Environment and Climate Regional Accession Network ECRAN

Environment and Climate Regional Accession Network (ECRAN)

Report on the Regional Training on Uncertainty Assessment on GHG Inventories

2-3 July 2014, Podgorica

ENVIRONMENT AND CLIMATE REGIONAL NETWORK FOR ACCESSION - ECRAN

WORKSHOP REPORT

Activity 3.2

REPORT ON THE FIRST REGIONAL TRAINING ON UNCERTAINTY ASSESSMENT ON GHG INVENTORIES

Podgorica, 8-9 July 2014

This Project is funded by the European Union

A project implemented by Human Dynamics Consortium

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LIST OF ABREVIATIONS	
CRF	Common Reporting Format
EC	European Commission
EF	Emission Factors
ETS	Emission Trading System
EU	European Union
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MCS	Monte Carlo Simulation
MMR	Monitoring Mechanism Regulation
PDF	Probability density Function
TCCCA	Transparency, Consistency, Comparability, Completeness, Accuracy
WG	Working Group

I. Background/Rationale

Effective monitoring, reporting and verification (MRV) of greenhouse gas (GHG) emissions is critical for tracking progress towards the achievement of emission reduction targets.

As Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, the European Union and Member States are required to report annually on their GHG emissions. They also have to report regularly on their climate change policies and measures through National Communications.

The annual EU GHG inventory report is prepared on behalf of the European Commission by the European Environmental Agency each spring. In line with UNFCCC reporting requirements, each Member State's annual inventory covers emissions up until two years previously.

Regulation (EU) No 525/2013 on mechanisms for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change (hereinafter: Monitoring Mechanism Regulation or MMR) fully substitutes the Decision No 280/2004/EC (Monitoring Mechanism Decision or MMD) and as such provides the legal basis to implement revised domestic commitments set out in the 2009 climate and energy package (20-20-20 commitments), as well as to ensure timely and accurate monitoring of the progress in implementation of these commitments.

The revised mechanism also enhances the current reporting rules on GHG emissions to meet requirements arising from current and future international climate agreements as well as the 2009 climate and energy package. It aims to improve the quality of data reported, help the EU and Member States keep track of progress towards meeting their emission targets for 2013-2020 and facilitate further development of the EU climate policy mix.

With the submission of the National Inventory Reports (NIRs), Member States have to provide information on various elements needed to prepare the Union greenhouse gas inventory report, including a general uncertainty assessment.

The report on *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* of the UNFCCC provides good practice guidance to assist all parties to the Kyoto Protocol in producing inventories that are neither over nor underestimates so far as can be judged, and in which uncertainties are reduced as far as practicable. To this end, it supports the development of inventories that are transparent, documented, consistent over time, complete, comparable, assessed for uncertainties, subject to quality control and quality assurance, and efficient in the use of resources.

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II. Objectives of the Training

Objectives

The workshop is the second Module of the multi-module series of workshops to be implemented in the framework of ECRAN's Working Group 2 on "National inventory systems and the EU Monitoring Mechanism Regulation".

- Module 1 included regional training on GHG inventory development process with a focus on the energy sector which was completed in Croatia on 5 – 7 March 2014.
- This Module 2 will deal with uncertainty assessment of GHG inventories
- Module 3 will be held in October 2014, June 2015 and March 2016 and will include field training on assessment of GHG inventories from the fuel combustion activities and fugitive emissions from fuels

This_regional training workshop is based on the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories,* the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and elements of *2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

The objective of this workshop is to provide the essential elements for the establishment and contribute to a fully functioning monitoring mechanism of greenhouse gas emissions in the beneficiaries, in line with the EU Monitoring Mechanism Regulation and UNFCCC requirements.

Expected Results

- Improved understanding of uncertainty analysis, including the methods to estimate uncertainties
- Improved skills on quantifying uncertainties in Energy sector using tier 1 method through a practical exercise
- Participants are familiarised on how Member States implement uncertainty assessment by using different methods, including Monte Carlo approach
- Participants are familiarised on how uncertainty is managed / assessed in different CRF sectors (energy, industry, agriculture, waste and LULUCF) in different Member States and in ECRAN beneficiaries

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III. Highlights

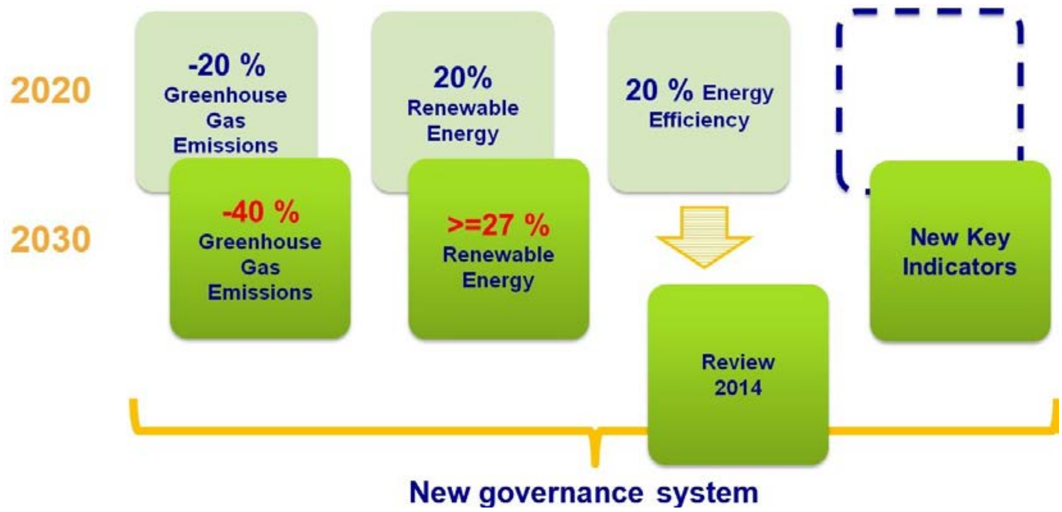
Reference is made to Annex I for the agenda. Below only the main elements are highlighted. The presentations are presented in Annex III.

