

Legal metrology systems in the Asia-Pacific region



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1 Introduction

This article provides a comprehensive overview of the legal metrology systems in the Asia-Pacific region from the author's personal viewpoint through the APLMF*, one of the RLMOs* that collaborates closely with the OIML*.

* See section 7 for the abbreviations.

1.1 Legal metrology system

The social system for metrology, an integral part of human life, has existed throughout history. In this framework, legal metrology forms an indispensable national infrastructure for security, trade, commerce, and consumer protection in many countries. The roots of this system are found in the ancient civilizations more than 5000 years ago. In Eastern Asia, an earlier system of measurement units was found during the Qin Dynasty in P.R. China in 221 BC. In Japan, a preliminary form of law on metrology was found in the Taiho Code enforced in 701 AD.

The modern scientific framework for measurement units/standards began with the Metre Convention in 1875. From the early 20th century, the Meter Convention recognized the need for a dedicated committee to respond to the needs of society regarding legal and/or practical measurements, including the control of measuring instruments. This recognition led to the establishment of the OIML in 1955, marking the beginning of the modern international framework for legal metrology. The OIML, in its role, supports the global framework for quality infrastructures in cooperation with other international organizations and emphasizes collective effort for conformance in the field of legal metrology. The significance of legal metrology with its perspective for the future was already mentioned in the articles [1] and [2].

1.2 Asia-Pacific region

The term 'Asia-Pacific' is generally considered to indicate a region surrounding the Pacific Ocean. However, the region is not precisely defined, and its boundaries vary slightly according to the context of using this term. It is generally composed of Northeastern Asia, Southeastern Asia, Oceania, the Pacific Islands, and North & South America. Referring to the APLMF member economies (**Figure 1**), this region has a total population of 2.8 billion, which covers 35 % of the entire world.

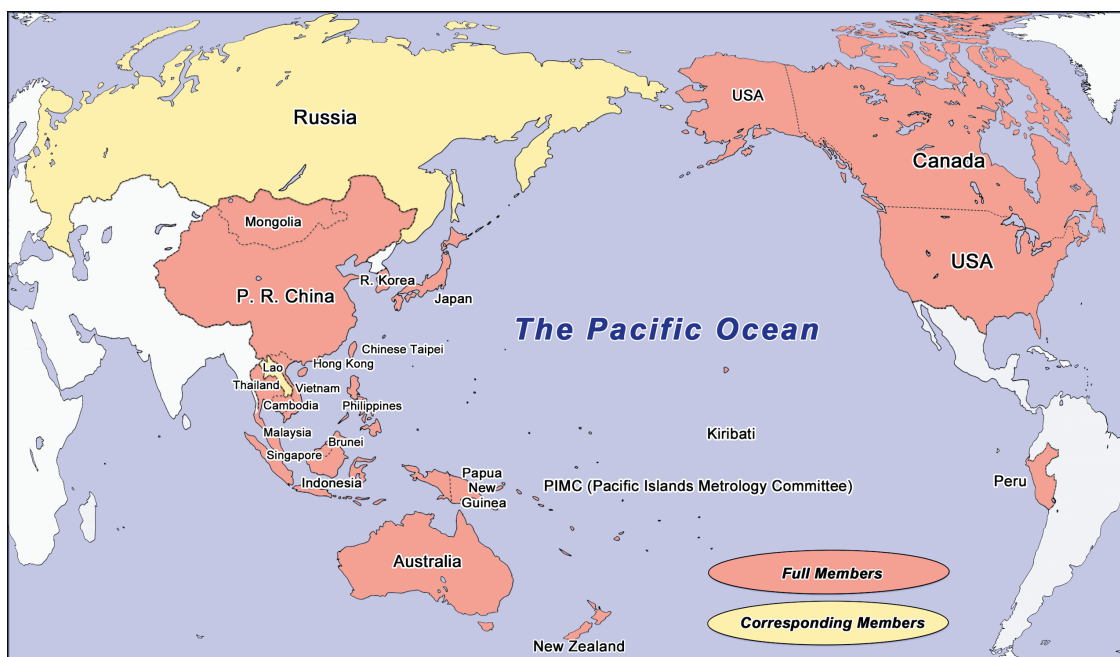


Figure 1: Geographical view of the APLMF member economies

During its long history, many countries and civilizations existed in this region. They may be categorized into (1) Western and Latin countries, several of which have historical roots and cultural ties to Europe, (2) Eastern Asian countries with a common cultural background, (3) Southeastern Asian countries, and (4) Pacific Islands. Due to such a variety in the region, there is significant diversity in culture, language, religion, lifestyle, and way of thinking. The diversity also applies to the history and the social infrastructure in metrology in each country.

