Organization of American States

Instituto Nacional de Metrología de Colombia

NIST National Institute of Standards and Technology U.S. Department of Commerce

Summary Report
Regional Workshop on
Metrology and Technology Challenges of
Renewable Energy and Climate Science (RECS)
November 6-7, 2014
Bogota, Colombia

a) Workshop Objectives:

Objectives of the OAS-NIST Workshops organized for each sub-region of SIM (Inter-American Metrology System) are to:

1) Assess technology, measurements, and standards needs and existing capabilities of regions and States of the Americas, and increase awareness of Government agencies interested in technology infrastructure;

2) Promote regional and international partnerships to share approaches and best practices for expanded utilization of renewable energy, measurement of GHGs and air pollutants, and efficient energy use and distribution systems;

3) Identify measurements and standards training needs to accelerate deployment of renewable energy technologies while minimizing their impact on our climate. These will be based on priorities developed by SIM members and could be provided through regional workshops and/or via collaborative research between the NMIs.

At the end of each workshop, an action plan is developed to further training and regional collaboration activities.

b) General Observations:

1. The Renewable Energy and Climate Science Workshop was held as part of the SIM Week organized in Bogota, Colombia by the National Metrology Institute (INM) of Colombia. Activities during that week included the General assembly of SIM, SIM Council Meeting, an International Congress on Quality, Research, Development, and Innovation, measurement equipment exhibits, and related training courses.

2. The Workshop was well organized, and well attended, with participation from all ANDIMET Countries except Venezuela. (It should be pointed out that many attempts were made to engage our colleagues from Venezuela with no result.) High quality speakers from four countries (Bolivia, Colombia, Ecuador and Peru) included policy makers and technical experts. Participation from Bolivia was more modest. INM staff and contractors provided excellent logistical support, and their gracious hospitality was much appreciated.

3. The Workshop Steering Committee deserves our thanks for putting together a program that was informative and stimulated much discussion. The program allowed ample time for Q&A's and discussion which was critical for success. Selection of only two general topics (Renewable Energy

and GHG/Air Quality Measurements) enabled more detailed coverage and discussion of these topics.

4. Participation by most of the countries of the ANDIMET Region was critical for the success of the workshop. More than one hundred attendees participated in the workshop, representing government policy makers, the NMIs, other research organizations, and universities. Participation from metrology as well as meteorology communities enriched the discussion and encouraged future collaborations. Presence of metrologists from other regions of SIM, who had earlier attended the SIM General Assembly, also contributed to the richness of the discussions.

5. Presentations on current programs related to RECS provided clear indication that these topics are of critical importance for most of the region; however, the size of their economies, the natural resources and the needs of each country are quite different, and therefore their emphasis is at times on different concerns and technologies.

6. ANDIMET NMIs have, in general, limited metrology capabilities. Especially Climate Science related activities present new challenges for most of the NMIs, since they require chemical metrology expertise. Collaborations, joint activities and additional training will be of benefit for most of the NMIs.

7. Three Panel Discussions helped focus us all on common experiences, issues and needs, and helped develop an action plan for the ANDIMET Region.

c) Summary of Presentations:

Presentations from Colombia, Ecuador and Peru demonstrated that thoughtful policies on RECS are in place in these countries; but they are still struggling with implementation of these policies.

ANDIMET Countries are considered quite vulnerable to impacts of climate change, in spite of their relatively small contributions to GHG emissions. Colombia is considered third most vulnerable country to climate change, because of Niña and El Niño phenomena.

Most of ANDIMET Countries are making attempts to change the energy matrix of their country and move as much as possible to renewable energy sources, including wind, solar, and geothermal. Hydro in most cases is already fully utilized and will not help meet further demands.

Most ANDIMET Countries have significant fossil energy resources; much of it is being exported to other countries around the globe. Ecuador is willing to stop development of fossil energy resources, if the international community could compensate for this loss; most of these are in dense forest areas.

