MRV REQUIREMENTS IN AN ETS

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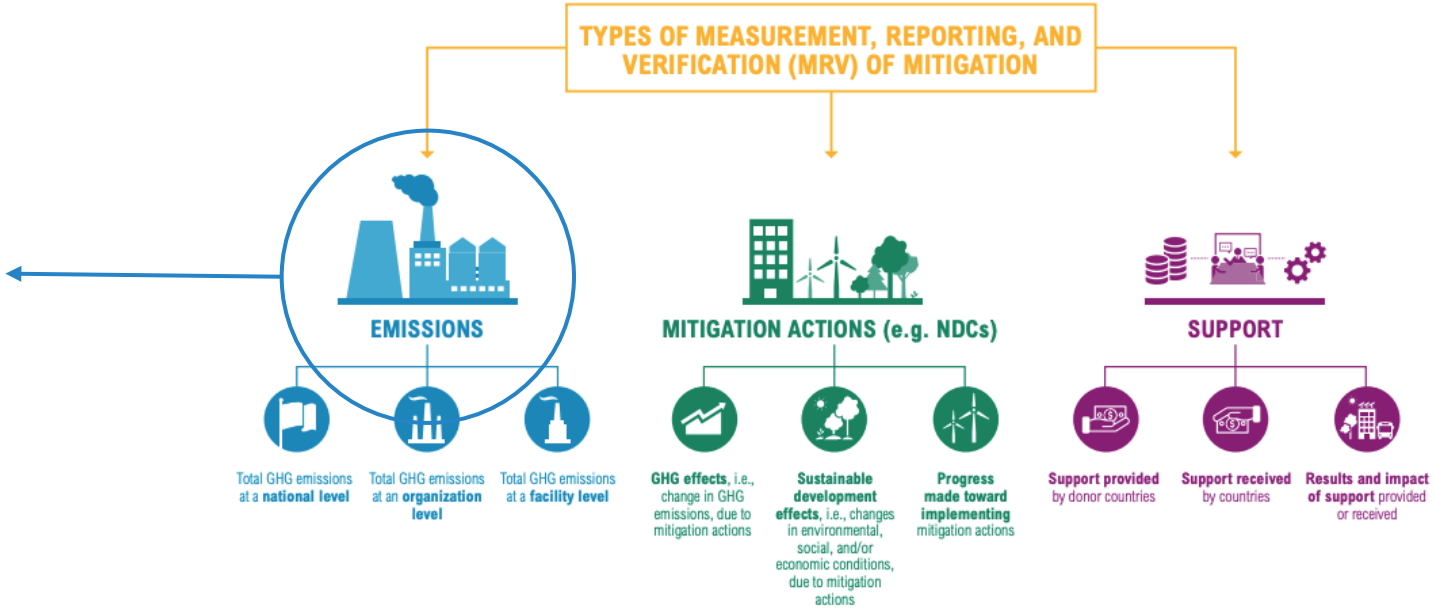
What is MRV?

Mitigation-related measurement, reporting and verification (MRV) is applied to:

1. **Emissions**
2. Mitigation actions
3. Support



Source: Singh et. al. (2016). "MRV 101: Understanding Measurement, Reporting, and Verification of Climate Change Mitigation." Working Paper. Washington DC: World Resources Institute. Available online at http://www.wri.org/mrv101.

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What is MRV of emissions?

MRV consists of the following steps and procedures

Measure or Monitor (M)

Direct physical measurement of GHG emissions, emissions (or emissions reductions) estimation by use of activity data and emission factors

Report (R)

Compilation of (GHG emissions) information in inventories and other standardized formats to make it accessible to a range of users

Verify (V)

Periodical review, analysis or independent assessment of the reported information to establish completeness and reliability.

Verification helps to ensure accuracy and conformance with any established procedures, and can provide meaningful feedback for future improvement.

Usually accompanied by an accreditation framework.

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Why the need for an MRV framework?

Supporting corporates' decarbonization strategy

- Obtain detailed understanding of emission profiles and trends of different sectors
- Facilitate setting of baselines or reference years for future emission reduction targets
- Supports design and operation of carbon pricing schemes such as ETS with source-level data
- Improve overall GHG data quality and informs national GHG inventory

Why the need for an MRV framework?