2 Outline of APLMF (Asia-Pacific Legal Metrology Forum)

2.1 Brief history

When the Asia-Pacific Economic Cooperation (APEC) was established in 1989, a new regional community for legal metrology was requested. It was intended to support APEC’s important objective of realizing sustainable economic development in the region through the exchange of goods and technology based on compliance with global standards. Compliance with the Agreement on Technical Barriers to Trade (TBT) has been an important objective of the World Trade Organization (WTO), which is a similar organization at the global level established in 1995 to promote open and multilateral trade.

To respond to such needs, the inaugural meeting of the APLMF was held in 1994 in Sydney with the legal metrology authorities from the fourteen APEC economies. Membership has since been extended to twenty-one Full Members and two Corresponding Members (**Table 1**).

Considering the diversity in the region, this forum was designed to be a community for cooperation and information exchange without strictly enforced requirements of the members. For this reason, some members also participate in other RLMOs.

The APLMF President and Secretariat typically come from the same economy. NSC (National Standards Commission) of Australia, which was later reformed as NMIA, initially took over these roles, which were subsequently handed over to Japan (NMIJ) in 2002, P.R. China (SAMR at present) in 2007, New Zealand (MBIE) in 2015, and Malaysia (NMIM) in 2021. Since its establishment, an APLMF Forum Meeting has been held every year. In 2020–2022, however, the meetings had to be held online due to the COVID-19 pandemic. The 30th forum meeting in 2023 was held in-person in the Philippines (**Photo 1**).



Photo 1: 30th APLMF Forum Meeting in the Philippines, 2023

2.2 APLMF member economies

APLMF member countries are always referred to as ‘economies’ following the practice of the APEC. The member economies are shown graphically in **Figure 1** and listed in **Table 1**, including their populations, areas, LMAs, NMIs, and status of participation in the international organizations. Chile, Colombia, DPR Korea, and Mexico previously joined as members, though they are not shown. At the 30th Forum Meeting in 2023, the PIMC was approved to be the first Observer. This committee, which was established in 2023 with the 18 economies of the Pacific Islands, actively conducts a development project in metrology to support the quality infrastructure in the islands.

Table 1: APLMF Member Economies

No.	Member economies (alphabetical order)	Population (10 ⁶) [3]	Area (10 ³ km ²) [3]	Legal Metrology Authority	National Metrology Institute	Participation in the international organisations* ¹					
						APL MF	BIPM	OIML (CS)	APM P	APE C	ASEA N
1	Australia* ²	27	7 741	NMIA	NMIA	F	M	F (I)	F	M	-
2	Brunei Darussalam	0.4	5.8	W&M Unit / MoFE	MSL-BD	F	-	-	F	M	M
3	Cambodia	17	181	NMC/MISTI	NMC/MISTI	F	A	F (U)	F	-	M
4	Canada	41	9 985	Measurement Canada	NRC	F	M	F (U)	-	M	-
5	China, P.R.	1 410	9 597	SAMR	NIM/SAMR	F	M	F (I)	F	M	P
6	China, Hong Kong	7.5	1.1	Customs & Excise Dept.	SCL	F	A	C	F	M	-
7	Chinese Taipei	23	36	BSMI	CMS/ITRI	F	A	C	F	M	-
8	Indonesia	282	1 905	DoM	SNSU-BSN	F	M	F	F	M	M
9	Japan	124	378	METI & NMIJ	NMIJ/AIST	F	M	F (I)	F	M	P
10	Kiribati* ²	0.1	0.8	MCIC	MCIC	F	-	C (A)	F	-	-
11	Republic of Korea	51	100	KATS	KRISS	F	M	F (U)	F	M	P
12	Lao PDR	7.4	237	DISM	DISM	C	-	-	-	-	-
13	Malaysia	34	330	KPDN & NMIM	NMIM	F	M	C	F	M	M
14	Mongolia	3.5	1 564	MASM	MASM	F	A	C	F	-	-
15	New Zealand* ²	5.3	269	MBIE	MSL	F	M	F (U)	F	M	-
16	Papua New Guinea* ²	12	463	NISIT	NISIT	F	-	C	F	M	-
17	Peru	34	1 285	INACAL	INACAL	F	A	C	-	M	-
18	Philippines	114	300	NML/ITDI	NML/ITDI	F	A	C (A)	F	M	M
19	PIMC* ²	3.0	88	-	-	O	-	C* ³	F* ³	-	-
20	Russian Federation	146	17 098	Rosstandart	VNIIM	C	M	F (U)	F	M	-
21	Singapore	5.9	0.7	Enterprise Singapore	NMC/A*STAR	F	M	C	F	M	M
22	Thailand	66	513	CBWM/DIT	NIMT	F	M	F (U)	F	M	M
23	The United States of America	336	9 525	NIST & NCWM	NIST	F	M	F (U)	A	M	-
24	Viet Nam	100	331	STAMEQ	VMI/STAMEQ	F	A	F	F	M	M
Total in the APLMF region		2 851	61 934	-	-	F:21 / C:2 / O:1	M:12 / A:7	F:12 / C:10	F:20 / A:1	M:19	M:8 / P:3