Highlights Day 1

Day 1 – Hotel Best Western Premier, Podgorica, Montenegro, 8 July 2014.

Introduction to the Workshop – Imre Csikos

- Extreme events such as wildfires, floods, soil erosions, tropical heat waves and storms, attract the attention of media and general public more and more. Statistical analysis show that the occurrence of these phenomena are increased due to the climate change. It is important to note that the Earth's climate has always been changing, at first as a result of changes in natural circumstances. However today, climate change term is used when talking about the changes that have been occurring since the industrial revolution that is, created as a result of human activities.
- Extreme climate events were presented in a clear and brief way, indicating the importance of prevention, or at least decrease of human activities that contribute to misbalance of natural processes. For instance, month May 2014 was the warmest May ever recorded, 15.54 Celsius degrees, which is 0.74 degrees higher than the average mean of 20th Century. First half of year 2014 (January to June) recorded average 2 Celsius degrees above normal average temperatures for that period.
- European Union (EU) climate and energy package is a set of legislation aiming to ensure climate and energy targets to 2020, known as "20-20-20" targets, setting three objectives:
    - Reduce Greenhouse Gas (GHG) Emission levels by 20%
    - Increase share of Renewables to 20%
    - Reduce energy consumption by 20%
- However, since year 2020 is approaching, a long term goals needed to be set up. Thus, EU set a roadmap for moving to a low-carbon economy by year 2050. Taking 1990 as a baseline, a long-term goal is to cut GHG emissions by 80% by 2050, taking in consideration available technologies.
- European Commission (EC) proposed a framework for climate and energy 2030. Targets for year 2030 are set tighter as comnpared to 2020 to allow a trajectory towards the 2050 decarbonisation targets as can be seen in picture 1.



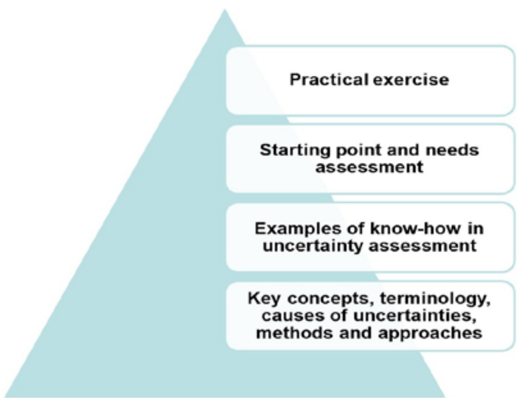
Picture 1

- Overview of the EU Climate Change legislation and policy was presented, including both legislation in force and newly planned EU Climate legislation and policies, such as: first generation biofuels (ILUC), ETS Aviation, Reform of the EU Emission Trading System (ETS), maritime transport, etc.
- ECRAN Activities were presented for the period 2013-2016. ECRAN programme is designed to engage candidate and potential candidate countries to converge with the EU Climate acquis and EU Climate policies. Regarding beneficiary countries however, it is necessary to ensure greater involvement from other sectors with direct relevance to climate work. Working Group (WG) 2: GHG Inventories and Monitoring Mechanism Regulation (MMR) of ECRAN Climate Component is dealing with this subject.

Introduction to Sub-task 2.1-B: Module 2 – Uncertainty Assessment of GHG Inventories – Davor Vesligaj

- ECRAN Senior Expert Mr. Davor Vesligaj briefly presented the activities of the WG2, national Inventory systems and the EU MMR that will include three tasks:
  - Task 2.1: Capacity building on GHG inventory process for the Energy Sector;
  - Task 2.2: Capacity building on GHG inventory process for the other sectors;
  - Task 2.3: Capacity building on other elements of the MMR.

- The main goals of the workshop were presented, that will follow up by an exercise that will be based on previous lectures and discussion. Structure of the training is as follows:;



Picture 2

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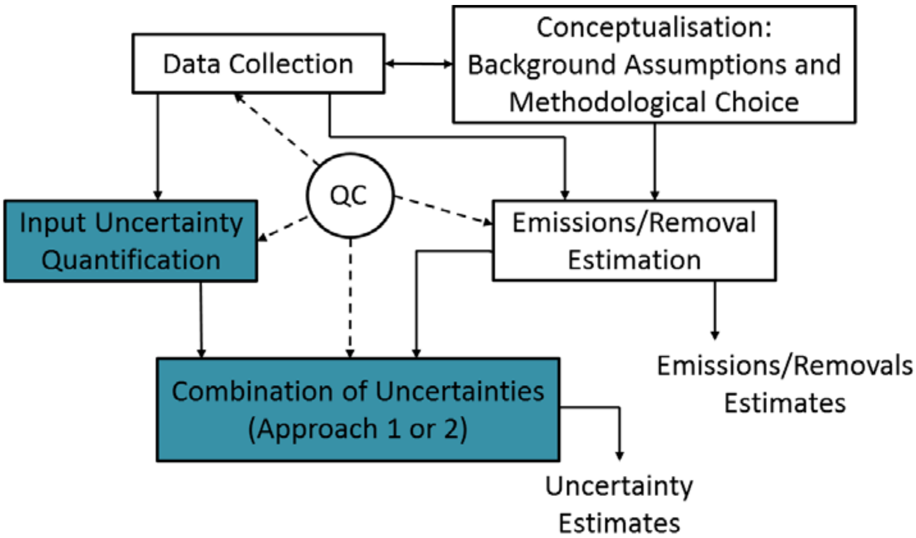
Introduction to basics of uncertainty analysis in the greenhouse gas inventories – Tinus Pulles

- Mr. Pulles started his presentation with perspectives on data quality:
  - Truth – scientist can never prove it;
  - Acceptance – policy maker makes the decision regardless scientific understanding;
  - Convincing – lawyer searches for proof or doubt.
- He pointed out that absence of evidence is not equal to the evidence of absence (referring to "The Big Foot" issue). However, the whole system of information stands on understanding of the perspectives of scientists and policy makers and layers.
- Emissions inventories must adhere to the so called TCCCA criteria (Transparency, Consistency, Comparability, Completeness, Accuracy). According to IPCC understanding, any emission inventory is an estimate (or model) of the real emission in a given time and place, and has unavoidably uncertainties. Uncertainty analysis needs:
  - To explain and quantify uncertainties of the total inventory (level and trend)
  - Data on uncertainties in individual categories (activity data, emission factors and any other parameters).
- There are two important concepts to understanding uncertainties and hence the quality of a reported inventory – *accuracy* and *precision.* There are four key concepts of accuracy and precision scientific approach:
  - High accuracy and high precision;
  - Low accuracy and high precision;
  - High accuracy and low precision;
  - Low accuracy and low precision.