Supporting national decarbonization strategy

- Obtain detailed understanding of emission sources i.e. facility processes and activities
- Manage GHG risks (i.e. costs) and identify emission reduction opportunities
- Enable participation in mandatory government programs (ETS)
- Improve facility and organization’s quality and management systems

Key principles in GHG accounting and reporting

Principles towards developing a compliance obligation

1. **Completeness** means that the MRV process covers all important and critical emissions sources within the boundary of the entity
2. **Consistency** refers to consistent application of accounting and calculation methods so that the reported emissions can be compared and tracked over time
3. **Transparency** relates to prescribing to what extent information on processes, assumptions, and limitations of the GHG inventory are to be documented in a clear, factual, neutral and coherent manner, which allows the creation of a clear audit trail to facilitate verification
4. **Accuracy** implies that the GHG measurements, estimates or calculations are systematically neither more nor less than the actual emissions value, as far as can be judged, and that uncertainties are reduced as far as practicable
5. **Relevance** means that emission sources are identified in accordance with the regulations, and that the emissions quantification approaches and methods are appropriate and representative of the facility's processes and operations.

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Key principles in GHG accounting and reporting

Principles towards fulfilling a compliance obligation

1. **Completeness** means that the MRV process covers all appropriate and necessary emissions sources within the defined boundaries of the regulated entity - all in accordance with legal requirements
2. **Consistency** refers to consistent application of accounting and calculation methods so that the reported emissions can be compared and tracked over time
3. **Transparency** relates to internal systems where information on processes, assumptions, and limitations of the GHG inventory are to be documented in a clear, factual, neutral and coherent manner, which also allows the creation of a clear audit trail to facilitate verification
4. **Accuracy** implies that the GHG measurements, estimates, or calculations are systematically neither more nor less than the actual emissions value, as far as can be judged, and that uncertainties are reduced as far as practicable.
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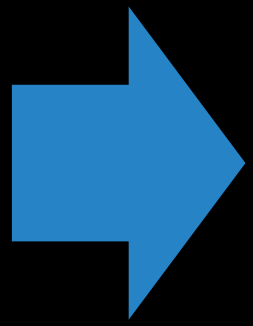
How would an MRV framework support ETS operationalisation exactly?

What it does

- Specifies and establishes measurement and reporting (M&R) requirements for emitters under the ETS in determining their emission levels
- Ensures all emitters would be subject to the same set of M&R requirements, and assessed based on the same set of rules (verification requirements)
- Improve the accuracy and reliability of emissions data, for operation of the ETS

