air Pollutants
MACT	Maximum achievable control technology

Set emission limits for source type (size and fuel)
Additional limits according to pollution control requirements

Several approved measurement methodologies -USA

Continuous emission monitoring systems (CEMS)

- Direct measurement of SO_2, NO_X, and CO_2 emissions
- Measurement of heat input from stack flow

Fuel flow

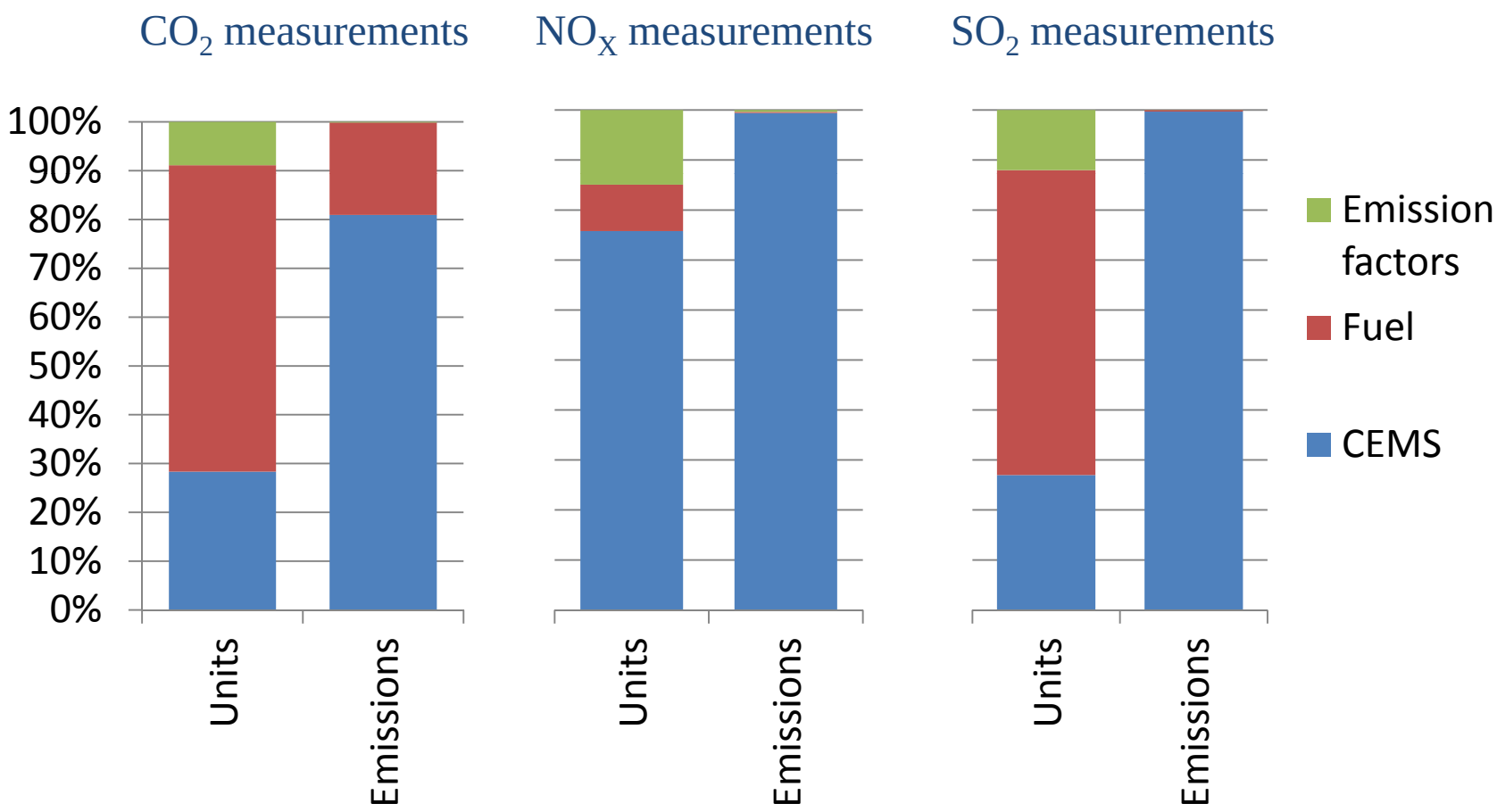
Correlation curves for NO_X

Low Mass Emission Units (LME)

- Default emission factors
- Operating conditions

Methods with less accuracy or greater uncertainty use conservative methods that do not underestimate emissions