*1 Letter represents membership: A: Associate, C: Corresponding Member, F: Full Member, I: OIML Issuing Authority (OIML-CS), M: Member State/Economy, O: Observer, P: ASEAN Plus Three, and U: Utilizer (OIML-CS)

- *2 Members of the PIMC (Pacific Islands Metrology Committee). The row of PIMC represents 14 out of the 18 Members, i.e., Cook Islands, Micronesia, Fiji, French Polynesia, Nauru, New Caledonia, Niue, Palau, Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.
- *3 Fiji participates in the OIML and in the APMP.

2.3 APLMF Working Groups

There are eight Working Groups (WGs) of experts in the APLMF, each responsible for a specific area of legal metrology and the practical implementations of technical work, survey studies on various legal metrology topics, and training. **Table 2** shows the names, economies responsible for the chair, covered fields, and brief histories of the WGs. Several members/experts from other member economies support each WG.

Table 2: APLMF Working Groups (WGs)

No.	Name (abbreviation)	Economy (LMA/NMI)	Covered fields	Brief history
1	Goods Packed by Measure (WG-GPM)	Indonesia (DoM)	Prepackages including inspection and certification systems	Set up in 1995 by New Zealand. Chaired by Indonesia in 2018
2	Utility Meters (WG-UM)	P.R. China (NIM)	Utility meters for water, gas, and electricity including EVSE	Set up in 1996 by Canada. Chaired by China in 2018
3	OIML Certification System (WG-CS)	P.R. China (SAMR)	Liaison with OIML Certification System	Set up in 1996 by the USA. Chaired by China in 2018
4	Quality Measurement of Agricultural Products (WG-QMAP)	Malaysia (NMIM)	Measurement of content of moisture, protein, sugar, etc.	Set up in 1997 by Japan. Chaired by Thailand in 2017 and Malaysia in 2020
5	Medical Measurements (WG-MM)	P.R. China (NIM)	Measuring instruments for medical purposes	Set up in 1997 by Chinese Taipei, disbanded in 2018, and re-established in 2022
6	Metrological Control Systems (WG-MCS)	P.R. China (NIM)	Metrological control systems and liaison with OIML	Set up in 2007
	Sub Working Group on Digitalization in Metrology (SWG-DM)	Malaysia (NMIM)	Digitalization and software for legal metrology / Liaison with OIML DTG	Set up in 2023
7	Weighing Instruments (WG-WI)	Malaysia (NMIM)	NAWIs, AWIs, and multi-dimensional measuring instruments	Set up in 2018
8	Measurement of Fuels (WG-MF)	Australia (NMIA)	Dispensers and flow/volume meters for fuels	Set up in 2022

2.4 Information on the APLMF website

The materials submitted to the recent Forum Meetings are shared on the APLMF website [4]. This includes economy reports, which are utilized as valuable sources of information about the current situation concerning legal metrology in the member economies. In 2003, the APLMF Directory, which introduced outlines of the legal metrology systems in the member economies, was published. Its contents were updated and uploaded on the APLMF website in the late 2010s [4]. This website also shares materials used for training and guidance documents for some categories of measurement [4].

2.5 Liaison organizations

The APLMF has a close liaison with the OIML through its CIML, TCs/SCs, RLMO RT, CEEMS AG, and DTG. Some member economies have assumed key roles in the OIML. It also has liaisons with APEC through the SRB Forum which is composed of the four regional organizations for standardization and conformance. The cooperation with the APMP has been enhanced through the MEDEA project (3.2). In the ASEAN, the APLMF has a liaison with WG3 on legal metrology under the Consultative Committee for Standards and Quality (ACCSQ).

3 APLMF training activities

3.1 Outline

The APLMF has focused on training activities since its establishment to support the development of the social infrastructures in legal metrology in the member economies. This role has been provided through training courses, seminars, and workshops conducted in a specific field of metrology. The training program started in 1997, and over 1 500 participants joined over 70 events. A complete list of all training programs is given in **Table 3**. Training plans are developed and prioritized based on the survey results among the member economies. Trainers and materials are provided by the responsible WG as well as the member economies.

