How to find Activity Data

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Contents

● Introduction

● Preconditions for establishing sustainable system for AD collection
  • Prioritisation and Planning
  • Approaches to data collection
    – Data sources
    – Communication with stakeholders
    – Filling the gaps
  • Archiving and documentation

● Conclusions
Activity data

- Activity Data
  - statistics (census, survey...)
  - measurements
  - model results
  - expert judgement
  - ...

\[ \text{AD} \times \text{EF} = \text{Emission} \]

- Obtaining good quality of Activity data (AD) is crucial for all emission inventories
What criteria should meet good AD sets?

- Completeness (all sources, all regions, time series, ...)
- Consistency
- Timeliness – (be ready on right time)
- Appropriate level of detail (subcategories, regions, ...)
- Unbiased (V&V and/or QA/QC plans in place)
- Low uncertainty
- Transparency (documentation, archiving)

Priorities may change with the purpose for which the inventory is compiled
Data collection

- The information to be put together annually is huge and is gradually increasing with new requirements on emission reporting.
- Formalised data collection routines have to be established to keep system sustainable and to guarantee availability of AD on annual bases and in real time.
- Archiving and documentation of AD is essential to make the inventories transparent, trustful, improvable,…
Preconditions for Establishing Sustainable System for AD Collection

- Setting up priorities – focus on most important sources
- Developing data collection strategies – (short & long term plans)
- Communication and establishing good relationship with data providers
- Collecting data regularly
  - Collect data at the level of detail where emissions are calculated (e.g. the same EF)
  - Review AD on regular bases; (V&V, QA/QC)
- Documentation andarchiving all AD, background information as well
Setting up priorities

- Complete/update list of source/sink categories for your country and identify important ones (Importance of source categories may differ between gases / pollutants)
  - Key source analyses,
  - Look at neighbour countries
  - Regional /world statistics emission per capita…

- Check availability of activity data needed for each source/sink category. Possible constraints e.g.:
  - data are available and accessible as needed
  - data are available but e.g.; not in requested structure, not complete, high uncertainty,…
  - data are in country but not accessible for the inventory team
  - data will be available but late
  - data missing

- Allocate resources (budget and expertise) and check for deadlines

- Elaborate plan /strategy for obtaining data
Developing AD Collection Strategy - Planning

Assess status, determine priorities and assign staff responsibility

- **What** (is to be collected) – AD for specific source categories
  - E.g. energy statistics, animal statistics, waste production…
  - Harmonisation of different requirements is essential

- **Where** (Source of the information)
  - E.g. statistical office, ministry of economy, municipalities, industries,…

- **Who** (will approach different data providers)
  - E.g.: MoE, Leading inventory Institution, Consultants,…

- **How** - procedural, institutional, legal, arrangements (e.g. what protocols does exist in the country for data acquisition, identification of new procedures to be established,..)
Number of emission inventories are to be complete annually for:

- international obligations like CLRTAP and protocols, UNFCCC, EU directives, local authorities, models,…
- Gases/pollutants - e.g. ozone precursors, $\text{SO}_2$, ammonia, GHGs, HM, POPs, particulate matter, PCBs…
## AD - Level of detail (WHAT)

- **0 level** = Total emission
- **1<sup>st</sup> level**
  - Total Agriculture = 328
  - A Enteric Fermentation = 278
- **2<sup>nd</sup> level**
  - 1 Cattle = 226
  - 2 Buffalo = 0
  - 3 Sheep = 43
- **3<sup>rd</sup> level**
- **4<sup>th</sup> level**
  - Total Energy = 108,048
  - A Fuel Combustion Activities (Sectoral Approach) = 108,048
    - 1 Energy Industries = 54,736
      - a Public Electricity and Heat Production
      - b Petroleum Refining
      - c Manufacture of Solid Fuels and Other Energy Industries

- **N<sup>th</sup> level** = Large point sources
Typical Data Sources in Country

- National Statistical Agency
- Industrial associations, trade associations
- Enterprises
- National Regulatory Authority
- Ministries, Agencies
- Custom administration
- Local governments
- Municipalities
- Universities
- ....
International data sources (examples)
(Where)

- **ENERGY**
  - IEA (production, transformation, consumption), UNSD (energy statistics and energy balance), world bank, OECD,
  - ICAO, IATA (air transport )
  - CDIAC, EDGAR partial info on fugitive emissions
- **Industrial processes, product use**
  - Eurostat and UN (production in physical units), OECD (production in monetary units)
- **Agriculture, Nature, Forestry**
  - FAO (animal statistics, fertilizer use, agriculture production,..)
- **Waste**
  - Eurostat, OECD, UN (limited information, not annual data)
Steps when gathering existing AD (HOW)

- Delegation of responsibilities
- Initial screening of data availability
- Specification of data requirements (years, subsectors, units, uncertainty information..)
- Specification of format, structure and time schedule
- Communication with stakeholders
- Collection of AD
- Review of AD
- Documentation & archiving of AD
Communication with stakeholders (How)

- **Target groups:**
  - government (backstoping, legal support), local authorities
  - data providers

- **Explain what is needed and why**

- **Submit your requirements in easy-to-understand form (tables, definitions), and in time**

- **Explain what advantages can have good set of AD for provider, government, local authorities,..** (e.g. good fuel consumption data are foundation for analysis of a range of energy and environmental issues, abatement strategies, emission trading,..)