Picture 3

- Participants were presented the basic terminology relevant to the topic of the workshop, some of which include random and systematic error, accuracy, precision, confidence interval and probability density function. An effort was put on the structure of the analysis. Structure of the uncertainty analysis lies down on the sources of uncertainty, while sources are based on conceptualisation, models and input data and assumptions. Structure of uncertainty analysis is shown on picture 3.

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- Two main statistical concepts are used for the uncertainty analysis, the probability density function (PDF) and confidence interval. Experience has shown that confidence interval concept is used for quantification of random errors, and that PDF can be both symmetrical and asymmetrical. Also, methods to combine uncertainties were presented, referring to Approach 1 – Propagation of error, and Approach 2 – Monte Carlo Simulation. Approach 1 is a simple spreadsheet calculation, using a combination of uncertainties by multiplication, and combination of uncertainties by addition and subtraction. This approach is used by 2006 IPCC Guidelines. On the other hand, Approach 2, or the Monte Carlo Simulation (MCS) includes a detailed category-by-category assessment of uncertainty. Both approaches were briefly described step-by-step during the training, but it was emphasised that sooner or later, the experts will transfer to the usage of Approach 2.

<u>Quantifying uncertainties in practice – Tinus Pulles</u>

- Model uncertainties and data uncertainties were addressed. Cause of uncertainty of the model approach can be lack of completeness and/or bias and random errors in the model. Regarding data uncertainties, the causes include are more extensive and they include:
  - Lack of data
  - Lack of representativeness of data
  - Statistical random sampling error
  - Measurement error: random components
  - Measurement error: systematic components
  - Misreporting of misclassification
  - Missing data
- Mr. Pulles explained how to find uncertainty information, that can occur in four ways:
  - Uncertainty in emission measurement;
  - Model uncertainty;
  - Input uncertainty;
  - Calculation uncertainty.
- Inventory team receives data and model results from external experts and researchers. Overall, uncertainty analysis will be based on the information provided by those experts and researchers.

<u>Case example: Finland's uncertainty assessment by using Monte Carlo Simulation (MCS) – Timo Kareinen</u>

- Mr. Kareinen presented a case example from Finland regarding MCS. Monte Carlo Simulation allows the overlook of all possible outcomes of decisions and access to impact of risk, allowing for better decision making under uncertainty. That is one of the main reasons for the use of MCS. Also, it will furnish the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action. Using this method, uncertainty assumptions can be tested trough method subcategories.
- Basics of MCS were presented. MCS performs risk analysis by building models of possible results by substituting a range of values (probability distribution) for any factor that has inherent uncertainty. Then in consecutively calculates results, each time using a different set of random values from the probability functions. MSC can involve thousands of calculations before completion, depending on the number of uncertainties. MCS for calculation of GHG emission was presented, stating that the emission depends on activity data and emission factor
- Finland's case study was presented. Inventory regarding energy, industrial processes, agriculture and waste was described, making a comparison between MCS and key category analysis. The conclusion was that MCS analysis is more detailed and comprehensive. For instance, regarding

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energy inventory, MCS table includes 606 rows and 36 subcategories, while on the other hand key category analysis includes 100 rows in 17 categories. Agriculture N-model was schematically described, starting from the reports on N2O emission from agriculture soils and manure management, trough nitrogen remaining and storage, finishing with nitrogen volatilisation.

- It was concluded that MCS is a method that makes possible calculations of uncertainties to a detailed level, and aggregation of results to appropriate key category analysis level.

<u>Uncertainties in industrial processes and Waste sector – Andrea Hublin</u>

- Ms. Hublin presented the information for key source estimation. Emphasize was put on activity data and emission factors in order to determine uncertainties in individual variables used in the inventory. GHG emission for 2012 for industrial processes and waste sector in Croatia was presented, highlighting the difference between the total CO_2 equivalent emission including Land Use, Land Use Change and Forestry (LULUCF) and total CO2 equivalent emission excluding LULUCF.
- Criteria for identification regarding key categories in industrial processes was shown, with direct GHG emissions with and without LULUCF. It was noticed that good practice in estimating and reporting uncertainties includes the national level and the trend estimate over time. On the other hand, IPCC Source categories in Waste sector include CH_4 emissions from solid waste disposal sites, and from waste water handling.
- Again, an emphasis was put on two approaches:
  - Approach 1 – Error propagation;
  - Approach 2 – Monte Carlo analysis.

  As seen in the case with Croatia, uncertainties are estimated for both excluding and including LULUCF.

  The presentation showed the participants both approaches for the industrial processes and waste.