Some of the ANDIMET Countries (e.g., Peru, Colombia) have programs to monitor air quality. They are working with other neighboring countries (e.g., with Argentina) to improve their capabilities.

Some ANDIMET countries have started efforts to provide GHG inventories, but most of these are at their early stages.

There is still some disconnect between regulatory agencies and metrology institutes; the workshop was instrumental in establishing dialogue among these institutions.

Renewable Energy:
There were presentations on implementation of renewable energy programs in Bolivia, Colombia, Ecuador and Peru. Bolivia has implemented a labelling program for Energy Efficient Lamps with assistance from PTB. They have compared performance of fluorescence and LED lighting systems. They have established calibration capabilities within IBMETRO which could possibly be used by neighboring countries.

In Peru, there is a significant effort to expand the use of solar energy systems, especially solar water heaters. These efforts benefit from UV energy exposure measurements and NASA data for South America.

There were also two excellent technical presentations from universities in Colombia and Ecuador. A researcher from the Universidad Libre de Colombia discussed the economic and environmental drivers that have promoted increased emphasis on renewable energy. These include the effect of air quality on human health, as well as the impacts of climate change such as more than 50% decrease in glacier coverage in Colombia over the 1960-2010 period, and more than 50% decrease in hydroelectric power generation as a result of intensified Niño phenomena from Feb. 2009 to Jan. 2010. As a result, Colombia has increased the use of biodiesel and bioethanol in transportation fuels, and has increased cultivation of African palm for biodiesel production. Colombia has also increased the use of solar energy for processing of dried fruits, which represent a major export market.

A researcher from the Universidad Central del Ecuador discussed a very interesting project to produce biodiesel using microalgae. Their approach obviates the issues of food vs fuel, and competition for farm land. This approach utilizes non-agricultural land, and no potable water is used in the process. This process is also extremely efficient in terms of land usage; microalgae produce 10 times more oil per hectare of land than other approaches. Another interesting feature is the use of microalgae from Antarctica. They are looking at some twenty different microalgae, to identify the most productive ones, as well as the best nutrients for them. In addition to inorganics such as N, P, Fe and Si, carbon dioxide and glucose/glycerin are used as nutrients. They are also addressing some of the materials issues encountered with these fuels such as thermal degradation and deposition in tubes.

The final presentation of the first day was from the U.S. on implementation of Smart Grid systems, which are important not only to improve the reliability of power distribution systems, but also to build more flexible power grids that enable efficient use, and interconnectivity, of distributed energy generation systems utilizing different technologies such as solar, hydro, wind, geothermal energy and fossil energy generation systems.

GHG and Air Quality Monitoring:

A summary of NIST Programs on Renewable Energy (Smart Grid, Solar Energy, and Building Energy Efficiency) and Climate Science (GHG and Aerosol Measurements) was presented. GHG Measurements carried out as part of recent undertakings in Indianapolis (INFLUX) and Los Angeles (LA Megacity Project) were discussed. Similar undertakings are being contemplated for South America (São Paulo) and in Asia to develop the framework for Verifying GHG Measurements in Urban Environments.

A comprehensive summary of GHG monitoring and inventory activities in Colombia was presented by a representative of ICONTEC, a non-profit organization. Colombia is a signatory of the Kyoto protocol, and is making every effort to comply with applicable IPCC protocols and ISO standards (e.g., ISO 14064, 14065 and 14066). Projected reductions in GHG emissions were discussed, and the importance of a trusted baseline was emphasized. The concepts of Life Cycle Analysis (LCA) and Carbon Foot Print were discussed, and the importance of Carbon Neutralization (mitigation and compensation) strategies for projections was emphasized. Colombia is benefiting from programs of other countries, such as Mexico and Japan, in GHG inventories. Efforts to reduce GHG emissions, such as increased use of low-emission or hybrid vehicles, and monitoring and capture of fugitive methane emissions, were mentioned. They are also using British Standards PAS 2060 to demonstrate carbon neutrality.