- **Praise received information, cite source**

- **Elaborate protocols for treating restricted data** (Sign confidentiality agreement, Agree level of data aggregation,..)

- **Perform awareness activities (seminars, trainings, media events,..)**
Steps when filling gaps in AD (HOW)

- Identification of data gaps and allocation of problems
- Checking alternative data sources
  - Try international agencies (IEA, FAO, OECD,..)
  - Examine Surrogate data /drivers
- Selecting methods for filling gaps in AD
- Filing gaps,
- Checking AD
- Documentation & archiving of AD and background information
Methods for filling gaps in AD sets (HOW)

- Different type of problems to be solved:
  - Non-calendar year data
  - Not complete time series
  - Not complete AD – e.g. only for 6 from 10 enterprises
  - No uncertainty information,
  - Big uncertainty of data
  - Not consistent data set

- Numerical methods
  - Weighted average
  - Extrapolation, interpolation
  - Regression
  - Models

- Expert judgement

- Default values, drivers, surrogate data

- Combination of all
Example: Reconstruction of Time Series –
Mathematical and Empirical Methods

- Interpolation/Extrapolation-Newton formula
  - Equivalence of function values \( f(x_i) = P(x_i) \)

- Regression: linear, quadratic, cubic
  - minimization of sum of squares \( (f(x_i) - P(x_i))^2 \)

- Approximation using drivers, examples:
  - GDP → Electricity production/consumption
  - GDP → Total Emission from Fuel Consumption
  - Fossil electricity production → Emission
Mathematical Methods – Interpolation

M. Tichy for UNDP training

\[ y = -195.29x^3 + 1E+06x^2 - 2E+09x + 2E+12 \]

\[ y = 674.01x^2 - 3E+06x + 3E+09 \]

Graph showing emission data over years with different lines for original time series, interpolation linear, interpolation quadratic (before), true value, regression cubic, regression quadratic, and interpolation quadratic (after).
Mathematical Methods - Extrapolation

M. Tichy for UNDP training

\[ y = 889.6x^2 - 4E06x + 4E09 \]
\[ y = -375.75x^3 + 2E06x^2 - 4E09x + 3E12 \]
Generation of new data (HOW)

- Method will depend on importance of source, character of data, availability of time and resources,...

- Options
  - Models
  - Measurements
  - Surveys, (Census)
  - Expert judgement
  - Communication with stakeholders
Expert judgement (HOW)

- **When** - to fill the data gaps, obtain uncertainty information
- **How** – in transparent manner, appropriately documented (standard format-protocol)
- **Possible bias in expert judgment**
  - Representatives
  - Insufficient adjustment
  - Desire to influence the result e.g. to avoid contradicting prior position
Developing AD collection Strategy - Steps

- Establish coordinating agency, experts, steering body…
- Assess current status
- Harmonise requirements
- Include time schedule
- Provide sector specific guidance
- Include contacts, addresses,…
- Plan validation & verification of AD
- Identify areas to be improved in the future, new routines to be invented…
- Strive to make from “AD collection strategy” a (legally) binding document (processes ISO9001, NIS, decree, memorandum of understanding…)
Documentation and archiving

● **Documentation**
  - collection of information on sources of the used data, and methods and „background“ leading to conclusions
  - the way how to persuade a reader or reviewer of a report that my data and conclusion are correct

● **Archiving**
  Storage of all (initial sets of AD), background information and revised sets of AD as well
  - to enable a follower to check all my steps and learn from my achievements and failures
  - to enable any recalculations
Documentation and archiving systems

- Delegate responsibilities
- More is better! But „heap-like“ archive complicates access to individual documents
- Make an easily understandable system
- Archive all „source materials“ (books, journals, reports, expert judgment protocols, communications!!,… )
- All AD have to be referenced
- Exception may be books and journals available in many public libraries
How to find AD - Conclusions

- Permanent awareness raising on importance of good AD with government and other stakeholders
- Build up good relationships to data providers
- Build up good inventory team, delegate responsibilities, harmonise efforts
- Elaborate ST&LT strategies for AD collection
  - Set up priorities
  - Harmonise requirements
- Formalise the system to the extend possible
- Be creative