<u>Uncertainty in Agriculture sector: Case Example Finland – Timo Kareinen</u>

- The presentation started with the introduction of the basic statistical data of Finland (surface area, population, etc.). Since the topic is about agriculture, agricultural facts from Finland were presented with more details. For example, growing season in Finland is 120-180 days, which is much less that Central Europe's average 220-260 days, which is to an extent reasonable considering the country's latitude. In 2011, there were 61,584 farms in Finland, which is over 1,000 less than the previous year. Also, one of the problem that arises is that the average age of the farmers is around 50, concluding that less and less young people are involved in the agriculture sector. Regarding cattle breathing, the number of cattle is mostly decreasing, except for suckler cows and sheeps.
- Greenhouse gases from agriculture can divided by their source:

	CH_4	N_2O
Enteric Fermentation	x	
Manure Management	x	x
Agricultural soils		x
Burning of agricultural residues	x	x

- Common Reporting Format (CRF) for several sectors is shown in the picture 4

Picture 4

- CH_4 emissions from all three sources were briefly presented, along with the methods for calculating emission factors (EF). In Finland, CH_4 emission from enteric fermentation is highest from dairy cattle, amounting to almost 130 kg CH_4 per animal per year. Proposed method for calculating EF in this case is IPCC, Tier 2. On the other hand, emission from animals fur is 0.10 kg CH_4 per animal per year, and this calculation can be performed using National methods of MTT Agrifood research of Finland. Prior to this conclusion, number of animals was presented, and it represents the activity data necessary for the calculation of uncertainties. The same approach is used for the CH_4 emissions from manure management. However, in this case proposed method for calculation of EF in all case is IPCC, Tier 2 (expert judgement).
- Emission of N2O is recorded from manure management, agricultural soils and burnings of agricultural residue. The experience shows that the method for calculation of EF is IPCC, tier 1 in all three cases.

Column G
Combined uncertainty using error propagation equation. See Equation 3.1 in Section 3.2.3.1.

$$G_x = \sqrt{E_x{}^2 + F_x{}^2}$$

Column H
Contribution to uncertainty. See also Equation 3.2 in Section 3.2.3.1.

$$H_x = \frac{(G_x \bullet D_x)^2}{(\sum D_i)^2}$$

- Uncertainty share of each subsector was presented trough equations, as shown in picture 5:

Picture 5

<u>Uncertainty of the estimates for the sector Land Use, Land-use Change and Forestry (LULUCF) – Peter Weiss</u>

- Under United Nation Climate Change Secretariat, LULUCF is defined as „A greenhouse gas inventory sector that covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change and forestry activities." The LULUCF sector includes six sub categories:
  - Forest land;

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- Cropland;
  - Grassland;
  - Wetlands;
  - Settlements;
  - Other land.
- Also, what was important to mention was that there were five pools per subcategory:
  - Aboveground biomass;
  - Belowground biomass;
  - Dead wood;
  - Litter;
  - Soil.
- Mr. Weiss emphasized that LULUCF sector is the only sector which does not include only GHG emissions, but also GHG removals, both reported as LULUCF totals as the result of subtraction. These results represent the results of each subcategory. However, the assessment of the input data and the estimates of the removals, that is, emissions, is complicated and comprehensive, regarding LULUCF. Emissions and removals in the LULUCF sector are assessed with indirect method. An example of this calculation was presented in details, step by step, of the annual change of carbon stocks in biomass, using a Stock-Difference method.
- It is typical that GHG emissions of LULUCF are estimated from a combination of input parameters based on systematic randomised and representative assessment, models, input data from local studies, literature and default values, and expert judgement. However, this type of assessment of uncertainties, resulting from these combined input parameters presents a big challenge.
- The net emissions and/or removals from subtractions may result in very low figures. But as a consequence, the relative uncertainties of LULUCF emissions and/or removals may become very high. Presenter went through one example briefly, focusing on absolute uncertainty and its share in the total GHG emissions.
- For some categories or for some country-specific situations, the only method of calculation is the stock change method. The method most commonly used to express carbon storage is based on calculating the difference in carbon stocks between a project and its baseline at a given point in time. Carbon stock change are relatively high in biomass and soil, but are low in biomass increment and harvest. The uncertainty of the carbon stock equals the magnitude of the annual increment/harvest.
- The use of error propagation for LULUCF would represent:
  - an extremely time consuming effort (due to the comprehensive LULUCF estimate tables) and
  - a scientific challenge (e.g.: preconditions for using the simple error propagation equations are seldom met by the LULUCF input parameters, non-normal distributions occur, various correlations between the input parameters need to be taken into consideration)

- Therefore, it is better not to start using error propagation (Tier 1) uncertainty estimation, but use Tier 2 approach (MCS) with well suited and use of friendly software. The following was a short exercise example for a Tier 2 approach for LULUCF uncertainty estimation that included:

- Definition of PDS of input parameters;
- Definition of PDF of input parameters and correlations;
- Definition of outputs and simulation parameters;
- Start of the simulation;
- Screen, copy and/or export simulation results.

- However, uncertainties of some input are not always now, thus we approach to the estimation of unknown uncertainties of LULUCF input parameters. In this case, uncertainties are estimated on the basis of logic, for example, estimation of unknown uncertainties of land categories with the known uncertainties of land categories regarding the total area of the country. Another approach of estimation of unknown uncertainties is expert judgement, with the following procedure:
  - Develop a questionnaire on the uncertainty of an input parameter;
  - Invite several experts familiar with the input parameter and its assessment and introduce them their task (judgment of the uncertainty of the input parameter);
  - Send them with the questionnaire home for individual uncertainty judgments.
- LULUCF uncertainty in Austria was presented. In Austria, the LULUCF sector significantly contributes to the total uncertainty of the GHG balance. About 66% of the total uncertainties are caused by the soul emission of forest land.

Highlights Day 2

Day 2 – Hotel Best Western Premier, Podgorica, Montenegro, 9 July 2014.

- The second day of the workshop was reserved for exercises and presentations of beneficiary countries' experiences with uncertainty assessment. There were presenters from the following countries: Kosovo*[1], Bosnia and Herzegovina, Montenegro, Croatia, fYR of Macedonia, and Turkey.
- Kosovo* - Kosovo experience was presented by Mr. Riza Hajdari, an acting director of the Directory of Environmental Monitoring, Assessment and Reporting of the Ministry of Environment and Spatial Planning of the Republic of Kosovo. Even though Kosovo is not a member of UNFCCC, they are doing their best to follow the policies and regulations of UNFCCC, EU and Kyoto Protocol. First steps to be done in Kosovo were strategic and legal assessment, followed by the system establishment and trainings. Mr. Hajdari mentioned that several workshops have been organised in Kosovo regarding GHG uncertainties with the help of the colleagues from Czech Republic. It had to be mentioned that 87% of CO2 equivalent emission is from the energy sector, comparing to 1% from industrial processes, 8% from agriculture and 4% from waste. They are relying on IPPC category analysis from 2006. What they have learned from their experience was that this was not an easy task requiring additional knowledge, human and financial resources. There is a need to improve involvement and commitment of other institutions and also collection of knowledge of other institutions.
- Bosnia and Herzegovina (BIH) - Ms. Svjetlana Stupar presented the Bosnian experience in uncertainty assessment. Bosnia and Herzegovina became a UNFCCC member in 2000 and The First National Communication (INC) was prepared in early 2008 in direct coordination with UNDP BIH and according to the guidance provided in „ Instuction for Preparation of National Communications of Member Countries not involved in Annex I to the Convention. The Second National Communication (SNC) has been finished in 2012 and adopted by the BiH Council of Ministers and entity governments in 2013. It has been submitted as well to the the UNFCCC Secretariat in Bonn in 2013.