The former Working Group on Training Coordination had long been responsible for training coordination. After it was disbanded in 2017, its role was transferred to that of Training Coordinator, a member of the Secretariat. NMIA, Australia took this responsibility for a long time with the coordinators, Mrs Kerry Marston (1996–2000) and Mrs Marian Haire (2001–2021).

Table 3: APLMF Training Courses (TCs) / Seminars / Workshops

No.	Brief course title	Start date 'd-m-y' (length of day)	Place
1	Workshop on high-capacity flowmeters	22-09-1997 (3)	Tsukuba, Japan
2	Workshop on legislation and administration	24-09-1997 (3)	Tsukuba, Japan
3	Workshop on NAWIs (OIML R 76)	01-10-1997 (3)	Tsukuba, Japan
4	TC (training course) on high-capacity weighing	31-08-1998 (3)	Shanghai, P.R. China
5	TC on pattern approval of NAWIs	03-09-1998 (8*)	Shanghai, P.R. China
6	TC on NAWIs	24-08-1999 (9*)	Bandung, Indonesia
7	TC on NAWIs	06-10-1999 (3)	Ottawa, Canada
8	TC on fuel dispensers for petroleum and LPG	14-05-2001 (10*)	Beijing, P.R. China
9	Study tour on rice moisture meters	01-10-2001 (5)	Japan
10	TC on NAWIs	08-04-2002 (5)	Hanoi, Viet Nam
11	TC on rice moisture meters	19-08-2002 (12*)	Khon Kaen, Thailand
12	TC on fuel dispensers	04-08-2003 (6)	Hanoi, Viet Nam
13	Symposium on traceability in legal metrology	30-10-2003 (2)	Kyoto, Japan
14	TC on legislation for prepackages (OIML R 87)	28-07-2004 (3)	Kuala Lumpur, Malaysia
15	Seminar on sphygmomanometers	30-08-2004 (5)	Taipei, Chinese Taipei
16	TC on rice moisture meters	30-08-2004 (12*)	Bien Hoa, Viet Nam
17	TC on NAWIs	08-11-2004 (5)	Shanghai, P.R. China
18	TC on rice moisture meters	15-11-2004 (12*)	Chiang Mai, Thailand
19	TC on electricity meters	09-03-2005 (4)	Hanoi, Viet Nam
20	TC on fuel dispensers for petroleum and LPG	25-04-2005 (11*)	Pattaya, Thailand
21	TC on rice moisture meters	15-08-2005 (12*)	Manila, Philippines
22	TC on NAWIs	12-09-2005 (5)	Jakarta, Indonesia
23	Seminar on clinical thermometers	20-12-2005 (4)	Taipei, Chinese Taipei
24	TC on electricity meters	28-02-2006 (4)	Ho Chi Minh, Viet Nam
25	TC on the application of R 87 (prepackages)	03-04-2006 (5)	SA (Shah Alam), Malaysia
26	TC on CNG fuel dispensers	27-06-2006 (4)	SA, Malaysia
27	Seminar on sphygmomanometers	17-07-2006 (5)	Taipei, Chinese Taipei
28	TC on LPG fuel dispensers	28-08-2006 (5)	Shanghai, P.R. China
29	Workshop on agricultural products and foods	07-02-2007 (3)	Chiang Mai, Thailand
30	Seminar on electricity meters	19-03-2007 (4)	Beijing, P.R. China
31	TC on mechanical weighing scales	25-09-2007 (4)	Ho Chi Minh, Viet Nam
32	TC on CNG fuel dispensers	13-11-2007 (4)	SA, Malaysia
33	TC on mechanical weighing scales	13-05-2008 (4)	Pattaya, Thailand
34	Workshop on agricul. prod. and food/product safety	04-06-2008 (3)	Hangzhou, P.R. China
35	Seminar on sphygmomanometers	24-06-2008 (5)	Taipei, Chinese Taipei
36	TC on water meters	23-09-2008 (4)	Hanoi, Viet Nam
37	Workshop on speed meters for vehicles	22-06-2009 (4)	Taipei, Chinese Taipei
38	TC on the application of R 87 (prepackages)	06-07-2009 (5)	Singapore
39	TC on electricity meters	10-08-2009 (4)	SA, Malaysia
40	Workshops on agricultural products and food safety	23-09-2009 (3)	Ho Chi Minh, Viet Nam
41	TC on gas meters	13-04-2010 (4)	Chongqing, P.R. China
42	TC on NAWIs (weighbridges)	07-06-2010 (4)	Bandung, Indonesia
43	TC on mass flow meters (OIML R 117)	06-07-2010 (4)	Singapore
44	Workshop on software-controlled instruments	03-08-2010 (4)	Bangkok, Thailand
45	Workshop on custody transfer of fuel	06-03-2012 (3)	Singapore

