IMPRESS 2: Metrology for Air Pollutant Emissions

European Directives are setting increasingly stringent Emission Limit Values (ELVs) for key pollutants to mitigate ~400 000 premature deaths and €300 - €949 billion p.a. of costs attributable to air pollution. This project will deliver the underpinning research enabling a metrologically robust framework of documentary Standard Reference Methods to allow full enforcement.

Economic and Societal Drivers

- The EC recognises "~400 000 premature deaths and associated health costs of €300 -€949 billion p.a. attributable to air pollution" 1.
- ~€169 billion p.a. of the above cost is attributable to Europe's 10 000 largest polluting facilities ².
- 64% of the EU's urban population is exposed to particulate matter (PM) above WHO guidelines: residential biomass boilers/space heaters are, "the most important contributors to total PM emissions in the EU" 3.

Directive Requirements and CEN Needs

- A Standard Reference Method (SRM) is a European (CEN) standard produced to support a Directive that has been independently validated.
- SRMs are not voluntary, have legal meaning, and set mandatory measurement standards.

Conventional Combustion

Biomass Combustion

- There are no SRMs for NH₃, formaldehyde or HF.
- Existing SRMs have not been tested / validated for: - Enforcing 80% lower HCl ELVs;
- Low concentration dust measurements.
- Uncertainty work associated with flow SRM incomplete:
 - Sensor obscuration and wall deceleration; - Little evaluation to date for narrow ducts (key
- to MCP Directive).
- No SRMs for semi-volatile organic compounds (SVOCs), organic gaseous carbon (OGC), polyaromatic hydrocarbons (PAHs) or PM.
- · No real-time, on-line technique capable of apportioning CO₂ emissions between fossil and biomass fuels in co-firing stations.
- To meet WHO air quality guidelines by 2050 **Future Directive Needs** increasingly stringent legislation will continue to be introduced. Therefore, work must start now innovating the next generation of techniques.