[1] This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ opinion on the Kosovo declaration of independence.

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Both National Communications (of the Federation and of the Republika Srpska) were participating individual experts in various fields because there is no national Institution in charge of the preparation of GHG inventory. According to the law, Official institution in the RS for creating and maintaining an inventory of GHG is the Republic Hydrometeorological Service, while in Federation there is no national institution for creating GHG inventories. One of the dificulties in preparing inventory is the lack of defined method for collecting data for GHG inventory in BIH. Due to lack of data and experiences, it was not possible to calculate the measurement uncertainty according to IPCC. There is a need for more experts on creating GHG inventories, as well as the rise of public awareness.

- Montenegro - Presentation was carried out by Ms. Ranka Zarubica. In Montenegro Ministry of Sustainable Development and Tourism prescribes the list of GHG gases, methodology for development of the national GHG inventory, data flow, reporting requirements and other important features of GHG Monitoring Mechanism, while Environmental Protection Agency maintains the national GHG emission inventory, Common Reporting Format (CRF) and National Inventory Report (NIR). Through bilateral cooperation between Italy and Montenegro, Agency has been involved in the establishment of system for updating of GHG Inventory. They have developed a E2Gov software for calculation of GHG uncertainties, which is a compilation of EMEP/CORINAIR and IPCC methodology, and three officers are dealing with it. However, there is a need for Intensive training for staff working with national data, and also for technical equipment and instalation.
- Croatia - Ms. Andrea Hublin presented the Croatian experience with uncertainty assessment. In Croatia both approaches are used for the estimation of uncertainty, error propagation and MCS, although MSC has been more in use. Sources that are included in the uncertainty model contribute to total emissions with 98%, but there is still lack of data for some source category that are needed to determine uncertainty of input data. Uncertainties are estimated for both excluding LULUCF and including LULUCF. Regarding Approach 1, assumption were that standard deviation divided by the mean value is small and that all PDFs have Gaussian (normal) distributions - uncertainty is symmetric with respect to the mean value. On the other hand, using Approach 2 (MSC), when using the software tool @RISK 5.7, each PDF was sampled 10,000 times.
- Turkey - Presentation was carried out by Ms. Fatma Betyl Beyguven, an engineer in Turkish Statistical Institute. Qualitative estimation of uncertainties is calculated by using three methods: Tier 1 method, IPCC default values, and expert judgment. An example of Turkish uncertainty calculation was shown for 2012, using 1990 as a baseline. What Turkey is designated to do is to review all parameters based on IPCC 2006, and to ensure technical assistance for setting AD and EF uncertainties. In Turkey, a GHG inventory Working Group was established, including governmental institutions, each responsible for different activities:
  - Turkish Statistical Institute;
  - Ministry of Energy and Natural Resources;
  - Ministry of Transport, Maritime Affairs and Communications;
  - Ministry of Environment and Urbanization ;
  - Ministry of Forestry and Water Affairs;
  - Ministry of Food, Agriculture and Livestock.

- Former Yugoslav Republic of Macedonia – Ms. Emilija Poposka presented Uncertainty analysis of national GHG inventory of Macedonia. First uncertainty analysis was performed in 2000 using

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MCS, for the purposes of 2nd National Communication to the UNFCCC, and it was done for the energy sector. However, in the period from 2003 to 2009 MCS was also performed but for each sub-category in the industrial processes. The country plans on adopting a more advanced QA/QC and improvement plans, adopt comprehensive laws on Climate Change and provide proper distribution of data. Occurrence of uncertainty of GHG inventories in Macedonia is due to:

- Cement production;
- Lime production;
- Limestone and Dolomite use;
- Iron and Steel production;
- Ferroalloy production.

But needs still exists regarding statistical reports and data quality objectives that affect the distribution of each variable.

Practical exercise on quantifying uncertainties in Energy sector using tier 1 method

- The remaining time of the workshop was reserved for the group exercise of calculation of uncertainties using Tier 1 method. Excel spreadsheets were provided to the participants, whereas they could practically do the calculation with the help of the presenters and experts. Reference is made to Annex III for the training materials.

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IV. Evaluation

20 Participants (excluding the presenters) filled in the evaluation form which is a response of 71.5% (as compared to the originally confirmed participants attendance list of 28 participants, excluding the presenters).

Statistical Information

1.1	Workshop Session	Regional Training on uncertainty assessment of GHG inventories
1.2	Facilitators name	Imre Csikós/ Davor Vesligaj /Tinus Pulles /Timo Kareinen /Andrea Hublin/ Peter Weiss
1.3	Name and Surname of Participants (evaluators)	As per participants' list.