46	TC on rice moisture measurement	28-05-2012 (5)	Bandung, Indonesia
47	TC on NAWIs	11-06-2012 (3)	Papua New Guinea
48	TC on bulk fuel systems	28-08-2012 (4)	Chon Buri, Thailand
49	TC on smarty electricity meter	17-06-2013 (4)	Bandung, Indonesia
50	TC on rice moisture measurement	25-11-2013 (5)	Chiang Mai, Thailand
51	TC on NAWIs	01-09-2014 (5)	Bandung, Indonesia
52	TC on prepackaged goods	18-05-2015 (5)	Bandung, Indonesia
53	TC on fuel dispensers	15-06-2015 (5)	Pattaya, Thailand
54	TC on taxi meters	07-07-2015 (4)	Shanghai, P.R. China
55	TC on CNG fuel dispensers	08-09-2015 (4)	SA, Malaysia
56	TC on rice moisture measurement	16-11-2015 (5)	Phnom Penh, Cambodia
57	TC on fuel dispensers	11-07-2016 (3)	Pattaya, Thailand
58	TC on mass standards	30-08-2016 (3)	Jakarta, Indonesia
59	TC on NAWIs	28-11-2016 (4)	Kuala Lumpur, Malaysia
60	TC on rice moisture measurement	17-07-2017 (5)	SA, Malaysia
61	TC on bulk flow metering systems	24-07-2017 (4)	Pattaya, Thailand
62	TC on water meters	12-09-2017 (3)	SA, Malaysia
63	TC on NAWIs (weighbridges)	26-09-2017 (4)	Beijing, P.R. China
64	TC on prepackaged goods (with OIML)	10-04-2018 (4)	Nanning, P.R. China
65	TC on NAWIs (weighbridges)	08-05-2018 (4)	SA, Malaysia
66	Small TC on rice moisture measurement	03-07-2018 (4)	Bangkok, Thailand
67	TC on rice moisture measurement	03-12-2018 (5)	Pattaya, Thailand
68	Seminar on OIML-CS (with OIML)	15-07-2019 (3)	Hangzhou, P.R. China
69	TC on water meters (OIML R 49)	15-10-2019 (4)	SA, Malaysia
70	TC on sphygmomanometers	11-11-2019 (5)	SA, Malaysia
71	TC on electricity meters and EVSE	18-01-2021 (4)	(Online)
72	TC on bulk flow-metering systems	22-02-2021 (4)	(Online)
73	Foundation TC on pre-packaged goods	03-03-2021 (4)	(Online)
74	Webinar on metrology for health (with APMP)	16-11-2023 (1)	(Online)
75	TC on sphygmomanometers (with APMP)	09-07-2024 (3)	Bangkok, Thailand
* Includes the days without training.			

3.2 Support for training

Training activities are supported using the APLMF membership fees and voluntary contributions from the member economies. In addition, from 2001 to 2012, the APLMF sought and utilised the APEC-TILF (Trade and Investment Liberalization and Facilitation) fund. Since 2014, the PTB in Germany has supported APLMF training activities through the MEDEA project. This project targets the developing economies of the APLMF and the APMP in South-West Asia. In 2021, the third-phase project (MEDEA 3) was continued for four years. One remarkable outcome of this project is the synergy with the APMP on scientific metrology. The APMP-APLMF Web Portal [5] has been created for sharing information and raising awareness in metrology.

3.3 e-Learning materials

During the pandemic, developing e-Learning materials (or modules) has become an important factor in training activities. An e-Learning module is normally a set of digital learning materials (e.g., slides, documents, videos, animations, and sample questions). The trainers use this module in online training courses, and it may be permanently provided on an online learning platform for self-learning by the participants. The APLMF WGs are drafting e-Learning materials and/or modules following the APLMF Guide 8: *How to Develop an eLearning Module* [4]. The two modules for fuel dispensers and NAWIs have been completed and utilized by the member

economies since 2021. The current movement from physical to online training with the use of e-Learning will likely continue in the future, even after the pandemic.

4 Common topics in the Asia-Pacific region

4.1 Mass measurement

Mass measurement is the most fundamental field in legal metrology. OIML R 76:2006 *Non-automatic weighing instruments* and its former editions have been introduced as a technical standard in many member economies. National or regional technical standards are largely compliant with this Recommendation. In addition, practical verification procedures, particularly for weighbridges and spring scales, have been requested in this region.