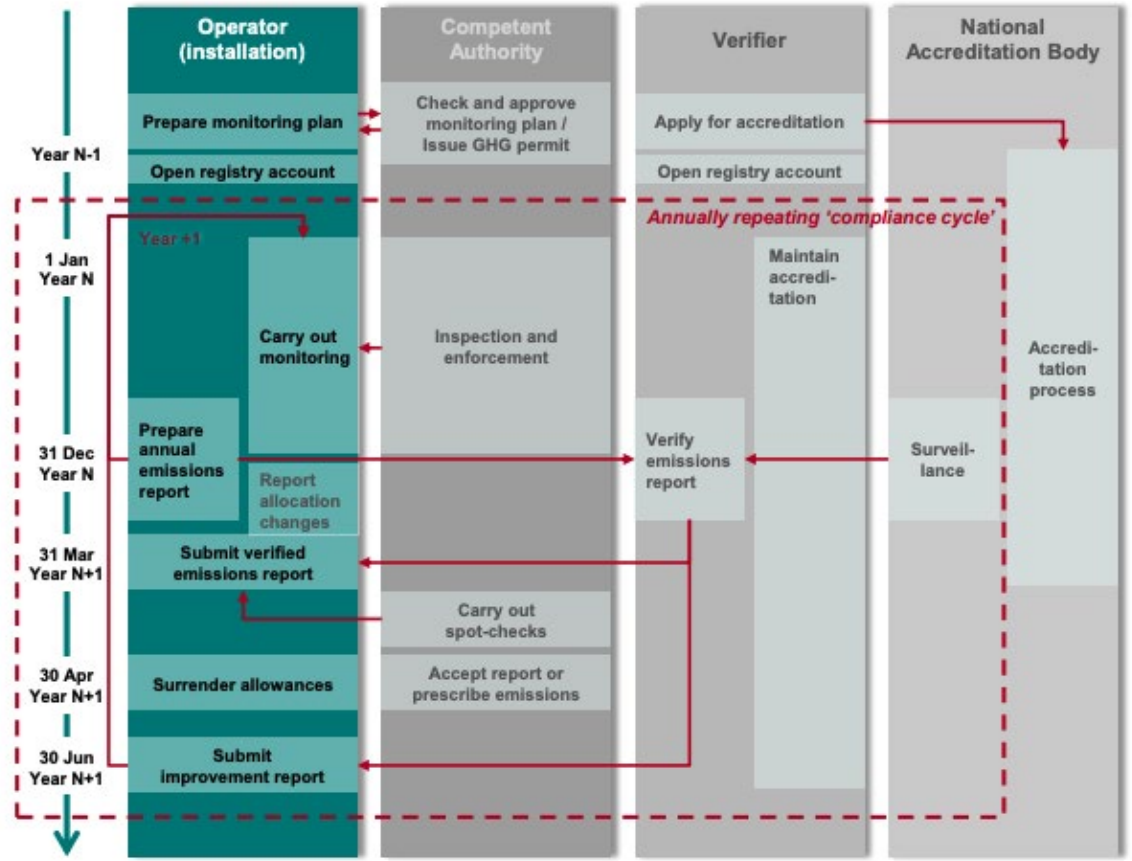


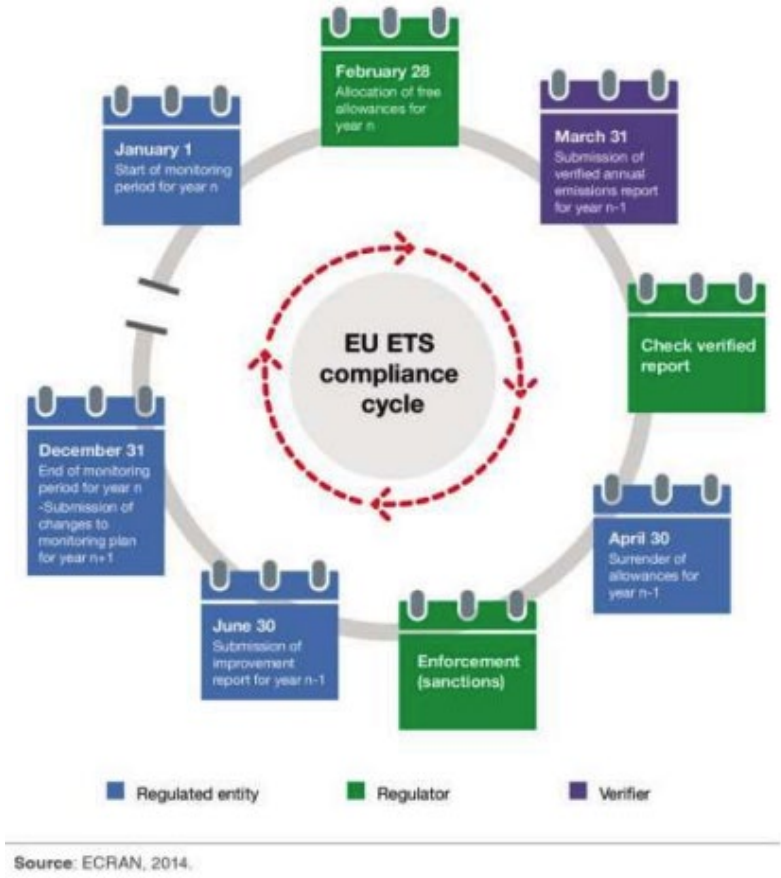
Why it is important

- Promotes transparency and clarity
- Establishes trust and integrity in the ETS
- Creates a level-playing field and promotes fairness among companies
- Promotes compliance and allows for enforceability against non-compliance
- Ensures comparability in data over time and among companies as same approaches are used