CEMS measure the majority of emissions



Common problems with CEMS

Unreliable results

- CEM suitable for actual process conditions (acid gases, temperature etc)
- CEM unsuitable for levels of emissions (high/low)
- Unrepresentative measurement (positioning of sampling or method of sampling/detection)
- influence of interfering chemicals and internal drifts

Common problems with CEMS

Reduction in reliability after initial calibration

- No zero and span checks to indicate if instrument is operating incorrectly
- Design does not support 3rd party auditing
- Undefined maintenance interval

Specification of monitoring requirements

Europe

Types of CEM

- CEM (QAL1 TUV/MCERTS approved)

USA

Types of CEM

- PM-CEM (PS-11)
- Opacity (PS-1)
- Gas CEM

Type approvals for CEM systems

European

- MCERTS and TUV are 'Type approval schemes (instruments approved against performance standards for a particular type of process and for a specific certification range)
- Plant operator may use instrument in similar processes with limited on-site calibration

Buying a certified, pre-approved CEM to be calibrated on site

US

- US EPA standards tend to be technology specific. Instrument manufacturers must assess compliance to a set of specific design criteria
- To be compliant Plant Operator must have instrument validated for specific process

Buying a CEM of a prescribed type to be certified on site and then calibrated

Example of MCERTS Certificate

PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

PCME QAL 181 Particulate Analyser
(previously LMS 181)
Including PCME QAL 181 SEN Sensor

manufactured by:

PCME Ltd
Edison Road
St Ives
Cambridgeshire
PE27 3GH
UK

has been assessed by Sira Certification Service
and for the conditions stated on this certificate complies with:

MCERTS Performance Standards for Continuous Emission Monitoring Systems, Version 3.1 dated July 2008, EN15267-3:2007,
& QAL 1 as defined in EN 14181: 2004

Certification Ranges :

Particulate Concentration 0 to 15 mg/m³
0 to 100mg/m³

Project No: 674/0263
Certificate No: Sira MC090162/00
Initial Certification: 17 August 2009
This Certificate Issued 17 August 2009
Renewal Date: 16 August 2014

Technical Director

MCERTS is operated on behalf of the Environment Agency by
Sira Certification Service
12 Acorn Industrial Park, Crayford Road, Crayford
Dartford, Kent, UK, DA1 4AL
Tel: 01322 520500 Fax: 01322 520501

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Key issues

- Class, version or date of approval
- Pollutant measured
- Certification range
- Certified Performance
  - Limitations of use
  - Test results including interferents

Example TUV/UBA Certificates

DAP-PL-3856.99

TÜV Rheinland Group

CERTIFICATE

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH

Manufacturer:	PCME Ltd in St. Ives / England
Measuring System:	LMS 181
Components:	Dust
Test Report:	Eignungsprüfung 936/21204255/A from 2006-07-07

The measurement system fulfils
the requirements of
QAL 1
according to EN 14181 and EN ISO 14956.

Köln, 2006-09-06 i.V. Dr. P. Wilbring i.A. Dipl.-Chem. M. Kerpa

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TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Am Grauen Stein,
51105 Köln

The company is accredited to DIN EN ISO/IEC 17025.

Deutscher Akkreditierungs Rat

DAP-PL-3856.99

TÜV Rheinland Group

CONFIRMATION

Umweltbundesamt

Announcement about the uniform practice in monitoring emissions and ambient air, circular from the Federal Environment Ministry (BMU) of 2006-09-12, publication BAnz 2006-10-14, no. 194, p. 6715 - 6718

I. Suitability of measuring equipment for the continuous emission monitoring

Under reference on number 3 of the guideline about the uniform practice in monitoring emissions (circular letter from BMU of June 13, 2005, publication GMBl. in 2005, 38, p. 795), the suitability of the following measuring equipment is announced in the task of the BMU:

1 Dust Emission (dust concentration)

1.2 LMS 181

Manufacturer:
PCME Ltd., St. Ives Cambs, UK

Suitability:
for measurements at plants requiring official permission and plants in accordance to the 27th BImSchV,

Measuring ranges during the suitability test:
Dust: 0-15 mg/m3
Dust: 0-100 mg/m3

Softwareversion: 1.2 H

Remark:
1. In case of a high dust concentration in the stack during the calibration with the standard reference method comes to a range of 0-85 mg/m3 dust in the measuring range of 0-100 mg/m³. The evaluation of the field test data was done in the range of 0-15 mg/m3.
2. The maintenance interval for the test check is 4 weeks.