Some economies include automatic weighing instruments (AWIs) in legal metrological systems, and these instruments are closely related to the prepackages they produce. R 51:2006 *Automatic catchweighing instruments* and R 61:2017 *Automatic gravimetric filling instruments* are the two common categories of AWI. Some economies also have concerns about R 50, R 107 and R 134.

The APLMF has conducted many training courses in this field since 1997 (**Photo 2**). The WG on Weighing Instruments in Malaysia coordinates training activities and e-Learning materials in this field.



Photo 2a: Training course on NAWIs in Indonesia, 2005



Photo 2b: Training course on mass standards in Indonesia, 2016

4.2 Measurement of fuel

The volumetric measurement of fuel is also an important category in legal metrology. Fuel dispensers for liquid petroleum and LPG (liquefied petroleum gas) for motor vehicles are the typical measuring instruments under metrological control. OIML R 117:2019 *Dynamic measuring systems for liquids other than water* and its former editions are used as the technical standard.

Some economies, such as Malaysia and the USA, utilize CNG (compressed natural gas) and LNG (liquefied natural gas) for vehicles and have made efforts to standardize and verify the metrological qualities of dispensers for compressed gas. Use of hydrogen as an alternative energy source has been increasing gradually over the past several years, and member economies have begun devoting attention to the practical application of OIML R 139:2018 *Compressed gaseous fuel measuring systems for vehicles*. Custody transfer of liquid petroleum for business-to-business transactions is controlled under legal metrology in some economies, and a reliable bulk flow metering system is requested.

The APLMF has conducted many training courses on fuel dispensers for petroleum, LPG, and CNG, as well as bulk flow metering systems (**Photo 3**). The coordination of these activities, which was previously a responsibility held by the Training Coordinators, is now conducted by the new WG on Measurement of Fuels in Australia.



Photo 3: Training course on fuel dispensers in Thailand, 2015

4.3 Utility meters

Utility meters are measuring instruments used in households and businesses to measure consumption of water, gas, and electricity. In many member economies, water and gas meters are controlled by the local authorities or suppliers under the supervision of the LMA. OIML Recommendations R 49:2013 *Water meters for cold potable water and hot water* and R 137:2012 *Gas meters* are introduced in many economies. The APLMF has conducted training courses on utility meters (**Photo 4**). The WG on Utility Meters in P.R. China coordinates training activities.

The scheme of metrological control on electricity meters is sometimes different, in large part due to the requisite technical expertise and the historical structure of the market. A ministry/agency responsible for energy, independent of the LMA/NMI, sometimes supervises such meters in cooperation with the electricity suppliers. OIML R 46:2012 *Active electrical energy meters* is utilized in this region. NMIA, Australia coordinates the OIML projects on electricity meters including EVSE, under the TC 12.

The increasing use of smart meters with a communication function is a common topic in electricity metering, and there is a high level of concern about the software used for metering and transferring data. Another recent concern for electricity metering focuses on the charging systems used for electric vehicles, also known as electric vehicle supply equipment (EVSE). In some economies, such as P.R. China, the use of electric vehicles is increasing rapidly, and metrological control of the DC metering systems for EVSE is an important issue for regulatory authorities.



Photo 4: Training course on water meters in Malaysia, 2019

4.4 Prepackaged goods

Control of prepackages is an important role of LMAs to protect consumers, and the control or inspection system for such products has a long history in many countries/economies.

In this region, New Zealand and Indonesia have supported the implementation of OIML R 87:2016 *Quantity of*

product in prepackages and its former editions, and they have led training courses and promotional activities on the importance of this topic. The Guide G 21:2017 *Guidance for defining the requirements for a certification system for prepackages* is also taken into consideration. Many economies have concerns about the practical implementation of market surveillance on prepackages. Indonesia recently provided an article [6] introducing the increasing trade of prepackages and the need for a consistent global control system.

However, there is still considerable diversity in approaches to this topic among the member economies. In general, an economy with a long history maintains its own control system, including a minimum quantity system, but broad harmonization with the average quantity system represented by the R 87 has not yet been realized.

The APLMF conducted many training courses on prepackages (**Photo 5**). The WG on Goods Packed by Measure in Indonesia coordinates training activities, e-Learning materials, and surveys on prepackages.



Photo 5a: Training course on prepackages in Malaysia, 2006 **Photo 5b: Training course on prepackages in Indonesia, 2015**

4.5 Quality measurement of agricultural products

The quality of agricultural products, particularly moisture content, is a critical factor for fair trade. Regarding moisture content, because grain samples are unstable in characteristics, a local authority should conduct a reference method using an oven to maintain regional traceability.