MRV compliance cycle & stakeholders

Example: EU ETS





Source: European Commission (2022). EU ETS Monitoring and Reporting – Quick guide for stationary installations. Available online at https://climate.ec.europa.eu/document/download/535fc76c-4466-4568-a88a-e205a5ee0d6f_en?filename=quick_guide_operators_en.pdf ; ICAP (2023). Emissions Trading in Practice: MRV. Available online at: https://pmiclimate.org/sites/default/files/2023-11/MRV%20-%20WB.pdf

Key elements of an MRV framework

A robust and effective MRV framework to support the operation of the ETS

1. Coverage (sectors, % of national inventory)
2. Scope and thresholds (including gases, facility definition)
3. M&R rules (including responsible entity, penalty regime, reporting period, GWPs)
4. Monitoring plan (content, approval process, template)
5. Emissions quantification methodologies
6. Quality control and external audit
7. Emissions reporting requirements for companies
8. Use of standards
9. Verification rules (including level of assurance, materiality, verification team)
10. Verification process (verifier activities, site visits, types of findings and outcomes)
11. Submission requirements for verifiers
12. Accreditation of verifiers including criteria, process, enforcement, independence reqmts

Source: South Pole (2024) based on international practices e.g. EU ETS, Korea ETS, California MRR, Australia NGER

Monitoring plan

Purpose, objectives, implementation

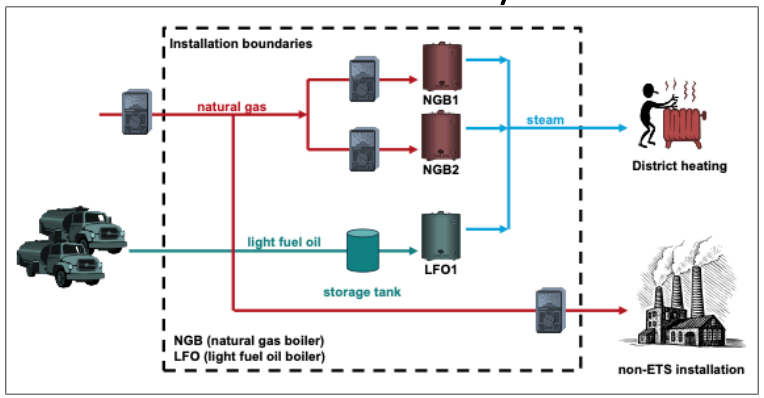
1. A **detailed** document of the monitoring methodology of the facility developed by the company
2. **Describes and demonstrates how** the company complies with regulatory requirements for M&R
3. **Guides the company** to design and implement M&R procedures, like a manual or handbook
4. **Mandatory** in almost all carbon pricing schemes, but could also be mandated for national inventory reporting
5. An **adaptive** document that is subject to updates, to reflect the current nature and operations of the facility - can be submitted when there are changes or on a regular basis
6. **Format** may be prescribed by the government i.e. templates
7. May be subject to **formal approval** by the government before commencement of monitoring for the compliance period

Monitoring plan

Contents for a comprehensive manual to support monitoring and reporting activities

Scoping of emission sources

1. Description of the facility's business activities, processes and activities generating emissions, process units and locations
2. Identification of discrete emission sources - distinct process units, measurement approach for activity data and conversion factors
3. Use of process flow diagrams indicating the process units, metering equipment, sampling points - with its serial number/ID



Source: European Commission. Exemplar monitoring plan. Available online at: https://climate.ec.europa.eu/document/download/7768a17c-397f-4c35-8844-82562bf93106_en?filename=t1_mp_installations_example_en.xls

Monitoring plan

Contents for a comprehensive manual to support monitoring and reporting activities

Determination of quantification approach

1. Description of emissions quantification approach of each emission source (calculation-based, measurement-based), including use of default or onsite conversation factors
2. Identification of measurement parameters (for determining activity data, conversion factors)
3. For each parameter, identification of the measurement method and instrument including external (e.g. supplier) data
    a. Onsite: metering equipment, laboratory for analysis of samples
    b. External sources: invoices, lab analysis reports (Conformity of Performance reports),