Your Expectations

Please indicate to what extent specific expectations were met, or not met:

My Expectations	My expectations were met		
	Fully	Partially	Not at all
1. Improved understanding of uncertainty analysis, including the methods to estimate uncertainties	IIIII I (30%)	**IIIII IIIII IIII (70%)**	
2. Improved skills on quantifying uncertainties in Energy sector using tier 1 method through a practical exercise	IIIII I (32%)	**IIIII IIIII I (58%)**	II (10%)
3. Participants are familiarised on how Member States implement uncertainty assessment by using different methods, including Monte Carlo approach	IIIII II (35%)	**IIIII IIIII I (55%)**	II (10%)
4. Participants are familiarised on how uncertainty is managed / assessed in different CRF sectors (energy, industry, agriculture, waste and LULUCF) in different Member States and in ECRAN beneficiaries	IIIII (25%)	**IIIII IIIII IIIII (75%)**	

Workshop and Presentation
Please rate the following statements in respect of this training module:

Aspect of Workshop	Excellent	Good	Average	Acceptable	Poor	Unacceptable
1 The workshop achieved the objectives set	IIIII II (35%)	**IIIII III (40%)**	III (15%)	II (10%)		
2 The quality of the workshop was of a high standard	**IIIII III (42%)**	IIIII I (31%)	III (16%)	II (11%)		
3 The content of the workshop was well suited to my level of understanding and experience	**IIIII II (35%)**	**IIIII II (35%)**	IIIII (25%)		I (5%)	
4 The practical work was relevant and informative	**IIIII III (40%)**	IIIII I (30%)	IIII (20%)	I (5%)	I (5%)	
5 The workshop was interactive	**IIIII IIIII IIIII (75%)**	II (10%)	II (10%)	I (5%)		
6 Facilitators were well prepared and knowledgeable on the subject matter	**IIIII III (40%)**	**IIIII III (40%)**	IIII (20%)			
7 The duration of this workshop was neither too long nor too short	IIIII I (30%)	**IIIII IIIII (50%)**	IIII (20%)			
8 The logistical arrangements (venue, refreshments, equipment) were satisfactory	**IIIII IIIII IIII (70%)**	IIII (20%)	II (10%)			
9 Attending this workshop was time well spent	IIIII III (40%)	**IIIII IIII (45%)**	III (15%)			

Comments and suggestions

I have the following comment and/or suggestions in addition to questions already answered:

Workshop Sessions:

- Some sessions were too long/short. It was hard to keep concentration for about two hours for some sessions
- The practical work could be more instructive and long for good understanding. Some sessions were too long
- Very good theme because we are at the same starting point
- More practical sessions and interactive work between facilitators and participants
- Maybe all countries are not on the same level of knowledge
- Duration of sessions are too long to fully concentrate on the workshop issue. More break is necessary
- Well done

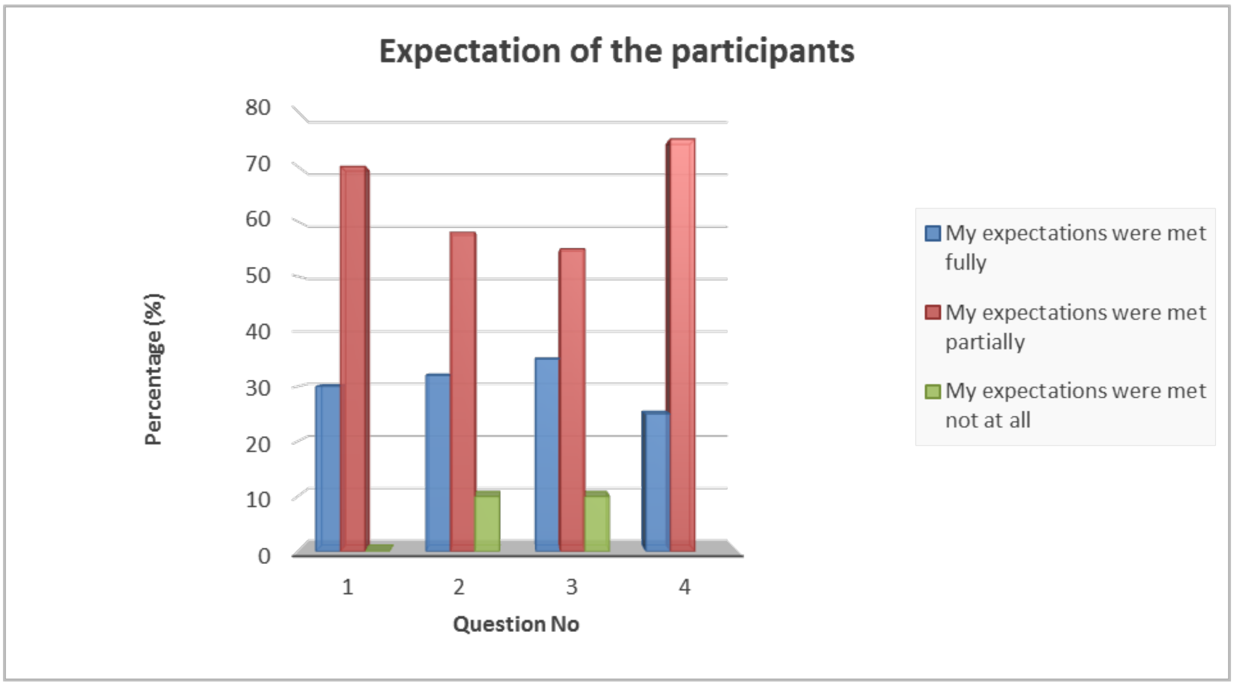
Facilitators:

- Good
- They are good and helpful
- Very practical

Workshop level and content:

- After theoretical presentations, before starting to do exercises, there should be an example of practice presented. Directly beginning hands on work was ineffective and time consuming. Particiants could directly start trying and calculating instead.
- It is on the upper level than my country is, we are at the beginning of the uncertainty assessment
- Provide workshops in countries separately due to national circumstances
- More theoretical level needs more practical level
- The need for more time for the practical execise
- Satisfactory

1. Improved understanding of uncertainty analysis, including the methods to estimate uncertainties
2. Improved skills on quantifying uncertainties in Energy sector using tier 1 method through a practical exercise
3. Participants are familiarised on how Member States implement uncertainty assessment by using different methods, including Monte Carlo approach
4. Participants are familiarised on how uncertainty is managed / assessed in different CRF sectors (energy, industry, agriculture, waste and LULUCF) in different Member States and in ECRAN beneficiaries