In some Southeast Asian economies with grain productions, moisture meters are controlled by legal metrology regulations to protect farmers, traders, and consumers through periodical verification or inspection. Some economies are setting up a local type-approval system based on OIML R 59:2016 *Moisture meters for cereal grains and oilseeds*. Separation of duties between multiple government ministries to enforce requirements for measurement traceability, field verification, and type approval of devices used in agriculture is sometimes seen, e.g., between the Ministry of Economy and the Ministry of Agriculture. However, some economies attempt to maintain cooperation among these entities.

The APLMF has conducted many training courses and workshops on agricultural measurement (**Photo 6**). The WG on Quality Measurement of Agricultural Products in Malaysia coordinates training activities and e-Learning materials. This WG also published the APLMF Guide Document on Rice Moisture Measurement in 2017 [4].



Photo 6a: Training course on rice moisture measurement in Malaysia, 2017



Photo 6b: Training course on rice moisture measurement in Thailand, 2018

4.6 Medical measurement

Clinical thermometers and sphygmomanometers are two categories of medical devices that often fall within the realm of legal metrology. In medical measurements, dual control by two separate government sectors, one for legal metrology and one for health/medicine, sometimes occurs. The former usually controls the medical devices as measuring instruments for temperature and pressure. The latter controls the devices to be allowed for practical medical applications. OIML R 114 and R 115 for clinical electrical thermometers and R 148 and R 149 for non-invasive sphygmomanometers are applied to type approvals.

The APLMF conducted seminars and training courses on medical measurement by the former WG on Medical Measurement chaired by Chinese Taipei. This role has been transferred to P.R. China, and the renewed WG coordinates training activities and surveys to assess the current situation in the member economies (**Photo 7**).



Photo 7a: Seminar on sphygmomanometers in Chinese Taipei, 2004



Photo 7b: Training course on sphygmomanometers in Thailand, 2024

4.7 Type evaluation and the OIML-CS

Many measuring instruments are produced and exported in this region, particularly in P.R. China, Japan, Rep. Korea, and the USA. This led to recognition of the importance of mutual acceptance of type evaluation of these devices. **Table 1** shows the participation status in the OIML-CS. There are three OIML Issuing Authorities, seven Utilizers, and two Associates. The WG on the OIML-CS in P.R. China is responsible for liaising with the OIML-CS and providing seminars and e-Learning materials to raise awareness of this system.

Many economies implement national/regional type-approval systems, and some have testing laboratories. In many cases, applicable OIML Recommendations are utilized as local technical standards. An OIML certificate issued by an OIML Issuing Authority abroad is normally accepted by a member economy. However, the acceptance is sometimes voluntary and depends on the specific procedure in each economy. The WG encourages more member economies to participate in the OIML-CS to facilitate mutual acceptance of the certificates.

4.8 Project for conformity to type (CTT)

There is concern regarding conformity to type (CTT), particularly in the economies that import measuring instruments. These economies have found unfavourable cases where imported instruments did not meet the predetermined performance on the OIML certificate/test report. New Zealand serves as the secretariat of OIML TC 3/SC 6 and has supported the OIML D 34:2019 *CTT - Pre-market conformity assessment of measuring instruments*. In 2018, NMIA, Australia proposed a pilot project for pre-market surveillance on CTT, in which a measuring instrument is purchased in the market and tested by an LMA/NMI.

4.9 Verification with a uniform test procedure

Verification of measuring instruments has been a significant concern in the APLMF, and many training courses have covered this topic. Regarding the initial verification, many economies are introducing testing by authorized manufacturers. Some of them are devising a scheme whereby government delegations are assigned to private institutes/laboratories to conduct periodical verifications. In Japan and some other economies, certified measurers are authorized by the government to facilitate verifications.

Uniform test procedures for verification, which are not fully covered by the respective OIML Recommendations, have been requested in this region. The APLMF conducted surveys from 2015 to 2020 to investigate the procedures employed in each economy. The outcomes of these surveys are shared on the website as Guide Test Procedures [4]. The results are being used to provide information on the development of e-Learning materials and guide documents.

Economies, particularly with low population density, often have difficulty conducting periodical verifications and maintaining trained verifiers. Some of them employ risk-based sampling inspections. P.R. China proposed remote testing methods using digital technology [7], which could be an effective solution in the new era of DX.

4.10 Digital transformation (DX) and the software used for measurement

Digital transformation in metrology has become a big movement in the metrology organizations. In the APLMF, a new Sub-Working Group (SWG) on Digitalization in Metrology was set up in 2023 under the WG on Metrological Control Systems. This SWG is responsible for digitalization in legal metrology. Software for measuring instruments is an important subject of this SWG because there has been a strong need for certification to protect consumers from unauthorized transactions. Liaison with the OIML DTG and OIML TC 5/SC 2, as well as other metrology organizations, is an important role of the SWG.