Monitoring plan

Contents for a comprehensive manual to support monitoring and reporting activities

Management procedures for ensuring data quality

1. Description of data processing and aggregation steps
2. Existence of internal procedures for data collection, compilation, review, reporting - and responsible teams
3. Existence of change management procedures
4. Description of “fall-back” monitoring methodology in the event of missing data, equipment failure etc
5. Existence of internal procedures for record keeping, maintenance of metering equipment and internal IT/data systems

Common considerations for establishing M&R rules

1. **Definitions of facility and the obligated entity**
    a. Contiguous and interdependent processes, land parcels that are adjacent
    b. Operation and financial controls over the facility

2. **Registration and deregistration of facility and the obligated entity**
    a. Use of criteria and thresholds, set by the government
    b. Companies are responsible for ensuring compliance to regulations
    c. Rules to handle change in ownership of facility or nature of the business activities

3. **Measurement effort and accuracy viz. resources and costs**
    a. For accuracy, use of onsite factors where available over default factors
    b. Phased transition from use of default factors to onsite factors, and increasing frequency for monitoring and sampling, where feasible
    c. Unique set of resource availability, know-how and challenges for each company
    d. Need to prevent perverse behaviour (e.g. use of lower emission factor)

Common considerations for establishing M&R rules

4. **Excluded emission source categories from reporting and/or carbon pricing (ETS)**
    a. Emissions which are covered by other form of taxes e.g. fuel levies in transport
    b. GHGs not covered by NDC (e.g. PFCs, NF3, SF6)
    c. Biogenic emissions (e.g. biomass combustion)

5. **Treatment of 'minor' emission sources**
    a. Definition of minor sources
    b. Determination of minor sources
    c. Use of simplified estimation approaches

Emission quantification approaches

Relevant considerations for developing an appropriate and suitable quantification approach

Monitoring guidelines and calculation equations for specific sectors and activities

Drawn from international guidelines e.g. 2006 IPCC Guidelines for National GHG inventories.

Overseas regulations:

- US EPA GHG Reporting Rule
- California Regulation for the mandatory reporting of greenhouse gas emissions,
- EU ETS Monitoring and Regulation Regulation (MRR)
- Australia National Greenhouse and Energy Reporting (Measurement) Determination 2008)

Measurement method

Three main methods:

- use of estimates (e.g. % valve opening)
- meters
- billing invoices (e.g. fuel gas in units of mmBTU)

Meter accuracy

Calibration schedule, preventive maintenance, operating range, pressure and temperature correction check in DCS