A presentation from the Climate Change Directorate of the Colombian Ministry of the Environment and Sustainable Development provided an excellent overview of government policies. Colombia contributes 4% of GHG emissions from Latin America (Brazil accounts for 58%); this corresponds to 0.37% of global GHG emissions. Colombia National Strategy is to reduce the impact of climate change by reducing deforestation and reducing contributions from agriculture, industry, residences and transportation; the other part of the plan is to develop adaptation strategies. At the current growth rate, GHG emissions are expected to grow from current level of 150 million tons of CO_2 to 350 million tons by 2040. The implementation of the new National Strategy starts in 2014 and calls for eight sectoral action plans and implementation of a monitoring and reporting system. Each sectoral plan (which includes transportation, mining, electrical energy, fossil energy, industry, agro-production, housing, and solid and water wastes) is the responsibility of different Ministries. Part of their responsibilities is identification of Nationally Appropriate Mitigation Actions (NAMAs) for Colombia. Specific targets for several, energy intensive, industries (such as cement, steel and metallurgy, chemicals, pulp and paper, and others) have been set. New legislation (Resolution 0909 of 2008) sets standards for admissible emissions and protocols for emission measurements. They expect to start reporting results at the next COP 21 Meeting in Paris (2015).

A presentation from CENAM (Mexico) provided an overview of the measurement capabilities required for effective monitoring of air quality and GHG emissions, and national inventories that could be reported to UNFCCC. This presentation gave a detailed look at measurement and calibration capabilities, as well as internationally recognized standards such as CRMs, that will be needed to perform reliable measurements with the appropriate accuracy levels and to ensure

mutual recognition by other countries and international organizations. GHG and air quality measurements from fixed and mobile emission sources will be required.

Another presentation from the Colombian Ministry of the Environment focused on health effects of urban air quality, which are estimated to be about $5.7 billion (corresponding to 1.1% of their GDP); about 5,000 premature deaths per year are attributed to air quality problems. New Policies for Prevention and Control of Air Contamination (2010) require: a) Diagnostics and Evaluation (include Air Monitoring Program, Inventory of Emissions, Vigilance System for Air Quality, and Dispersion Modelling); b) Standards Development; and c) Tool Development. Regulations such as Decree 948 (1995) set permissible emission and fugitive emission levels as well as protocols for fixed sources and mobile sources. It also requires measurements to be adjusted for altitude and meteorological conditions at tropical forests. Specific requirements are set for automotive and diesel emissions; use of USEPA Methods is required; the regulation also sets the requirements for Diagnostic Centers. Part of the current challenge is to meet USEPA as well as EU requirements.

The next two presentations were from the meteorological communities in Peru and Colombia, focusing on measurement capabilities and standards that are needed to improve reliability of measurements and data quality. The presentation from Peru's National Meteorology and Hydrology Service (SENAMHI) described the challenges they face on an ongoing basis; their country represents 27 different weather categories ranging from tropical to glacier covered areas, representing a wide range of biodiversity. Impact of climate change in Peru is already highly visible, both in terms of reduced glacier coverage, increased desertification, reduced biodiversity, variability in hydrological resources, as well as increasing number of natural disasters, partly due to El Niño phenomena. These result in increased disease events, effecting both humans and animals; agricultural cycles are also modified, reducing yield and productivity. Peru and SENAMHI are active in the international community; they are a member of WMO (actually there are 13 members in So. America); they are in close collaboration with laboratories in U.S. (NOAA/ESRL), Switzerland (EMPA), and Finland. They work closely with their National Metrology Institute INDECOPI; most of their instruments are calibrated by them; they get occasional help from Finland. They maintain a Network of Meteorological Monitoring Stations in Peru; these include 693 manually operated, and 152 automated stations. They also maintain 134 hydrological stations to monitor river levels. In addition, they have a UV Radiation Monitoring Network (9 stations) and an Air Quality Network, primarily near urban areas where they measure ozone (O_3), sulfur dioxide ($SO_{2)}$, and oxides of nitrogen (NO_2, NO, and NO_x). They also expect to set up new stations at high elevations as part of the GAW Network.