4.11 Cooperation with the RLMO RT and the CEEMS AG

The utilization of e-Learning modules/materials is an important topic of the OIML RLMO RT. In its meetings, the APLMF has encouraged OIML member countries to provide their materials voluntarily. The APLMF also continues to discuss sharing its e-Learning materials for the benefit of OIML member countries.

At the 58th CIML Meeting in 2023, the CEEMS AG proposed a work program, entitled “NEXT LMS”, which Thailand had developed as the ‘Chiang Mai Declaration’ [8]. This program aims to strengthen the legal metrology systems of the CEEMS countries by providing a framework for utilizing the expertise of the OIML member countries. This program will also be coordinated with APLMF activities.

5 Conclusions

It should be noted that the common topics mentioned above might be similar to those in other regions. The author hopes that this article will be informative to all OIML member countries and that it will aid in promoting regional cooperation, especially among the economies where there might be significant differences in legal metrology systems.

Recent digital communication technology has lowered the barriers between countries and regions, and people can meet online at virtually any time. As a positive outcome of this newly common practice, global cooperation among the legal metrology community is expected to accelerate in the future.

6 References

- [1] John Birch A.M., International Organization of Legal Metrology (OIML), OIML E 2:2003: *Report: Benefit of Legal Metrology for the Economy and Society*.
- [2] Akira Ooiwa, International Organization of Legal Metrology (OIML), OIML Bulletin Vol. XLIV No. 2, April 2003, pp. 20-23: *Desirable legal metrology framework for the APLMF*.
- [3] Wikipedia:
List of countries and dependencies by population
[\(\[https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population\]\(https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population\)\)](https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population)
List of countries and dependencies by area
[\(\[https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_area\]\(https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_area\)\)](https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_area)
- [4] APLMF Website:
 Directory of the APLMF Member Economies (<https://www.aplmf.org/full-members1.html>),
 Forum Meetings in 2023 (<https://www.aplmf.org/philippines-2023.html>),
 Guide Documents (<https://www.aplmf.org/aplmf-guides.html>), and
 Guide Test Procedures (<https://www.aplmf.org/guide-test-procedures.html>).
- [5] APMP-APLMF Web Portal / Metrology Asia-Pacific (<https://metrologyasiapacific.com>)
- [6] Rifan Ardianto, Bonita Oktriana and Tsuyoshi Matsumoto, International Organization of Legal Metrology (OIML), OIML Bulletin Vol. LXIV, No. 2, April 2023, pp. 40-46: *Control on prepackaged goods within the Asia-Pacific region and challenges faced by the local authorities*
- [7] Cai Changqing, *Digital transformation: Remote testing in OIML-CS daily work*, Agenda 2.11.2 of 30th APLMF Forum Meeting (November 2023)
- [8] Resolutions 2023/35 and 2023/36 of the 58th CIML Meeting (October 2023)

7 Abbreviations

APEC: Asia-Pacific Economic Cooperation

SRBs: Specialist Regional Bodies: APAC (Asia Pacific Accreditation Cooperation), APLMF, APMP, and PASC (Pacific Area Standards Congress)

APLMF: Asia-Pacific Legal Metrology Forum

APMP: Asia-Pacific Metrology Programme

ASEAN: Association of South-East Asian Nations

AWI: Automatic Weighing Instrument

BIPM: International Bureau of Weights and Measures

CTT: Conformity to Type

DoM: Directorate of Metrology, Ministry of Trade of Indonesia

EVSE: Electric Vehicle Service Station

LMA: Legal metrology authority

MBIE: Ministry of Business, Innovation and Employment of New Zealand

MEDEA: Metrology: Enabling Developing Economies within Asia (PTB, Germany)

NAWI: Non-automatic Weighing Instrument

NIM: National Institute of Metrology of P.R. China

NMI: National Metrology Institute

NMIA or NMI: National Metrology Institute of Australia

NMIJ: National Metrology Institute of Japan / AIST

NMIM: National Metrology Institute of Malaysia / SIRIM

OIML: International Organization of Legal Metrology:

CEEMS AG: Countries and Economies with Emerging Metrology Systems Advisory Group,

CIML: International Committee of Legal Metrology,

DTG: Digitalization Task Group,

OIML-CS: OIML Certification System, and

RLMO RT: Regional Legal Metrology Organization Round Table.

PIMC: Pacific Islands Metrology Committee

PTB: Physikalisch Technische Bundesanstalt of Germany

RLMOs: Regional Legal Metrology Organizations:

SAMR: State Administration for Market Regulation of P.R. China

8 About the author

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