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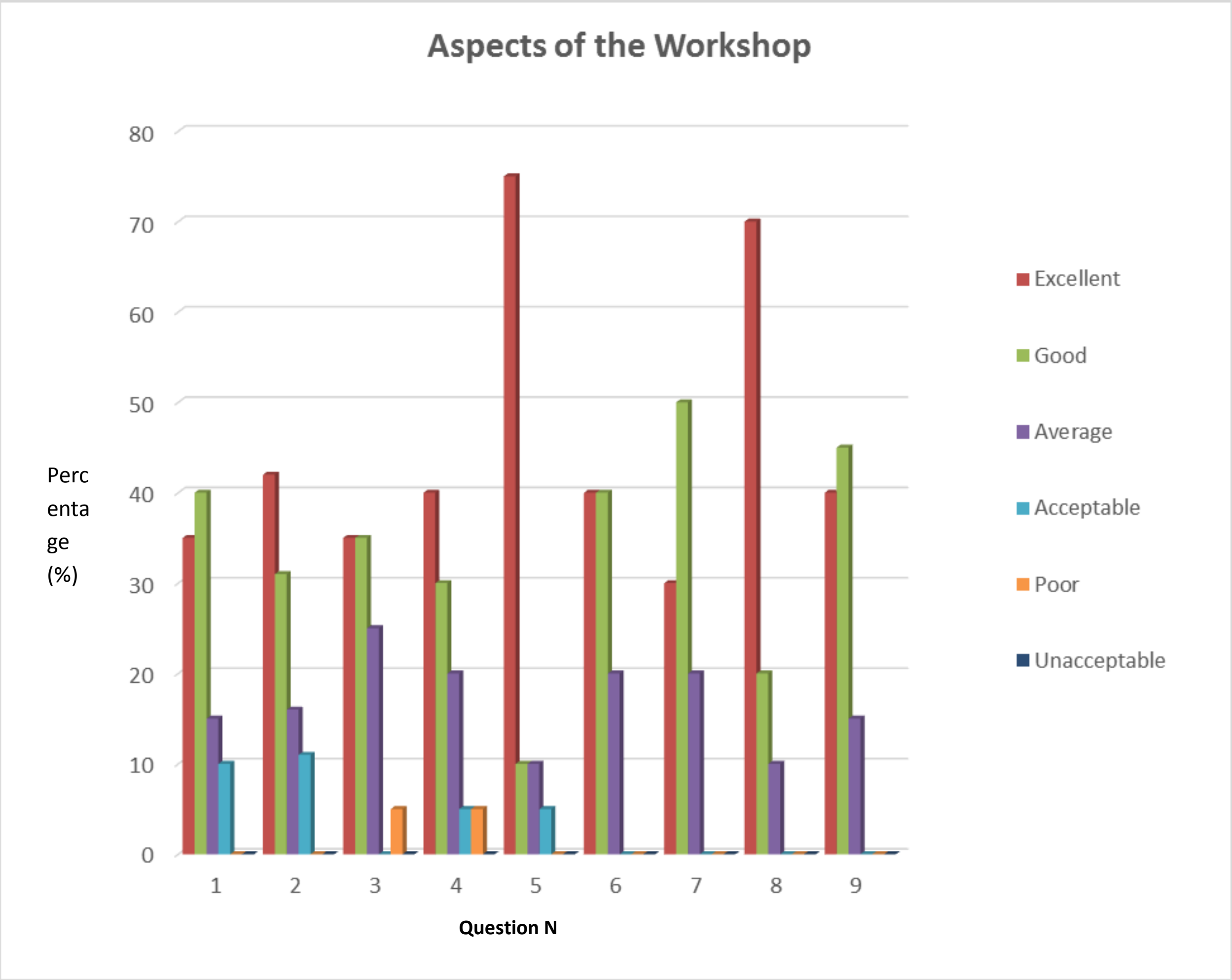
1	The workshop achieved the objectives set
2	The quality of the workshop was of a high standard
3	The content of the workshop was well suited to my level of understanding and experience
4	The practical work was relevant and informative
5	The workshop was interactive
6	Facilitators were well prepared and knowledgeable on the subject matter
7	The duration of this workshop was neither too long nor too short
8	The logistical arrangements (venue, refreshments, equipment) were satisfactory
9	Attending this workshop was time well spent



ANNEX I – Agenda

Day I: Tuesday 8 July 2014				
Start	**Finish**	**Topic**	**Speaker**	**Sub topic/Content**
08:30	**09:00**	**Registration**		
09.00	09.15	Welcome	Imre Csikós, ECRAN	• Introduction of participants • Approval of the agenda
09.15	09.30	Introduction to Sub-task 2.1-B: Module 2 – Uncertainty assessment (15')	Davor Vešligaj, ECRAN	• Overview • Goals and expectations
09.30	10.15	Introduction to uncertainty analysis in GHG inventories (45')	Tinus Pulles	• Key concept and terminology • Structure of uncertainty analysis • Basis for uncertainty analysis • Causes of uncertainty • Q/A
10.15	11.00	Quantifying uncertainties in practice (45')	Tinus Pulles	• Sources of data and information • Techniques for quantifying uncertainties • Methods to combine uncertainties (Basics of Approach 1 and Approach 2 Monte Carlo simulation) • Q/A
11.00	11.15	***Coffee Break***		
11.15	12.00	Example of MS uncertainty	Timo Kareinen, from Statistics	

		assessment by using Approach 2 Monte Carlo simulation: Case of Finland (45')	Finland	
12.00	13.00	***LUNCH***		
13.00	13.45	Uncertainty in the MS GHG Inventory – Focus on Energy sector (45')	Tinus Pulles	• Uncertainty of activity data • Uncertainty of emission factors • Example(s) of expert judgement
13.45	14.15	Uncertainty in the MS GHG Inventory – Focus on Industrial processes and Waste sector (30')	Andrea Hublin, EKONERG	
14.15	14.45	Uncertainty in the MS GHG Inventory – Focus on Agriculture Sector (30')	Timo Kareinen, from Statistics Finland (tbc)	
14.45	15.00	***Coffee Break***		
15.00	15.45	Uncertainty in the MS GHG Inventory – Focus on LULUCF Sector (45')	Peter Weiss, UBA Austria	• Uncertainty of activity data • Uncertainty of emission factors • Example(s) of expert judgment
15.45	16.00	Conclusions and closing of Day 1	Imre Csikós, ECRAN Davor Vešligaj, ECRAN	