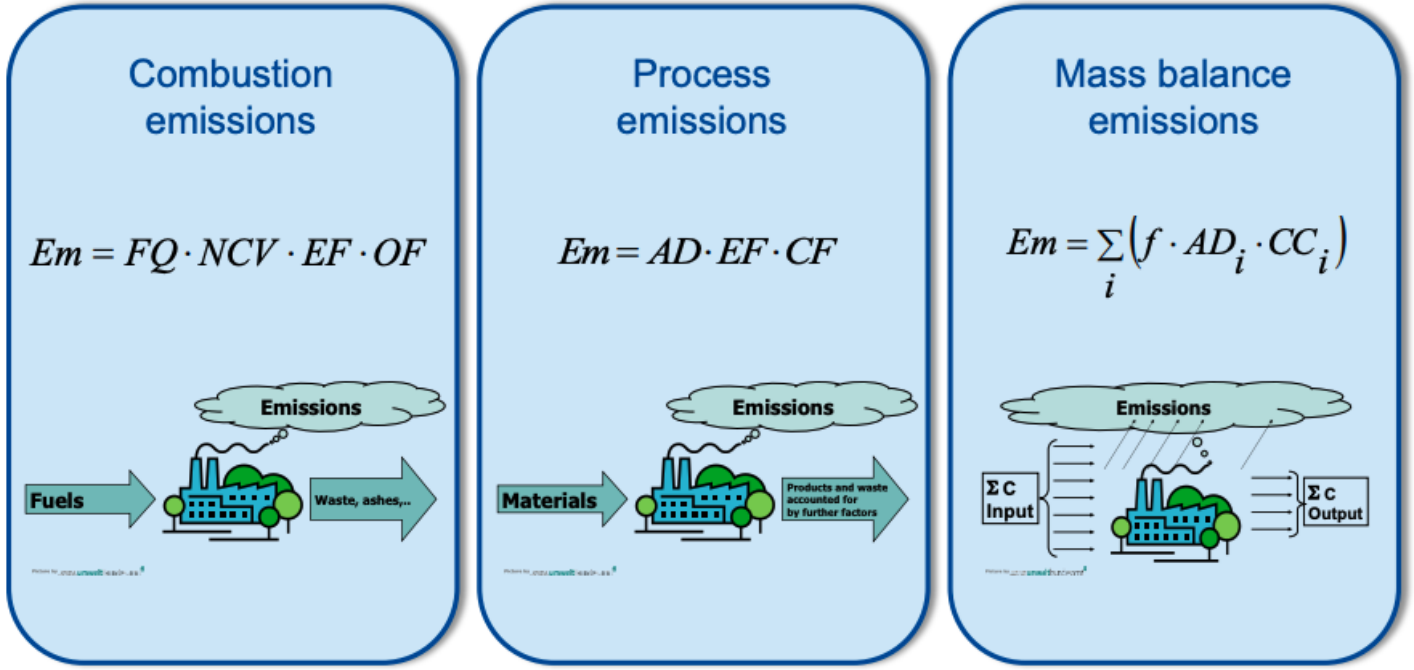
Sampling and analysis

Procedure, laboratory accreditation, frequency (periodic or by batch)

Emission quantification approaches

All emission quantification approaches utilize some form of activity data and conversion factors

$$\text{Emissions} = \text{Activity data x Conversion factor(s) x GWP}$$



Companies may utilise a range of approaches, based on existing practices and set-up in the facility.

Source: European Commission (2022). EU ETS Monitoring and Reporting – Quick guide for stationary installations. Available online at https://climate.ec.europa.eu/document/download/535fc76c-4466-4568-a88a-e205a5ee0d6f_en?filename=quick_guide_operators_en.pdf

Emission quantification approaches

Common types of activity data and conversion factors

Activity data	Conversation factors
• **Quantity of fuel combusted, feedstock or products** • **Volumetric gas flow** (e.g. in flare stack) • **Operating hours**	• **Emission factor**: average rate of a specific GHG produced in relation relative to the activity data utilised, expressed in tCO2e/kJ or tCO2e/t • **GHG concentration in gas** • **Calorific value**: amount of thermal energy released by a tonne, litre or cubic meter of a material during complete combustion expressed in kJ/unit • **Carbon content**: fraction of carbon in a unit of a material expressed in tC/t • Numerical factor to convert Carbon to CO2 according to the respective stoichiometry • **Oxidation rate**: fraction of carbon which is oxidized during combustion • **Flare combustion efficiency**: the rate at which hydrocarbons are converted into CO2 by the flaring system, whereas the remaining gas stream contains uncombusted hydrocarbons, CO, etc • **Destruction or removal efficiency**: efficiency of thermal oxidation / abatement systems in the removal or destruction of a substance, e.g. VOCs, PFCs

Emission quantification approaches

Emission source example - fuel combustion

Scenario	Activity data	Conversion factors
Activity data in mmBTU from invoices	Quantity of fuel purchased and combusted, in mmBTU	• Emission factor (tGHG/GJ) • Unit conversion factor from mmBTU to GJ (GJ/mmBTU)
Conversion factor based on onsite analysis of carbon content (t carbon / t fuel) of fuel	Quantity of fuel measured from metering equipment, in t	• Carbon content of fuel • Molecular weight ratio from C to CO2: 44/12
Conversion factor based on onsite measurement of gas calorific value based on online gas chromatograph of fuel gas constituents	Quantity of fuel measured from metering equipment, in t	• Net calorific value (GJ/t) • Emission factor (tGHG/GJ)