Modelling

impact on

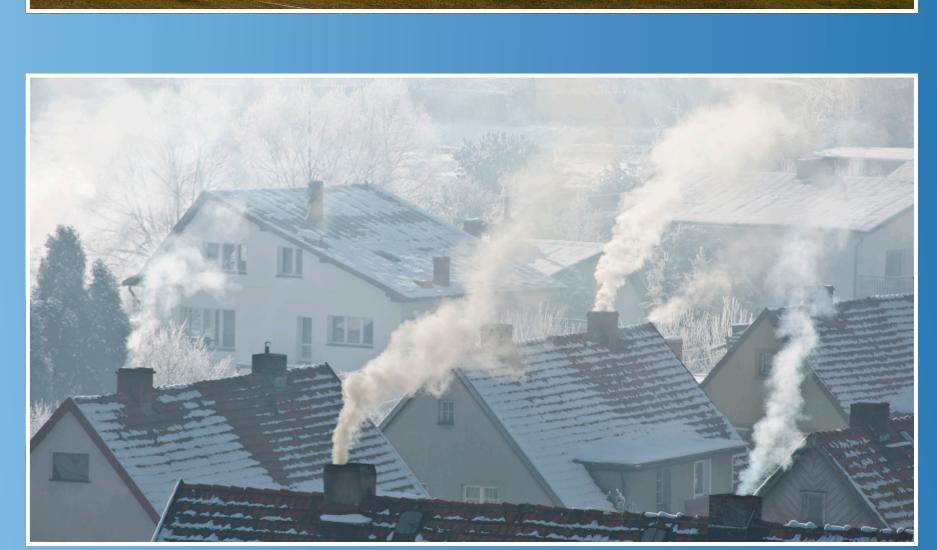
concentration

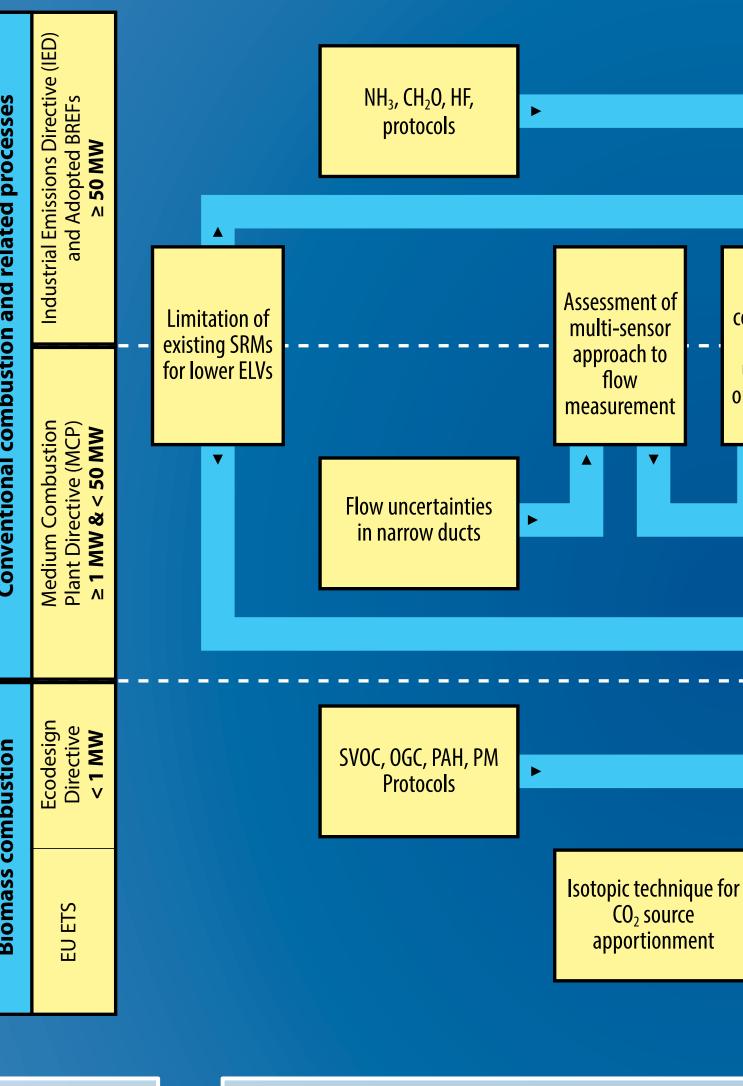
and the

uncertainty on annualised

emissions







Standardisation CEN/TC 264 / WG3 HF CEN/TC 264 / WG40 Formaldehyde ISO/TC 146 / SCI / WG28 CEN / TC 264 / WG36 ISO / TC146 / SC1 / WG31 CEN / TC264 / WG9 **Data Handling** CEN / TC264 / WGXX **Inter-laboratory comparisons** CEN / TC295 Residential Solid Fuel Burning Appliances CEN / TC57 **Central Heating Boilers** Regulation

> Paper on feasability of further lowering ELVs

Hyperspectral techniques for stand-off monitoring Paper on directive uncertainty requirements Discussion paper on myriad of regulations

Future Legislation Support

Next generation

techniques

Supporting

spectroscopy

Implementation

- The Project Management Board (PMB) will ensure the project is delivered efficiently from a non-technical perspective.
- The work will be delivered under: WP1 Conventional combustion; WP2 Biomass combustion; WP3 Flow uncertainties; WP4 Impact; WP5 Management.
- A Technical Management Board (TMB) will be created with the focussed responsibility of ensuring scientific quality. The TMB will feed into and review work across 5 technical strands across the work packages maximising scientific impact.

Coordinator **Project Management Board (PMB)** Emissions uncertainty & Legislation ISO / CEN standards NPL, INERIS VSL (practical) TU Delft (modellng) **Optical** PTB (spectroscopy) VTT (instrumentation **Timely Delivery on Budget**

Beyond the State-of-the-Art

- New measurement methods developed: SRMs for NH₃, CH₂O and HF achieving uncertainties of ≤ 0.3 mg.m⁻³, ≤ 0.6 mg.m⁻³ and ≤ 0.4 mg.m⁻³, respectively.
- · Flow studies in support of the MCP directive and determining if a novel multi-sensor in-stack approach can address current uncertainty requirements (i.e. < 1.5%).
- New measurement methods developed and promulgated at CEN for SVOCs, OGC, PAHs and PM.
- Development and validation of next generation techniques:
 - novel hyperspectral, multispecies capability to monitor biomass and other combustion sources;
 - real-time, on-line capability to apportion CO₂ emissions in co-firing plants;
 - laser based emission monitoring with associated spectroscopy for calibration.

Stakeholder Impact

Stakeholder	Impact Mechanism
CEN/ISO community	 Measurement methods and associated validation data promulgated into a raft of SRMs supporting European Directives. Limitations of existing SRMs independently tested.
National Regulators & Policy Makers	 SRMs passed into member state legislation enabling European Directives to be enforced. SRMs providing the accuracy necessary to track impact of directives and inform policy makers on ELVs in future directives.
Plant Operators & Stack Testing Organisations	 Confidence that reported emissions data are comparable and of a defined quality, protecting society and reputation.
Manufacturers of Residential Boilers and Associated Test Laboratories	 Measurement techniques facilitating design and achieving Eco-labelling. Test data for products of a defined quality that is defendable.

IMPRESS 2 follows on from the highly successful ENV60 IMPRESS project addressing new emission species and expanding into residential emissions.





































Complexity of stack

input from plant.

flow. Counter-rotating flows generated as a result of perpendicular

European Commission MEMO/13/1169. Questions and Answers on the EU Clean Air Policy Package. 13th December 2013.

² Towards an Improved Policy on Industrial Emissions. Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions. Commission of the European Communities, COM(2007), 843 final

³ European Environment Agency, www.eea.europa.eu/soer-2015/europe/air









