Day II: Wednesday 9 July 2014				
Start	**Finish**	**Topic**	**Speaker**	**Sub topic/Content**
09:00	**09:15**	**Registration**		
09.15	09.30	Introduction to Day 2	Imre Csikós, ECRAN	
09.30	10.30	ECRAN country experiences with uncertainty assessment – Part I Max 15 minutes presentation per country	Kosovo Bosnia and Herzegovina Albania Montenegro	• Country experience in uncertainty analysis • What is needed to improve uncertainty analysis in inventory preparation process
10.30	10.45	***Coffee Break***		
10.45	11.45	ECRAN country experiences with uncertainty assessment – Part II Max 15 minutes presentation per country	Croatia Republic of Serbia The former Yugoslav Republic of Macedonia Turkey	• Country experience in uncertainty analysis • What is needed to improve uncertainty analysis in inventory preparation process
11.45	12.15	Discussion on needs	Imre Csikós, ECRAN	• Immediate needs and options for fast track ECRAN/TAIEX assistance

12.15	13.15	***Lunch***		
13.15	14.30	Practical exercise on quantifying uncertainties in Energy sector using tier 1 method – Part I	Davor Vešligaj, ECRAN Andrea Hublin, EKONERG Tinus Pulles	• Uncertainty estimates for emission factors and other parameters • Uncertainties associated with activity data from energy balance
14.30	14.45	***Coffee Break***		
14.45	15.45	Practical exercise on quantifying uncertainties in Energy sector using tier 1 method – Part II	Davor Vešligaj, ECRAN Andrea Hublin, EKONERG Tinus Pulles	• Uncertainty calculation using worksheet model • Interpretation of results • Discussion
15.45	16.15	Discussion, Conclusions, evaluation and wrap up	Imre Csikós, ECRAN	

ANNEX II – Participants

First Name	Family Name	Institution Name	Country	Email
Ranka	Radic	Republic Hydrometeorological Service	Bosnia and Herzegovina	radicranka@gmail.com
Svjetlana	Stupar	Republic Hydrometeorological Service	Bosnia and Herzegovina	stuparsvjetlana@gmail.com
Dino	Kriznjak	Croatian Environment Agency (CEA)	Croatia	dino.kriznjak@azo.hr
Igor	Stankic	Energy Research and Environmental Protection Institute Department	Croatia	igor.stankic@ekonerg.hr
Zeljko	Crnojevic	Croatian Environment Agency (CEA)	Croatia	Zeljko.crnojevic@azo.hr
Elena	Gavrilova	Ministry of Environment and Physical Planning	former Yugoslav Republic of Macedonia	Egavrilova.mk@gmail.com; E.gavrilova@moepp.gov.mk
Emilija	Poposka	Ministry of Environment and Physical Planning	former Yugoslav Republic of Macedonia	emilija.poposka@gmail.com; e.poposka@moepp.gov.mk
Ljubomir	Kjurkchiev	Ministry of Environment and Physical Planning	former Yugoslav Republic of Macedonia	kj_bobi2000@yahoo.com
Natasa	Serdarevik	Ministry of Environment and Physical Planning	former Yugoslav Republic of Macedonia	nserdarevik@gmail.com
Letafete	Latifi	Ministry of Environment and Spatial Planning	Kosovo*	Letafete.latifi@rks-gov.net
Nezakete	Hakaj	Ministry of Environment and Spatial Planning	Kosovo*	Nezakete.hakaj@rks-gov .net
Riza	Hajdari	Ministry of Environment and Spatial Planning	Kosovo*	rizah.hajdari@rks-gov.net
Zymer	Mrasori	Ministry of Environment and Spatial Planning	Kosovo*	Zymer.Mrasori@rks-gov.net
Dusko	Mrdak	Environmental Protection Agency Montenegro	Montenegro	dusko.mrdak@epa.org.me

First Name	Family Name	Institution Name	Country	Email
Irena	Tadic	Environmental Protection Agency	Montenegro	irena.tadic@epa.org.me
Milena	Spicanovic	Ministry of sustainable Development and Tourism	Montenegro	milena.spicanovic@mrt.gov.me
Olivera	Kujundzic	Ministry of sustainable Development and Tourism	Montenegro	olivera.kujundzic@mrt.gov.me
Ranka	Zarubica	Environmental Protection Agency	Montenegro	ranka.zarubica@epa.org.me
Aynur	Toker	Turkish Statistical Institute	Turkey	aynur.tokel@tuik.gov.tr
Fatma	Betül Baygüven	Turkish Statistical Institute	Turkey	betul.bayguven@tuik.gov.tr
Pelin	Haberal	Ministry of Energy and Natural Recourses	Turkey	phaberal@enerji.gov.tr
Andrea	Hublin	EKONERG	Croatia	andrea.hublin@ekonerg.hr
Tinus	Pulles	ECRAN	Netherlands	tinus@pulles.eu
Semra	Cerit	NGO KADOS	Turkey	scmazlum@marmara.edu.tr
Imre	Csikos	ECRAN	Netherlands	imre.csikos@ecranetwork.org
Davor	Vesligaj	ECRAN	Croatia	davor.vesligaj@ekonerg.hr
Milica	Tosic	ECRAN	Serbia	milica.tosic@humandynamics.org
Ivana	Mijatovic Cernos	DG Clima	EU	Ivana.mijatovic-cernos@ec.europa.eu

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ANNEX III – Workshop materials (under separate cover)

Workshop materials including presentations, exercise materials and agenda, can be downloaded from:

http://www.ecranetwork.org/Files/GHG_Inventories_Podgorica_8-9_Jyly_2014_materials.rar

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