Quality control and external audit

Ensuring accurate and complete emissions data

Internal quality control (SOPs, checklists, etc)	External audit
● GHG inventory development and maintenance ● Data flow activities and management procedures ○ Data collection, validation and processing ○ Data review and reporting ● Roles and responsibilities of involved personnel ○ Competence and authorization of personnel ○ Assignment of roles to job positions/titles ○ Preparer and Reviewer roles (“four-eyes” principle) ● Data management systems ○ Access rights ○ Records keeping ● Management of metering equipment, IT systems ● Change management	● Requirement for external (third-party) verification of the emissions data submitted to the Government ● Accreditation of external auditors

Quality control and external audit

Examples of typical errors and ways to prevent them

1. Omission of emission sources from the monitoring plan
2. Cell reference errors in Excel calculation spreadsheets during data processing
3. Calculation errors in Excel calculation spreadsheets during data processing (e.g. unit conversion errors, cell formula errors)
4. Inaccurate metering data making it unusable for emissions reporting
5. Anomalies (spikes or dips) in emissions tends (monthly, daily, weekly)

1. **Use of PFDs, P&IDs, DCS** for development and conduct routine checks on the monitoring plan
2. **Use of absolute references** (e.g. A1) to avoid cell reference errors
3. **Clear labelling** of measurement parameters, meter ID, time stamp and units in internal calculation spreadsheets; staff **trainings**; **four-eyes principle**
4. Development of **internal processes** to identify such instances and mitigation actions (e.g. meter drift & use of **adjustment factors, meter calibration schedule, use of alternative meter data**)
1. Development of **internal processes** where teams conduct a **sense-check of monthly trends against records of production data**, flaring activity or shutdown events

Emissions Report

Principles for report & Considerations for information to be submitted in the Emissions Report

- Emissions report must be verified
  - Errors and non-conformities must have been corrected
- Granularity of data to be reported
  - By individual emission sources from fuel combustion, industrial processes
- Emissions data to be reported for each emission source:
  - Activity data and conversion factors
  - Emissions breakdown by GHG
- Other relevant information
  - Use of “fall-back” approach
  - Deviations from monitoring plan
- Reporting format (online tool, offline template, etc)
- Automation of calculations in reporting tools, use of summary tables

Use of standards

Ensuring conformance to international practices, allowing for comparability

- **Basis of reporting** (facility definition and boundaries, reporting principles):
  - GHG Protocol Corporate Reporting Standard
  - ISO 14064-1, Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

- Specificalities of **measurement and reporting methods and practices**
  - IPCC methods, international
  - Suitable ISO or national standards

- **Verification standards**
  - ISO 14064-3, Specification with guidance for the validation and verification of greenhouse gas assertions
  - International Standard on Assurance Engagements (ISAE) 3410, Assurance engagements on greenhouse gas statements

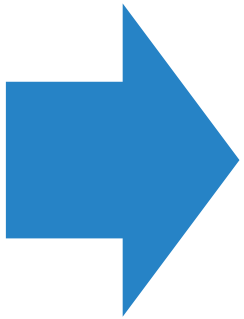
Common gaps in MRV & recommendations

1. Companies do not fully understand the measurement and reporting requirements, what is exactly needed to be done and how to get started

1. Companies are unfamiliar with the emissions quantification approaches and the requirements of the monitoring plan

1. Companies do not fully understand the quality management requirements

1. Companies do not know what is an verification audit, what is required and how to prepare for it



1. **Invest in technical capacity building training** for companies to improve acceptance, compliance and data quality

1. **Provide templates, technical guidance documents, factsheets in advance** to promote early preparatory efforts

1. Supplement technical training with **online resources** e.g. FAQs, help desks, short courses

2. **Engage companies on the verification requirements** early, including the verification industry players

Conclusions

A robust MRV framework is essential and fundamental for the **proper functioning of the ETS**.

An MRV framework needs to be **fit-for-purpose**, where **international best practices** is customized to **local circumstances and objectives**.

Every element of the MRV framework requires **careful consideration and planning**, deep understanding of various **stakeholders' capabilities and gaps**, and an **implementation roadmap** to ensure market readiness.

In the development of the MRV requirements, **close engagement between government and industry** is required to gain a shared understanding on solutions that are feasible and implementable, industry's capacity building needs, governments' timelines and future plans.

THANK YOU!

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