Test Report:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln, TÜV Rheinland Group, Report-No. 936/21204255/A of 2006-07-07

Köln, 2006-11-03 Dr. P. Wilbring Dipl.-Chem. M. Kerpa

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UBA confirmation (announcement) gives best visibility to

- Certification range
- Limitations
- Guidance on use

Compliance with emission norms vs compliance with reduction targets and national emissions inventories

Top down or bottom up?

Top down:

emission factor x activity = emissions

Simple, quick ... but can be a best guess

Bottom up:

emissions + emissions + emissions + emissions

Accurate ... but time consuming and expensive

Emissions inventories

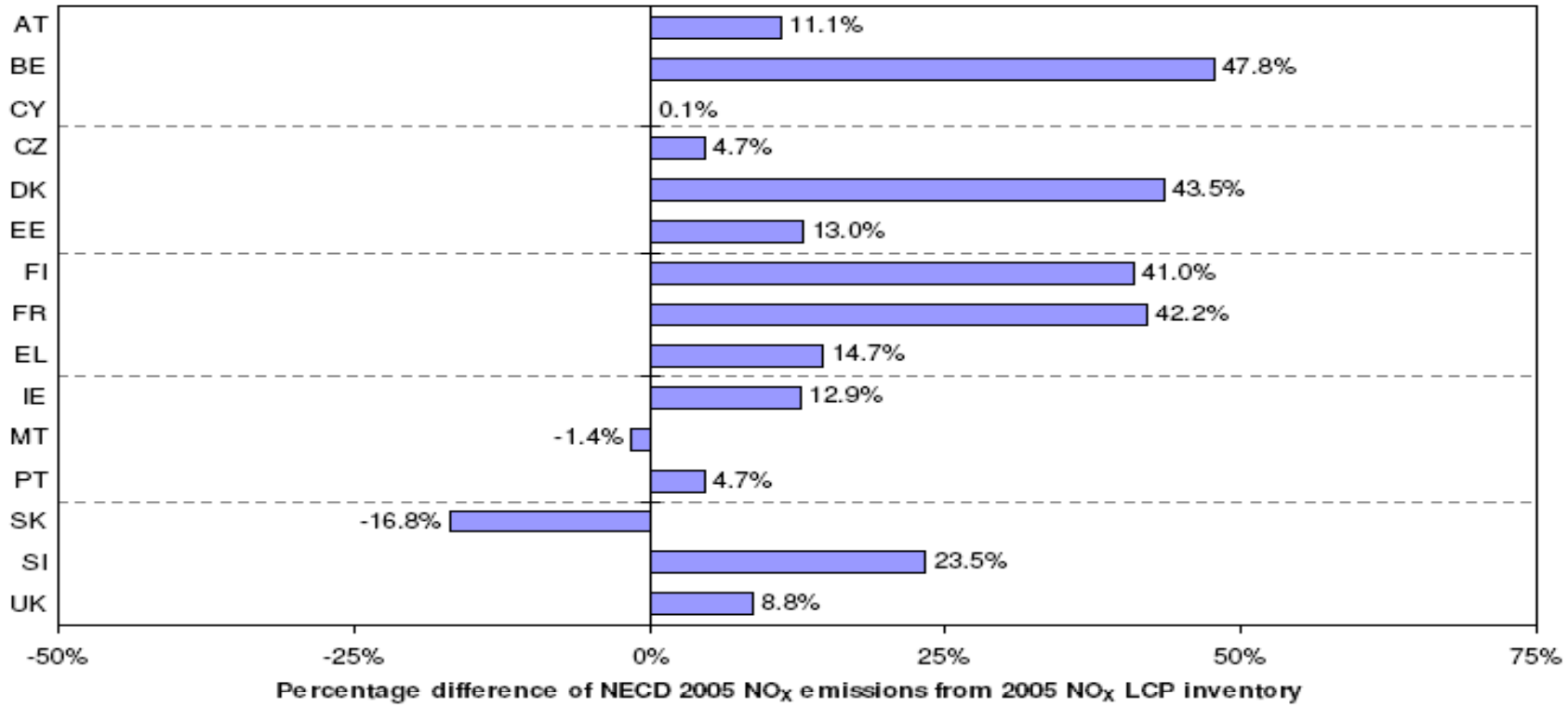
Different approaches are used:

- Estimated emissions using emission factors
- Averaged emissions using annual testing
- Direct measurements using continuous emission monitors

Monitoring/reporting requirements are specific to each protocol – miss-matches occur

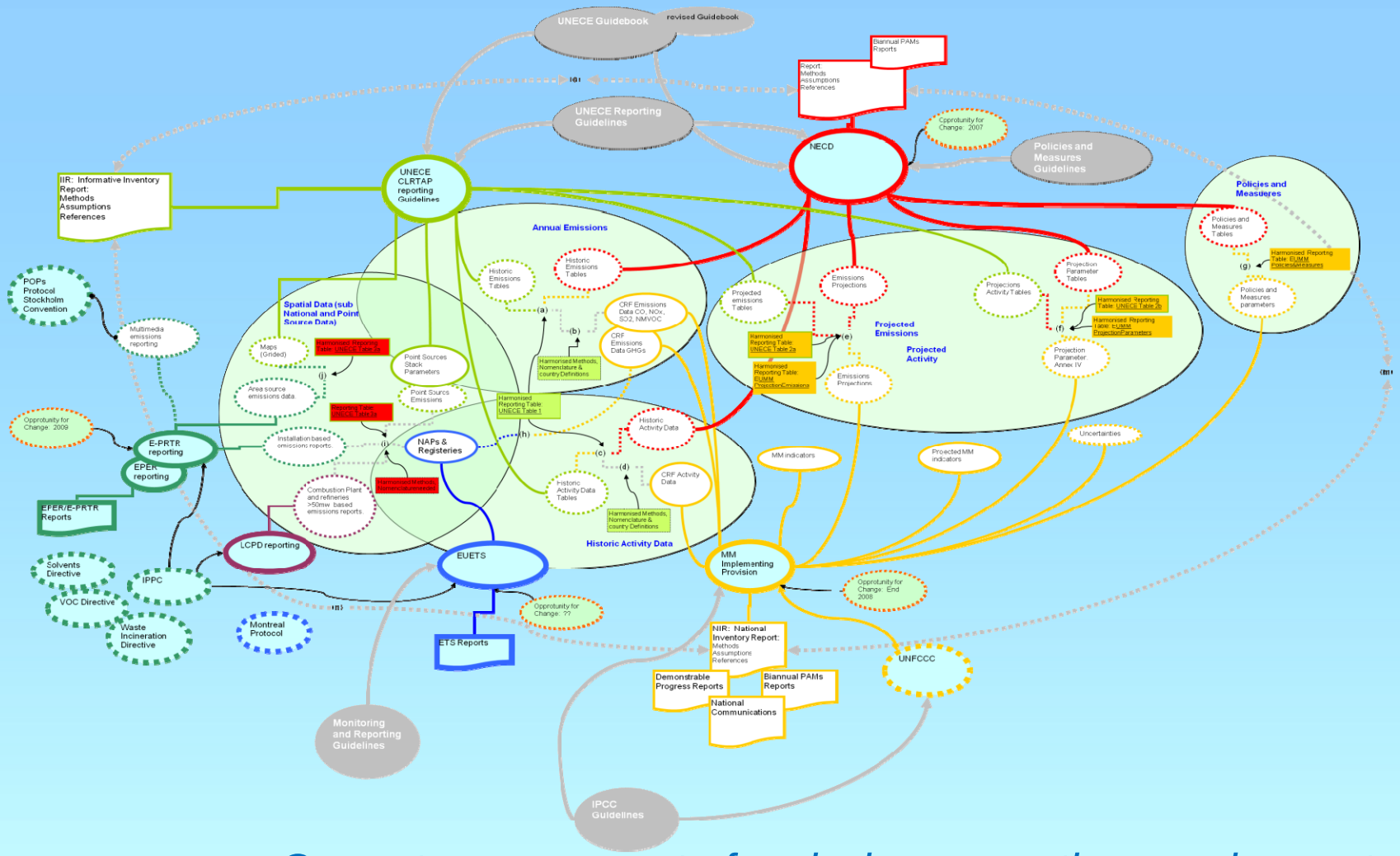
Difficult to reconcile estimates using different methodologies

Figure 4.23 Percentage difference of NECD national inventories (IPCC code 1A1a) from 2005 NO_X emissions as reported in MS LCP inventories (sectors ESI and district heating)