A presentation from IDEAM (Instituto de Hidrologia, Meteorologia y Estudios Ambiental) provided an overview of their meteorological monitoring activities in Colombia. This organization was established back in 1958; the name of the organization was changed couple of times, and now they are more focused on Forecasts and Alerts, and is considered as part of their Risk management System. They have a large network, which includes 2414 conventional stations and 284 automated stations. Some are used primarily for alerts, some serve special/local purposes, but most of them are part of the national network. Part of their objective is to monitor susceptibility to floods and soil erosion; they also provide services to establish susceptibility to fire, and meteorological modelling.

A Panel Discussion on GHG/Air Quality Measurements provided the opportunity for further discussion and identification of common areas of concerns.

Finally, a Panel Discussion was held towards development of an Action Plan for the Region. Some of the NMI Directors from other regions who were present (they had earlier attended the SIM GA) were invited to join the discussion. The participants were asked to keep the following three questions in mind during the discussions:

- Is your country prepared to meet Metrology and Technology Challenges presented by Renewable Energy and Climate Science policies?
- Does your NMI have the necessary metrology and technology capabilities to meet these challenges?
- What type of assistance would be useful for your NMI (specific areas, equipment needs, training needs, etc.)? Would regional cooperation be productive?

Participants generally agreed that the Workshop was highly valuable; it catalyzed interactions and much discussion among NMIs of different countries, among members of the metrology and meteorology communities, and among policy making organizations and NMIs. It also highlighted much of the R&D activities on Renewable Energy and Climate Science that are being carried out in the Americas, and emphasized the importance of metrological contributions to these efforts.

It was also agreed that:

- Policy makers don't always understand the measurement and other infrastructural requirements to implement policies.
- They are sometimes unaware of metrology capabilities in their own countries; such workshops improve interactions and communications among different agencies.
- There is a general lack of resources; regional efforts would be much more effective for more efficient use of resources.
- Most of the countries in the region have only some of the metrology capabilities at hand; they need to develop additional tools and capabilities.
- Implementation of Renewable Energy resources will require new standards and measurement capabilities; for example, for management of natural gas quality (calorific value), standards to ensure quality of biodiesel and bioethanol, etc.
- Solar panel market is dominated by China, but capabilities for quality control of imported panels is still needed.
- Much more work is needed for implementation of Smart Grid.
- Implementation of a simpler version of the NIST NZERTF would be educational.

d) Action Items under Consideration:

Highest priority action items identified during this Panel Discussion, as well as during the earlier discussions, are summarized below:

1. Organize a meeting to discuss GHG emission inventories to develop more consistent (standardized?) approaches and methodologies.

2. Hold a Workshop on GHG measurements to develop a regional plan (perhaps for all of Latin America) to develop GHG instrument calibration capabilities and initiate joint efforts to develop CRMs that could be shared regionally. (Items 1 and 2 may be combined)

3. Develop training opportunities for measurement of emissions from fixed and mobile sources (e.g., automotive vehicle emissions); this is an area of interest for CAMET and SURAMET countries as well.

4. Organize a discussion group for CRMs needed for monitoring of atmospheric GHG levels and the required accuracy levels.

5. Develop training opportunities for Energy Efficiency labelling for appliance (e.g., refrigerators), lighting, solar panels, and building energy systems to establish ratings (e.g., LEED ratings).

6. Promote enhanced collaboration between metrology and meteorology communities in ANDIMET.

A complete agenda and copies of all presentations can be found at the following website:

http://www.nist.gov/iaao/upload/ANDIMETWorkshop.pdf

5/5/2015