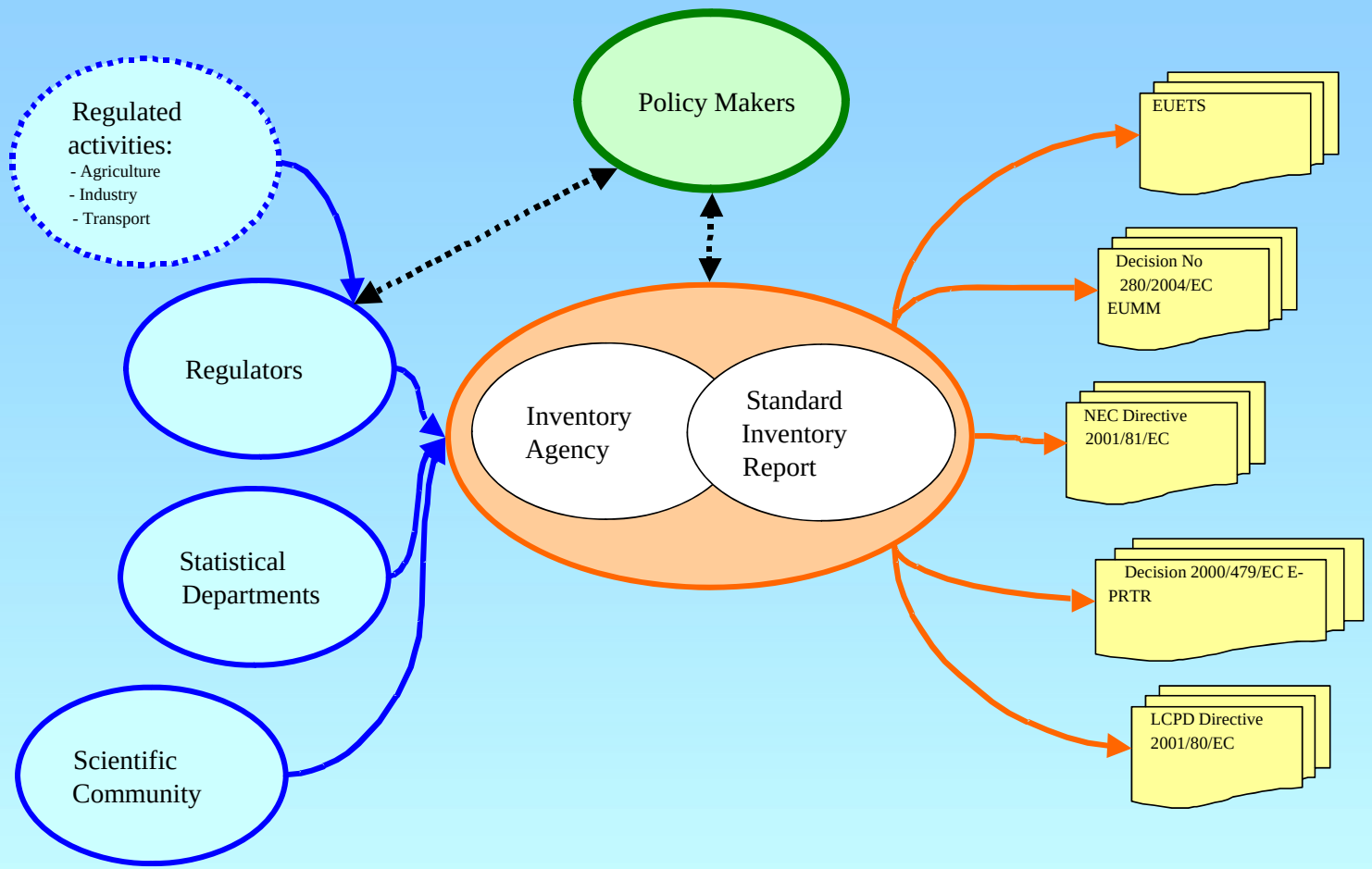
Source European Commission – Evaluation of the Member States' emission inventories 2004-2006 for LCPs under the LCP Directive - ENTEC 2008

… and here is why it's complicated



Current arrangement of emissions reporting requirements

Ideally it would look like this...



Conclusions and comments

- Different methods are used in different regions as a result of legislation evolving sporadically over time
- Any move towards alignment internationally is hindered by different legislative format
- Top down versus bottom up methods give different results which can lead to problems
- Centralised data storage and availability of emissions information to academia and the public is desired

Thank you

Any questions : lesleysloss@gmail.com

Also, many, many thanks to: