Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

Report of Training Course on Electricity Meters

APEC/APLMF Training Courses in Legal Metrology (CTI-18/2004T)

March 9-12, 2005
Hanoi, Viet Nam

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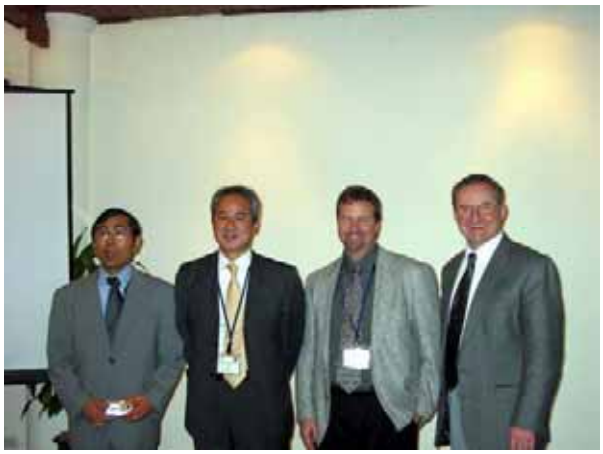
February 2006

Training Course on Electricity Meters
March 9-12, 2005 in Hanoi, Viet Nam



Photos taken at the training course in Hanoi

Contents

Foreword

This booklet is one of outcomes of the APEC Training Courses in Legal Metrology titled 'Training Course on Electricity Meters' that was held on March 9-12, 2005 in Hanoi, Vietnam. This training course was organized by the Asia-Pacific Legal Metrology Forum (APLMF) with a support fund of APEC-TILF (Trade and Investment Liberalization and Facilitation) program, CTI-18/2004T. The training course was also supported by (1) Directorate for Standards and Quality (STAMEQ), Vietnam, (2) Measurement Canada, Government of Canada, and (3) National Metrology Institute of Japan (NMIJ). Having this result, I would like to extend my sincere gratitude to all the staffs of the STAMEQ, two trainers from Measurement Canada, and a trainer from Japan Electric Meters Inspection Corporation (JEMIC). Also, special thanks should be extended to the APEC Secretariat for their voluntary supports.

We have kept making surveys among the APEC member economies concerning seminar and training programs in legal metrology to find their needs and also possible resources which would be available for the region. The survey shows that there is a strong need for a new training course on electricity meters that is one of the important utility meters in legal metrology closely connected to daily life of every people. In addition, according to the globalization of international trade of measuring instruments in worldwide, the compliance to international regulations and recommendations related to electricity meters, which are represented by the ISO/IEC standards and the OIML Recommendation R46, is getting an important issue for the APEC and APLMF member economies.

Main target of this training course was to assist the experts in charge of type approval and/or verification of electricity meters in the APEC / APLMF member economies to learn deeply and to develop common understanding about such regulations and test procedures based on the international standards and OIML recommendations. Thus the target would meet the APEC objective to harmonize metrology legislation within the OIML framework. The actual contents of the training course were focused on the understandings of basic principle and construction of electricity meters, international regulations and recommendations related to the electricity meters, and learning of actual test procedures.

In view of these situations, this first training course concerning electricity meters had been planned and finished successfully so as to settle a sure basis of confidence in legal metrology related to the measurement of electric power within the Asia-Pacific region. I would like to say certainly that this is the valuable first step to fruitful future activities in legal metrology related to electricity meters in the Asia-Pacific region.

I am really pleased to have this outcome from the training course and again deeply appreciate invaluable voluntary efforts of the APEC secretariat.

February 15, 2006

Dr. Akira Ooiwa
APLMF President

Summary Report
on the APEC/APLMF Training Course on Electricity Meters

In support of APEC and APLMF objectives, the APEC/APLMF Training Course on Electricity Meters was held in Hanoi, Vietnam, from March 9 to 12, 2005. The training was organized by the APLMF, the Environment Directorate for Standards and Quality (STAMEQ) of Vietnam, and Measurement Canada. The course was attended by 35 participants representing 15 economies, including Brunei Darussalam, Cambodia, Chile, PR China, Indonesia, Lao PDR, Malaysia, Mexico, Mongolia, Papua New Guinea, Peru, Philippines, Chinese Taipei, Thailand, and the host country, Vietnam.

Electricity is one of the most commonly used and traded commodities in the world today, but the nature of electrical power and energy, the forms in which it is delivered to the consumer, and the processes used in trade measurement are complex and often poorly understood by the general population. In order to develop and maintain mutual confidence in the measurement of electricity, APLMF member economies have recognized the need for effective legal metrology program.

The Training Course on Electricity Meters was developed to provide attendees with a greater understanding of the issues and challenges associated with achieving accuracy and equity in the trade measurement of electricity. One of the challenges in preparing for this course was the quite diverse technical and legislative background of participants. The benefit such a diverse group was that it provided participants with the benefit of exposure to legal metrology from different perspectives. While it is beneficial for legislators to understand the significance of the technical aspects of electricity measurement, it is equally important for technical personnel to understand the benefits of national requirements that are in harmony with international standards or policies. With this in mind, the course was structured in a manner that would allow participants with varying levels of technical and legislative expertise to enhance their understanding of electricity measurement from a legal metrology perspective, while providing the flexibility to add or expand on content which required addressing the training needs of the participants.

At present, the legal requirements for electricity measurement vary significantly between the participating APLMF economies. In preparation for the session, participants were provided with nine key questions concerning legal metrology, and requested to make a three minutes' presentation on the current requirements within their respective economies, in

relation to these questions. This provided a means for establishing the training needs of the individual participants, and also provided them with a greater understanding of the different practices of other economies.

This was followed by the lecture by Mr. Takao Oki, Director, Technical Research Laboratory, Japan Electric Meters Inspection Corporation. It was entitled *The Current Situation in Legal Metrology on Electricity Meters in Japan*, and provided the participants with an example of a mature legal metrology program for electricity meters.

The balance of the training session was presented by Mr. George Smith and Mr. Paul Rivers, Electricity Specialists for Measurement Canada, which is the government organization responsible for the administration of the legal metrology legislation for Canada. Since this was the first APLMF training course for electricity meters, the session covered a broad range of topics applicable to the development of effective legal metrology programs for electricity measurement. Topics included the various single phase and polyphone electricity delivery configurations, energy and power analysis, various methods for calculating the units of measure, energy and demand measurement options, induction and electronic meters, type approval, meter verification, revivification intervals, meter test equipment, and the dispute investigation process used in the resolution of complaints.

All those involved with the training course should be commended for their contribution in making this a successful session. George Smith and Paul Rivers (Measurement Canada) developed and presented the training material. The training session participants are to be commended for their commitment to the training session, often working well into their break periods and after class to gain a greater understanding of the concepts presented. Special appreciation is given to the APLMF Executive Secretary, Dr. Tsuyoshi Matsumoto, and Mr. Bui Quy Long, (STAMEQ) who arranged such a well- organized training course, and who were always available to provide whatever assistance was necessary to make it run smoothly and productive training session.

Mr. Gilles Vinet
Vice President
Program Development Directorate
Measurement Canada

APEC/APLMF Training Courses in Legal Metrology (CTI-18/2004T)
Training Course on Electricity Meters
March 9-12, 2005 in Hanoi, Viet Nam

Program

Venue:
Thang Loi Hotel
Yen Phu Street, Tay Ho District, Hanoi, Viet Nam
Tel: +(84.4) 8294211/ 8290145, Fax: +(84.4) 8292927, Email: thangloihtl@hn.vnn.vn
http://www.thangloitourhtl.com.vn/hotel/

Organized by:
1. Asia-Pacific Economic Cooperation (APEC)
2. Asia-Pacific Legal Metrology Forum (APLMF)

Supported by:
1. Directorate for Standards and Quality (STAMEQ)
2. Measurement Canada, Government of Canada
3. National Metrology Institute of Japan (NMIJ)

Trainers:
1. Mr. George Smith, Measurement Canada, Government of Canada
2. Mr. Paul Rivers, Measurement Canada, Government of Canada
3. Mr. Takao Oki, Director, Technical Research Laboratory, Japan Electric Meters Inspection Corporation (JEMIC)

Contacts:
1. APLMF Secretariat (registration, scheduling and funding)
Dr. Tsuyoshi Matsumoto
APLMF Executive Secretary
NMIJ/AIST Tsukuba Central 3-9, 1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
Tel: +81-298-61-4362, Fax: +81-298-61-4393, E-mail: e.sec@aplmf.org

2. Working Group on Utility Meters of APLMF (lecture and training materials)
Mr. Gilles Vinet
Vice-President, Program Development Directorate, Measurement Canada
Holland Avenue, Tunney's Pasture, Ottawa, Ontario, K1A 0C9 Canada
Tel: +1-613-941-8918, Fax: +1-613-952-1736, E-mail: vinet.gilles@ic.gc.ca

3. Host in Viet Nam (visa assistance, accommodation and venue)
Mr. Bui Quy Long
Project Manager, Planning and Cooperation Department,
Directorate for Standards & Quality
Tran Hung Dao Street, Hanoi, Viet Nam
Tel: +84-4-7911633, Fax: +84-4-7911605, E-mail: qhqt1@hn.vnn.vn

Agenda[*1]

Wednesday March 9, 2005

09:00 - 09:30 Opening Ceremony
- Welcome address by the host
- Opening address by the APLMF Executive Secretary
- Introduction by Mr. George Smith and Mr. Paul Rivers
- Roll Call

09:30 - 09:50 *Coffee Break*

09:50 - 10:50 Special Lecture - Current Situation in Legal Metrology on electricity meters in Japan by Mr. Takao Oki.

10:55 - 12:30 Overview of the Measurement System and Current Situation about Electricity Meters in Each Economy Presented by the Trainees[*2]

12:30 - 13:40 *Lunch*

13:40 - 15:00 Course Outline / Time Lines / Metrological Control (Overview) / Electricity Distribution Systems / Electrical Power and Energy[*3]

15:00 - 15:30 *Coffee Break*

15:30 - 17:30 Single-Phase Metering Circuits / Polyphase Metering Circuits / Power and Energy Measurement[*3]

19:00-21:00 Welcome Party Invited by the Host (West Lake Cruise)

Thursday March 10, 2005

09:00 - 10:20 Watt-hour Measurement / VA-hour Measurement / VAR-hour Measurement[*3]

10:20 - 10:50 *Coffee Break*

10:50 - 12:00 Watt Demand Measurement / Volt-Ampere Demand Measurement / Basic Induction Meters[*3]

12:00 - 13:00 *Lunch*

13:00 - 13:55 Electronic Meters[*3]

13:55 - 14:10 *Short Break*

14:10 - 15:00 Type Approval Process[*3]

15:00 - 15:30 *Coffee Break*

15:30 - 17:00 Type Approval Process[*3]

18:00 - 22:30 Dinner and Entertainment Program Invited by the Host (Dien Luc Hotel – 30 Ly Thai To, Hanoi for dinner and Water Puppetry show for entertainment)

Friday March 11, 2005

09:00 - 10:00 Meter Verification Process / Test Methods / Reverification Intervals / In-service Compliance[*3]

10:00 - 10:30 *Coffee Break*

10:30 -12:00 Electricity Measurement Standards and Test Apparatus / Measurement Dispute Investigations[*3]

12:00 - 13:30 *Lunch*

13:30 - 15:00 Review / Questions / Answers

15:00 - 16:00 *Coffee Break*

16:00 – 16:30 Closing Ceremony
- Give a certificate to all attended trainees.
- Closing address by the APLMF Executive Secretary.
- Closing address by the host.

19:00-21:00 Farewell Party Invited by APLMF (Thang Loi Hotel)

Saturday March 12, 2005

08:00 - 12:00 Company visits to the EMIC Co. and the Song Da Electrical Labs.
12:00 - 13:00 Lunch invited by Song Da Electrical Labs.
13:30 Go back to the Thang Loi Hotel

Additional Comments:

***1 This proposed course outline is based on the trainee's having previous knowledge and experience with Electricity Metering.**

***2 This session will be presented by the Trainees**
A trainee from each economy provides a brief (3 minutes or less) overview of the measurement system and current situation about electricity meters in their economy. For example:

- What organization(s) regulate the measurement of electricity in your economy?
- What are the legal units of measure for the sale of electricity?
- Do electricity meters require approval of type?
- What organization performs approval of type testing?
- Is meter verification testing required?
- What organization performs the meter verification tests?
- Are tests performed on meters in service?
- Are meters given a reverification interval? (8 years? 12 years?)
- Is there as measurement complaint/dispute resolution process?

***3 These lectures will be given by Mr. George Smith and Mr. Paul Rivers**

Participants List: APEC/APLMF Training Courses in Legal Metrology (CTI-18/2004T)
Training Course on Electricity Meters
March 9-12, 2005 at Thang Loi Hotel in Hanoi, Viet Nam

No.	Economy	Category	Name	Organization
1	**Brunei Darussalam**	Trainee	Mr. Fernando Jesus De Castro	Calibration Centre Ministry of Defense
2	**Cambodia**	Trainee	Mr. Vanndeth Yin	Department of Metrology (DoM), Ministry of Industry, Mines and Energy (MIME)
3	**Canada**	**Trainer**	Mr. Paul Gregory Rivers	Measurement Canada, Government of Canada
4	**Canada**	**Trainer**	Mr. George Albert Smith	Measurement Canada, Government of Canada
5	**Chile**	Trainee	Mr. Roberto Andres Paut	Superintendencia de Electricidad y Combustibles
6	**China, PR**	Trainee	Mr. Lin Li	Jiangsu Institute of Measurement and Testing Technology
7	**China, PR**	Trainee	Ms. Lijuan Liu	National Institute of Metrology
8	**China, PR**	Trainee	Mr. Feng Zhao	Jiangsu Institute of Measurement and Testing Technology
9	**Indonesia**	Trainee	Mr. Haris Sutanto Broto	Directorate of Metrology, Directorate General of Domestic Trade, Ministry of Trade
10	**Japan**	**APLMF**	Dr. Tsuyoshi Matsumoto	Executive Secretary of APLMF / National Metrology Institute of Japan, AIST
11	**Japan**	**Trainer**	Mr. Takao Oki	Technical Research Laboratory, Japan Electric Meters Inspection Corporation (JEMIC)
12	**Lao PDR**	Trainee	Mr. Viengthong Vongthavilay	Science Technology and Environment Agency (STEA), Dept. of Intellectual Property, Standardization and Metrology (DISM)
13	**Malaysia**	Trainee	Mr. Nazri Marzuki	National Metrology Laboratory, SIRIM Berhad
14	**Mexico**	Trainee	Mr. Victor M. Alvarez Chavez	Direccion General de Normas (DGN), Secretaria de Economia
15	**Mongolia**	Trainee	Ms. Bolormaa - Baigalmaa	Mongolian Agency for Standardization and Metrology
16	**Mongolia**	Trainee	Ms. Bayar Jamiyan	Mongolian Agency for Standardization and Metrology
17	**Papua New Guinea**	Trainee	Ms. Debbie Anne Taitarae	Papua New Guinea National Institute of Standards and Industrial Technology (NISIT)
18	**Peru**	Trainee	Mr. Jorge Soriano	National Institute for the Defense of Competition and Protection of Intellectual Property-INDECOPI
19	**Philippines**	Trainee	Mr. Anson Santos Tarce	MERALCO – Manila Electric Company
20	**Taipei, Chinese**	Trainee	Ms. Sophia H.L. Chang-Chien	Bureau of Standards, Metrology and Inspection, Ministry of Economic Affairs
21	**Taipei, Chinese**	Trainee	Mr. Ching-Tung Lien	Taiwan Electric Research & Testing Center
22	**Thailand**	Trainee	Ms. Pattaraporn Surasit	Central Bureau of Weights and Measures
23	**Viet Nam**	**Host**	Mr. Long Quy Bui	STAMEQ

24	**Viet Nam**	**Host**	Mr. Thang Tat Ho	STAMEQ
25	**Viet Nam**	**Host**	Mr. Diep Hung Nguyen	STAMEQ
26	**Viet Nam**	**Host**	Mr. Hai Minh Phan	STAMEQ
27	**Viet Nam**	**Host**	Mr. Giau Quy Tran	STAMEQ
28	**Viet Nam**	**Host***	Mr. Nam Dinh Ho	Electric Measuring Instrument Company (EMIC), Ministry of Industry
29	**Viet Nam**	**Host***	Mr. Duong Bach Nguyen	Song Da Company No. 11
30	**Viet Nam**	**Host***	Mr. Khanh Vo	Electrical Testing Center, Song Da Company No. 11
31	**Viet Nam**	Trainee	Mr. Phuc Van Dinh	Ha Noi Electrical Measuring Instrument Co.
32	**Viet Nam**	Trainee	Mr. Hung Duc Do	Viet Nam Electricity
33	**Viet Nam**	Trainee	Mr. Hong Buu Nguyen Lam	Power Company N. 2
34	**Viet Nam**	Trainee	Mr. Hoan Quang Le	Ha Tay Power Company
35	**Viet Nam**	Trainee	Mr. Hoang Huy Le	Hai Phong Department for Standards and Quality
36	**Viet Nam**	Trainee	Ms. Anh Thi Nguyen	QUATEST 2
37	**Viet Nam**	Trainee	Mr. Cuong Manh Nguyen	Ha Noi Department for Standards and Quality
38	**Viet Nam**	Trainee	Mr. Duc Manh Nguyen	Bac Ninh Power Company
39	**Viet Nam**	Trainee	Mr. Lam Thanh Nguyen	Power Company N. 1
40	**Viet Nam**	Trainee	Mr. Quang Xuan Nguyen	QUATEST 1
41	**Viet Nam**	Trainee	Mr. Viet Xuan Nguyen	QUATEST 1
42	**Viet Nam**	Trainee	Mr. Ninh Hai Tang	Power Company N. 1
43	**Viet Nam**	Trainee	Mr. Binh Thanh Tran	Power Company N. 3
44	**Viet Nam**	Trainee	Mr. Nam Tuan Tran	Electrical Testing Centre- Song Da Company 11
45	**Viet Nam**	Trainee	Mr. Phuong Le Tran	QUATEST 3
46	**Viet Nam**	Trainee	Mr. Tap Van Vo	Electrical Testing Centre- Song Da Company 12
47	**Viet Nam**	Trainee	Mr. Quang Dang Vu	Viet Nam Metrology Institute

*Host staffs for the tuor
Names are listed in alphabetical order of their economies and last names.

Current Situation in Legal Metrology on Electricity meters in Japan

March 9, 2005

Takao Oki

Japan Electric Meters Inspection Cooperation
（JEMIC)

Contents

General

Legislation and Regulation

1. Measurement Law
2. Cabinet Order on Enforcement of Measurement Law
3. Regulation for Verification and Inspection of Specified Measuring Instruments
4. Regulation on Inspection of Verification Standard

General

Organization for Type Approval and Verification Services

The Japan Electric Meters Inspection corporation provide a type approval and a verification for the electricity meters used for tariff or certification purposes.

What does JEMIC do?

JEMIC Activities

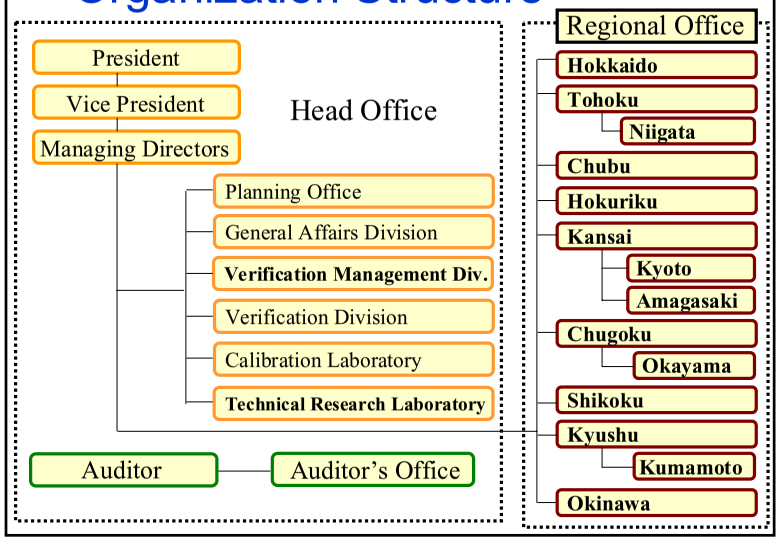
[Legal Metrology Services]
1. Type Approval for Electricity Meters
2. Type Approval for Illuminance Meters
3. Verification of Electricity Meters
4. Verification of Illuminance Meters
5. Inspection of Legal Standards

R & D

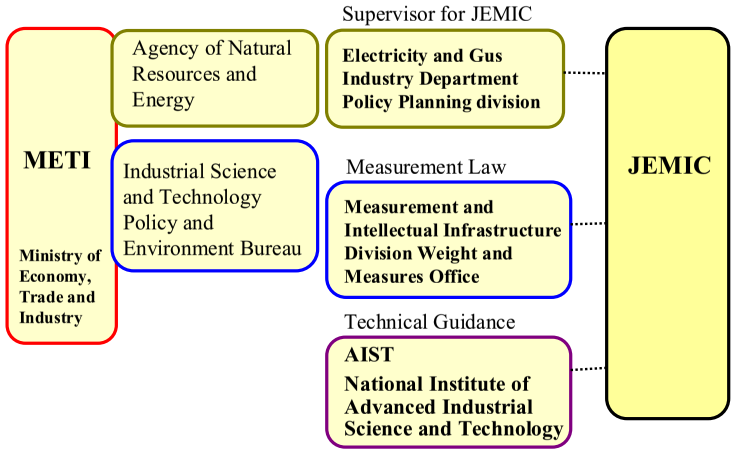
Technical Cooperation

[Calibration Services]
1. JCSS Cal. Service
2. Calibration Service
3. Mobile Cal.Service

Organization Structure



Relationship Between JEMIC and METI

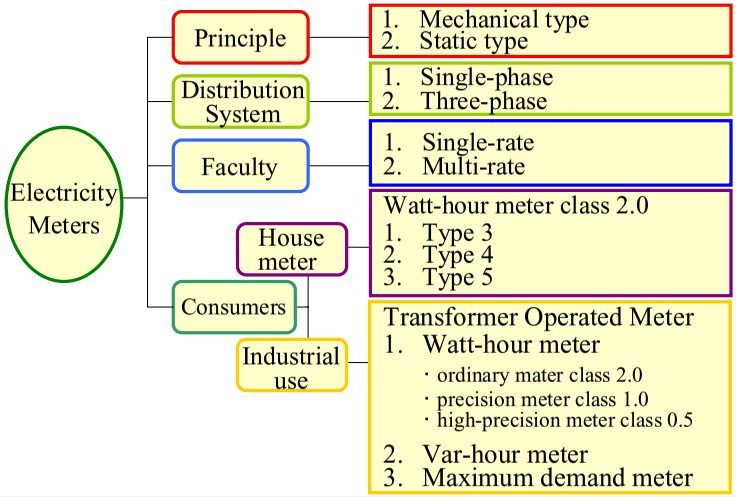


Purpose of Type Approval

1. It is practically impossible to conduct all electrical performance tests for every mass-produced electricity meters due to the huge cost and time involved.

2. Therefore, these tests are conducted on samples of newly developed electricity meters and those passing the test are given a type approval number.

Classifications of the Electricity Meters in Japan



Type Approval (1)

1. Documentation

   Submission of a meters to JEMIC for type approval shall be accompanied by sufficient technical information.

2. Meters Submitted for Testing

   Tests shall be carried out on five meters

3. Laboratory Examination
   a. Construction
   b. Markings

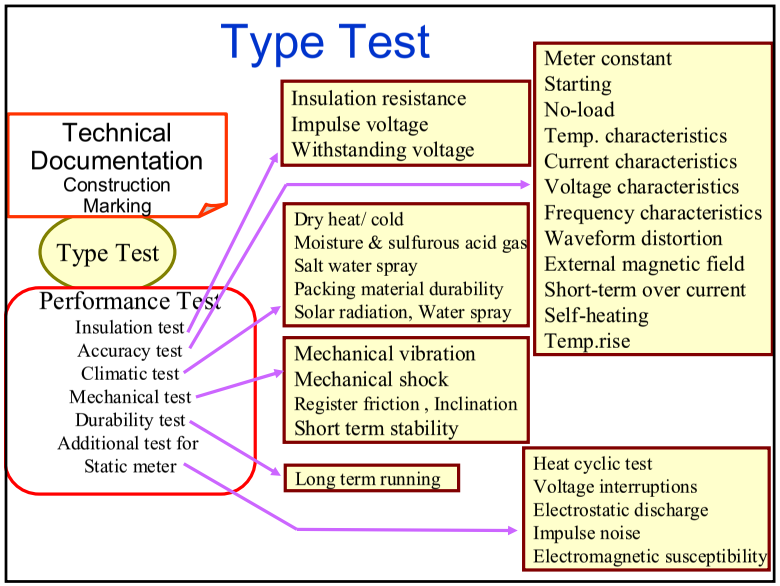
Type Approval (2)

Laboratory Tests

Laboratory tests shall be performed to ensure that it complies with the metrological requirements of the Regulation

1. Insulation properties
2. Accuracy Requirements
3. Climatic influence
4. Mechanical requirements
5. Additional requirements for static electricity meters

Type Test



Type Approval

1. Certificate of Type Approval
2. Time Limit to Perform Approval: 90days
3. Type Approval Fees

   (Cabinet Order and Ministerial Order) :

   126,800yen (direct-connected meters)

   185,400yen (others)

Type Test Lab.

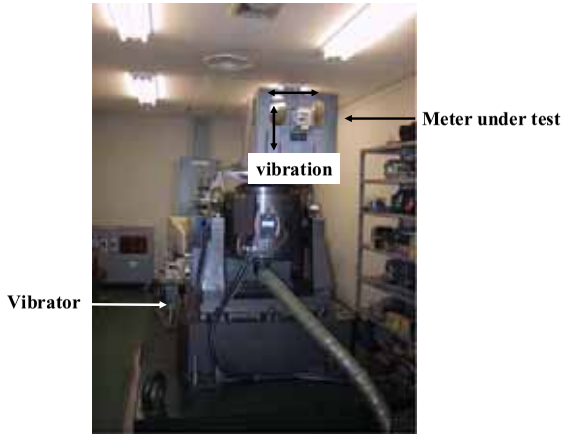
Inclination test, characteristic test, influence test in a magnetic field

Type Test Lab.

Temperature Rising Test

Type Test

Vibration Test for Electricity Meters



Type Test Lab.

EMC Testing Chamber for Electronic type Electricity Meters

Verification (1)

Verification body(JEMIC)

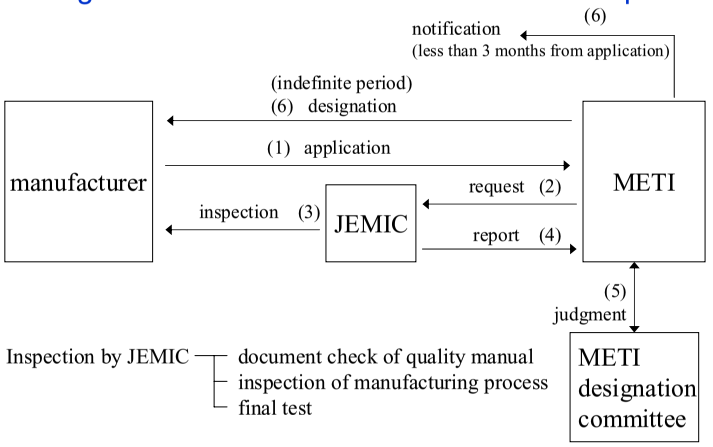
1. Under the ministerial ordinance, JEMIC carries out verification tests on each meter submitted for verification.
2. The test specified in the ordinance are the same for both new and repaired meters.

Verification (2)

Verification body (designated manufacturer)

1. In 1992, the new Measurement Law came into force in JAPAN.
2. The Major change is the introduction of self-verification system for electricity meters by the designated manufacturer of meters which has the same effect as the national verification.
3. The self-verification of electricity meters was introduced on October 31, 1998

Designation Procedure for Manufacturer in Japan



Verification (3)

Tests for type approved meters

Meters tested for verification shall comply with the following requirements:

1. Insulation requirement
2. Starting current requirement
3. No-load requirement
4. Error test

Verification (4)

Test Conditions

Temperature: 23ºC+/- 5 ℃.

(23 ºC +/- 2 ºC for a high precision watt-hour meter)

Voltage: rated voltage +/- 0.3%

Frequency: rated frequency +/- 0.5%

Voltage and Current waveforms: Distortion Factor

Mechanical Type <3%

Static Type <2%

(<1% for a high precision watt-hour meter)

Verification (5)

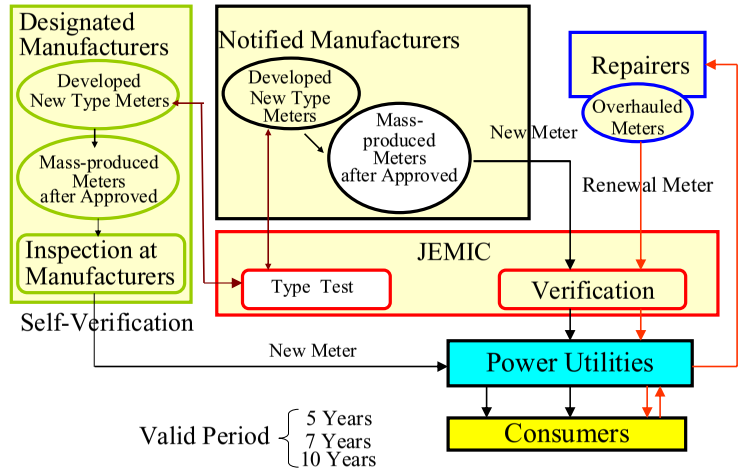
Verification Mark and Sealing (1)

1. The verification mark shall be affixed to the meters which have passed the verification.
2. JEMIC has devised new sealing system, consisting of an ABS plastic cap loaded with a stainless steel spring.
3. The system permits a simple sealing process.

Verification (6)

Verification Mark and Sealing (2)

Legal Electricity Meter Verification Scheme in Japan

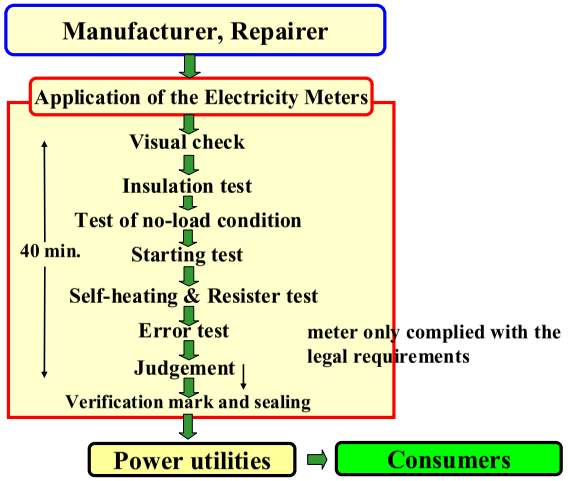


Time Limit to Perform Verification

Periods prescribed by the Regulation are as follows:

1. Type approved direct-connected meter (Domestic meter): 20 days
2. Type approved transformer operated meter: 20 days
3. Type approved transformer operated meter and instrument transformer: 30 days
   Inspection of instrument transformer is carried out at consumer's premises: 50 days

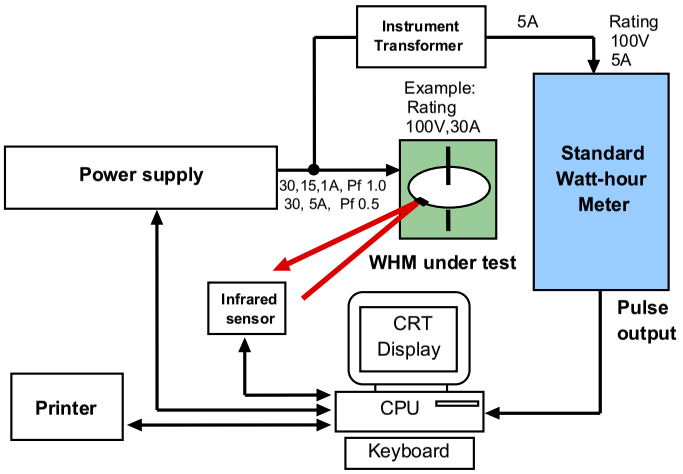
The daily Verification process



View of the Automatic Testing System for Electricity Meters

Static Electricity Meters

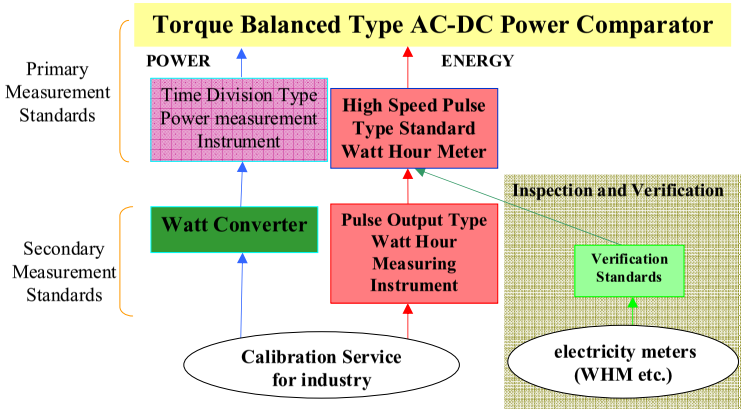
A Test Method



Verification Standards

1. Inspection of Verification Standards
2. Traceability system of power and energy standards(Verification Standards)
3. Introduction of National Standard for power and energy
4. Establishment of power and energy Standard
5. A Digital System for Calibrating Active/Reactive Power and Energy Meters

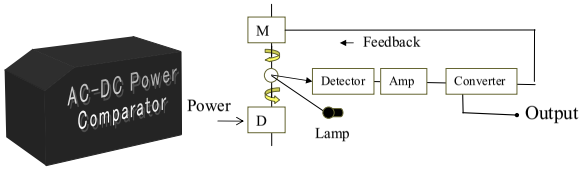
Traceability system of power and energy standards (Verification Standards)



Introduction of National Standard for power and energy

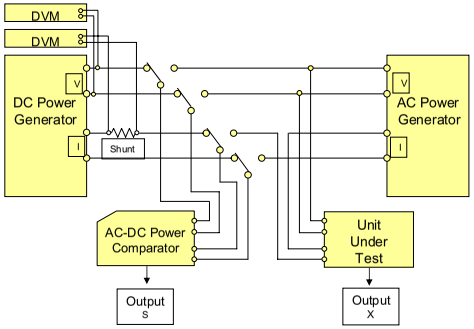
JEMIC developed a high precision power comparator which has a structure applying the electrodynamometer'principle in 1965.

The torque balanced type AC-DC power comparator, which is maintained by JEMIC, has been designated as the Primary Measurement Standard by government since 1993.

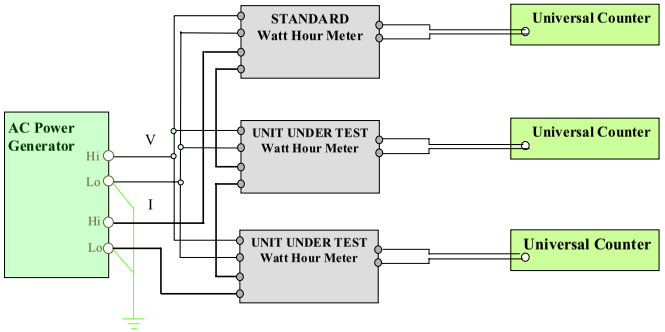


Establishment of power and energy standards

The AC-DC difference and the internal phase angle error of the AC-DC Power Comparator were estimated both theoretically and experimentally.
DC power is determined by using two DVMs and a shunt which are traceable to SI units.
Therefore it is possible to establish AC power and energy standard.



Comparison method of energy standards



A DIGITAL SYSTEM FOR CALIBRATING ACTIVE/REACTIVE POWER AND ENERGY METERS

Equipment for caribrating precision active/reactive power and energy meters

Voltage : 100V

Current : 5A

Frequency : 50, 60Hz

Simple approaches for power/energy measurement with digital technique.

System Overview (1)

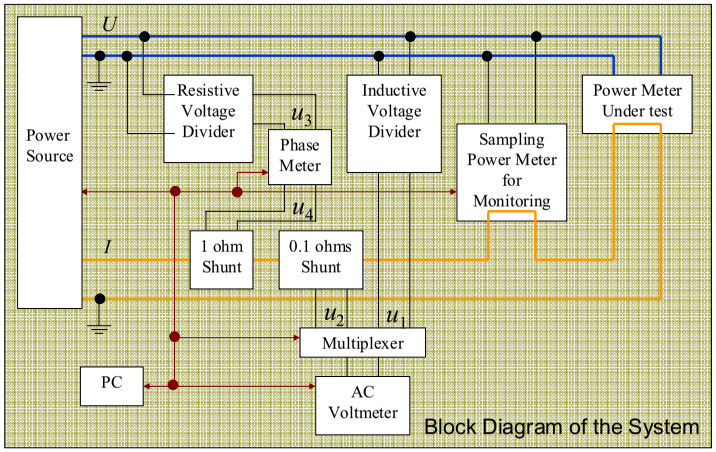
Basic Principle

Active power (P) and reactive power (Q) can be calculated from voltage (U), current (I) and phase angle ($ø$) .

$P = UI\cos ø$

$Q = UI\sin ø$

System Overview (2)



Block Diagram of the System

System Overview (3)

Active power (P) and reactive power (Q) can be calculated from the measurement results of U, I and $ø$

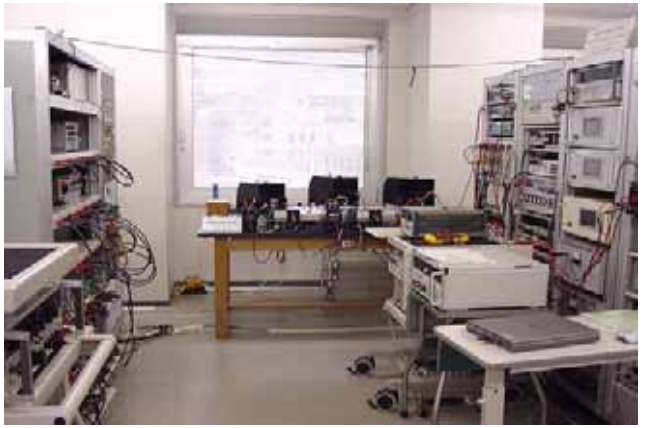
Active power

$P = UI\cos ø = Au_1u_2\cos ø / R$

Reactive power

$Q = UI\sin ø = Au_1u_2\sin ø / R$

A View of Calibration System for Verification Standards



Maximum Permissible Errors for Verification

1. Domestic meters (Direct-connected watt-hour meters)

	Maximum Permissible errors	Power factor	Test current
Type 2	2.0%	1	5%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type 3	2.0%	1	3.3%In,50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type 4	2.0%	1	2.5%In,50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type 5	2.0%	1	2%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In

2. Transformer operated meter

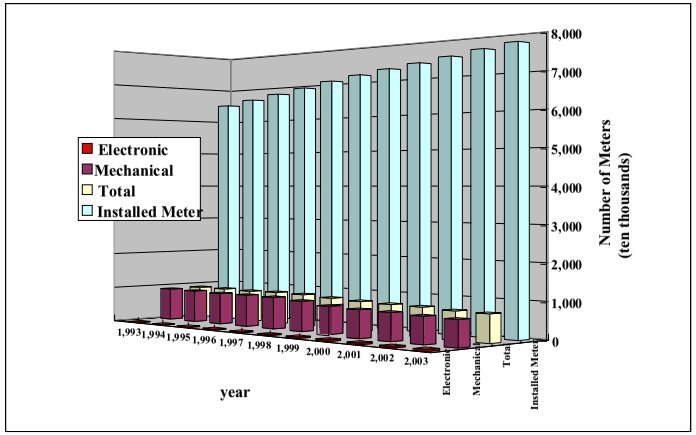
	Max.Permissible errors	Power factor	Test current
Ordinary watt-hour meter	2.0% (2.0%)	1	5%In,50%In, 100%In
	2.5% (2.5%)	0.5 inductive	20%In, 100%In
Precision watt-hour meter	1.0% (1.2%)	1	20%In,50%In, 100%In
	1.5% (1.8%)		5%In
	1.0% (1.3%)	0.5 inductive	20%In,50%In,100%In
	1.5% (2.0%)		5%In
High precision watt-hour meter	0.5% (0.6%)	1	20%In, 50%In,100%In
	0.8% (1.0%)		5%In
	0.5% (0.7%)	0.5 inductive	20%In,50%In, 100%In
	0.8% (1.1%)		5%In
Var-hour meter	2.5% (2.5%)	0	100%In
		0.866 inductive	20%In,50%In, 100%In
Maximum demand meter	3.0% (3.0%)	1	10%In,50%In, 100%In
		0.5 inductive	100%In

Note (1) In: Rated current
(2) ( ): Maximum Permissible errors for a meter error + an instrument transformer error

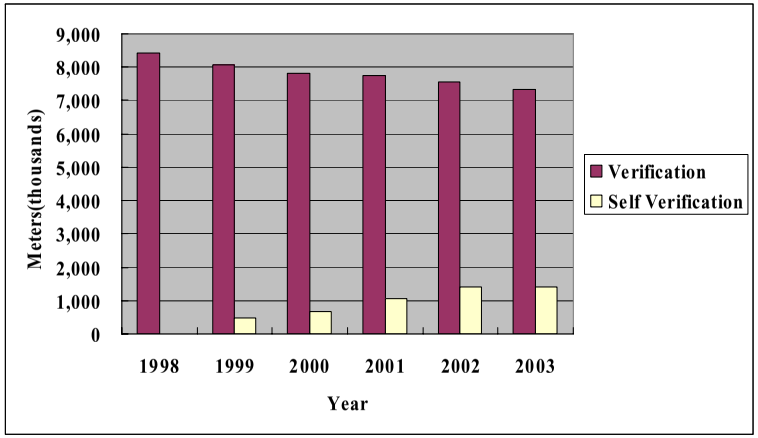
3. Maximum Permissible Errors for Meters in-service and Duration of Verification

Electricity meters	Maximum permissible errors in-service	Verification period (years)
Domestic Watt-hour meter 100%In to 20%In, pf 1 Rated current: 30, 120, 200 , 250A Rated current: 20, 60 A	+/-3.0%	10 7
Precision watt-hour meter 100%In to 10%In, pf 1 5%In, pf 1	+/-1.7% +/-2.5%	5
High precision watt-hour meter 100%In to 10%In, pf 1 5%In, pf 1	+/-0.9% +/-1.4%	5
Var-hour meter 50%In, pf 0.866	+/-4.0%	5
Maximum demand meter 50%In, pf 1	+/-4.0%	5

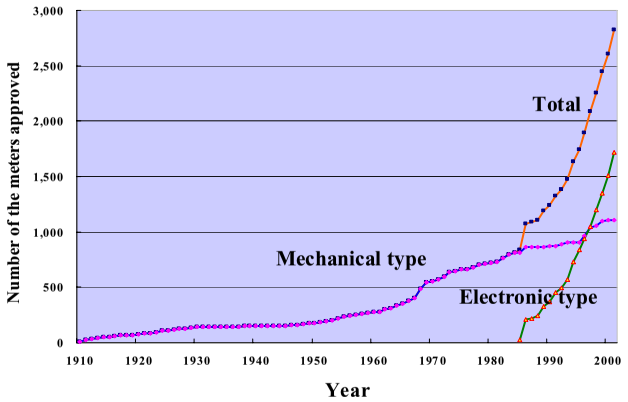
Annual Number of Electricity meters in service and Number of Meters Verified



Number of Meters Verified by JEMIC or Designated Manufactures



Total number of the meters approved by JEMIC



Thank you for your Attention

BRUNEI ELECTRICITY METERING SYSTEM

Ministry of Development

Department of Electrical Services

Berakas Power Station
Berakas Power Management Corporation (BMPC)

Department of Electricity Services

Objective:

- To provide services and adequate, efficient, reliable, continuous, economical and safe electricity supply.
- Main Functions:
- To generate electricity
- To provide electricity supply infrastructure
- To collect revenue from the sale of electricity
- To provide technical advice in the field of electricity
- To inform and educate the customer on the technology and safe usage of electricity
- To control the quality of electrical equipment supplied and those used by contractors
- To develop and maintain the electrical system in the department

Berakas Power Station- Berakas Power Management Corporation (BMPC)

- Independent private contractor
- Supply and provide testing of meters
- Carry out meter acceptance and verification test for newly acquired meters
- Conduct verification test for meters subject to customer complain

Legal Units of Measure for the Sale of Electricity

Kilowatt-Hr

Residential

KVA Maximum Demand

Commercial and Industrial

Billing System

- Prepaid Metering System
- Electricity Billing System (EBS)

The EBS allows the consumer to pay their electricity bills and request for a re-print of their bills anywhere in Brunei at any DES payment counter

Measurement System and Current Situation:

- Organization that performs approval of type: NIL
- Organization that performs meter verification tests: BPMC
- Meters in service:
  - Test are not performed on meters in service (unless there is a complain)
  - Meters are not given a reverification interval

Presentation

History

- 1999 Department of Metrology was established.
- 2002 Became the full member of APLMF

Role of Department of Metrology

- Implementation of the National Metrology Policy
- Issuing document concerning to manufacture
- Use
- Import-Export
- Repair of the measuring instruments.
- Custodian and Maintenance of the Secondary Standard.

Role of Department of Metrology

- Pattern approval and verification of the measuring instrument.
- Review the need, establishment the work plan monitoring the implementation.
- Organization the training on Metrology.
- Maintenance of industrial and legal metrology laboratories.

Action Plan

- 2004 establishment of the National Laboratory and the Regional Verification Center No. 2
- 2005 establishment of the Regional Verification Center No. 3 and No. 4
- 2006 establishment of the Regional Verification Center No. 5.
- 2005 establishment of the Regional Verification Center No. 1

Metrology Law

- The new metrology law drafted with the Technical assistance from the UNIDO and now is on discussion and We expect that Metrology Law will finish in 2005.

Standardization

- Department of Metrology has established the National Metrology Laboratory that consists of :
  - Mass
  - Volume
  - Temperature
  - Electricity
  - Dimensional
  - Pressure- force

Thank for your attention!

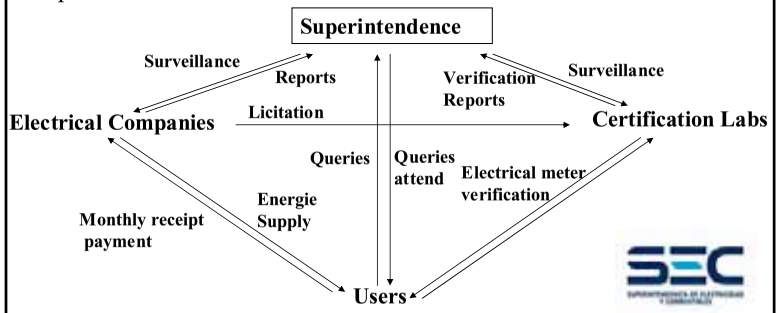
Overview of the Measurements System and Current Situation about Eletricity Meters in Chile

Hanoi, Vietnam

9-12 March, 2005

Electrical System Regulator

Superintendence of Electricity and Fuel is the goverment organization in charge of set up electrical system rules and surveys Electrical Companies and Certification Labs. Also attend users queries.



Regulations about Electrical Meters

Electrical Meters (EM). For sales, every single meter must have an approval certificate given by a Certification Lab.
When they are put in service, Certification Labs must calibrate,verify and stamp them.
Legal units of measure are Kwh.

Electrical Companies (EC). No matter who is the owner of the Electrical Meter (EC or Users), EC must present a plan of EM verification which must be approved by the Superintendence. This period has been fixed in 4 years. EC must licitate and report to the Superintendence the Certification Lab choosen for the execution of the verification plan.

Certification Labs. Must be recognized by Superitendence. Give the approval certificate to Electrical Meters. Execute EM verification plan proposed by EC. Report verification results must be given to Superintendence.

Users. Must pay EM periodic verification to EC. This payment is included in the receipt monthly.
If there are suspects about the performance of EM, users can ask for a new verification. If suspects are correct, EC must pay the verification, otherwise user must do it.

Next Steps

On Line Information. Superintendence is working on Internet Software for get online EM verification results. Penalty to EC woul be applied based on statistical analyses from on line information.

Users would know on line result of their Electrical Meter verification.

APEC/APLMF Training courses in Legal Metrology and Training course on Electricity meters, Hanoi, Mar 9, 2005

Electricity meters metrology in NIM

Speaker:
Liu Lijuan

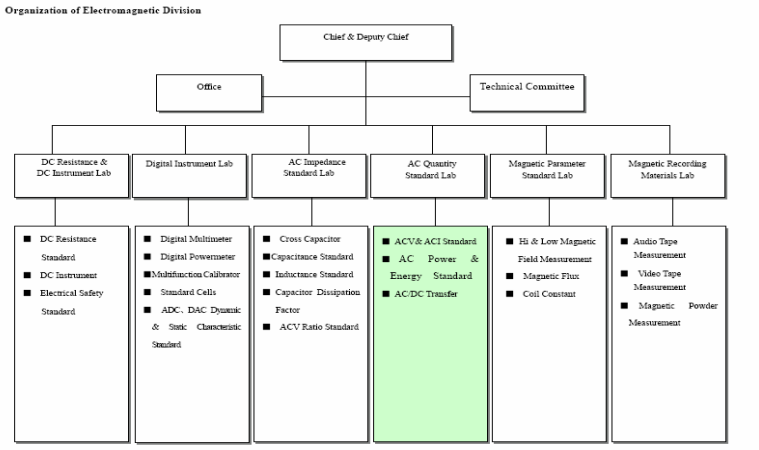
Co-authors:
Li Min, Wang Lei and Zhou Hao

National Institute of Metrology (NIM)
Electromagnetic division

Organizational Structure of National Institute of Metrology (NIM)

- Administrative Departments
  - Science and Technology Department
  - Calibration Service Department
  - Legal Metrology Department
  - Technical Development Center
  - Planning Department
  - Foreign Affairs Office
  - Logistics Departments
- Professional Divisions
  - Length Division
  - Heat Division
  - Mechanical Division
  - Electromagnetic Division
  - RF & Microwave Division
  - Quantum Division
  - Optical Division
  - Ionizing Radiation and Medical Division
  - Engineering Technology Division
  - Optical Engineering Division
  - Electronical Engineering Division
  - Energy Conservation Center
  - Information and Training Center

Introduction of Electromagnetic division of National Institute of Metrology (NIM)

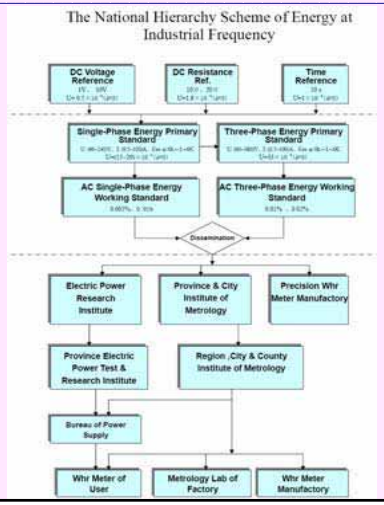


Introduction of Energy Measurement Laboratory of National Institute of Metrology (NIM)

The mission of Energy measurement Lab. of the electromagnetic division of NIM :

- development and maintain the energy standards
- disseminate the value of energy unit into whole country, including to calibrate the standard energy meters

Introduction of Energy Measurement Laboratory of National Institute of Metrology (NIM)



Introduction of Energy Measurement Laboratory of National Institute of Metrology (NIM)

In our Lab. there are two standards:

1. National primary standard of energy for single phase
2. Three phase energy standard

National Primary standard of energy for single phase

National Primary standard of energy for single phase

- *Rang*:

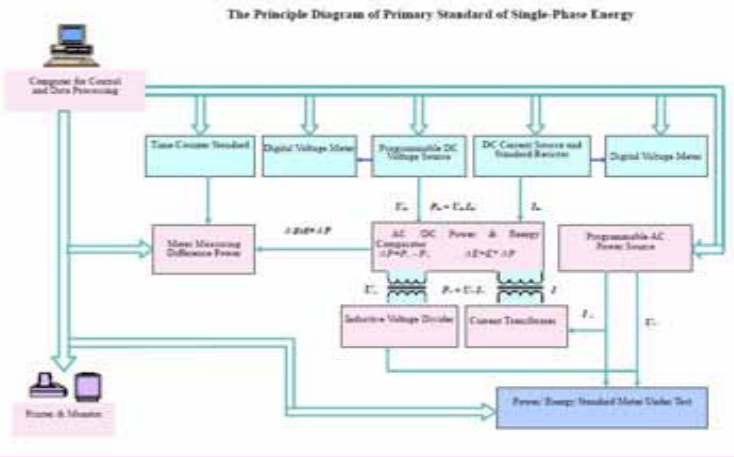
Voltage 60 volts to 240 volts

Current 500 mill amperes to 100 Amperes

power factor zero lead to unity to zero lag.

Best uncertainty 15ppm, k=3.

National Primary standard of energy for single phase



National Primary standard of energy for single phase

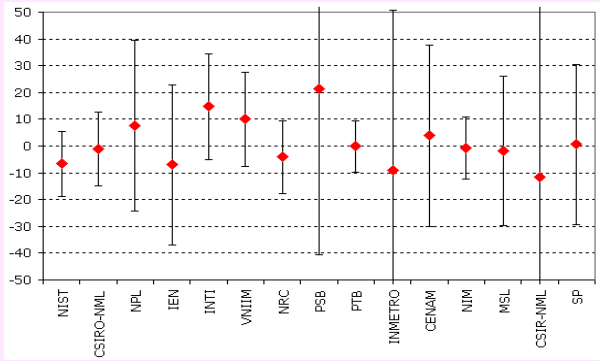
Its main principle:

- DC voltage source and DC current source.
- Double Bridge Power Comparator, in which thermo-converting principle is applied
- The results will be calculated as difference between AC and DC power.
- To hold the stabile of AC and DC power output and to measure continue during a time interval, the energy can also be obtained.

National Primary standard of energy for single phase

MEASURAND: electric power at 120 V, 5 A, 53 Hz, power factor 1.0

NOMINAL VALUE: 600 VA, 600 W

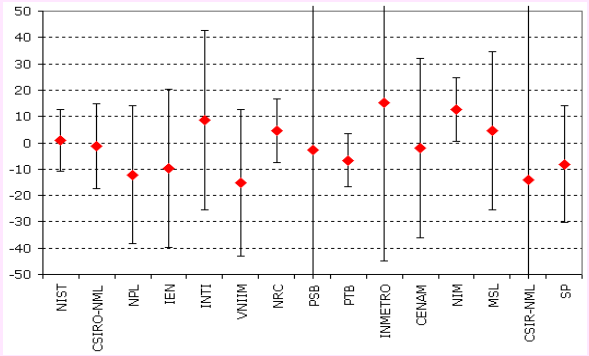


Degrees of equivalence $D_i = (x_i - x_R)$ and expanded uncertainty U_i (k = 2), expressed in W/VA

National Primary standard of energy for single phase

MEASURAND: electric power at 120 V, 5 A, 53 Hz, power factor 0.5Lead

NOMINAL VALUE: 600 VA, 300 W

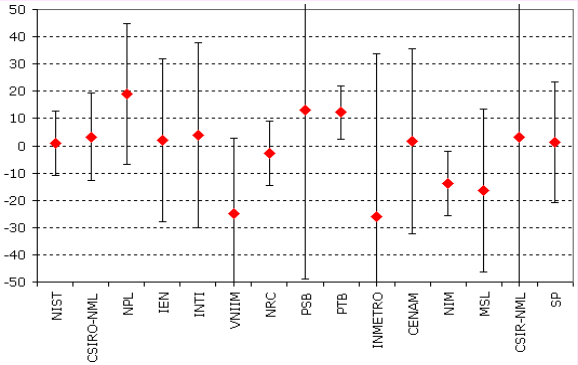


Degrees of equivalence $D_i = (x_i - x_R)$ and expanded uncertainty U_i (k = 2), expressed in W/VA

National Primary standard of energy for single phase

MEASURAND: electric power at 120 V, 5 A, 53 Hz, power factor 0.5Lag

NOMINAL VALUE: 600 VA, 300 W



Degrees of equivalence $D_i = (x_i - x_R)$ and expanded uncertainty $U_i(k = 2)$, expressed in W/VA

Three phase Energy Standard

Three phase Energy Standard

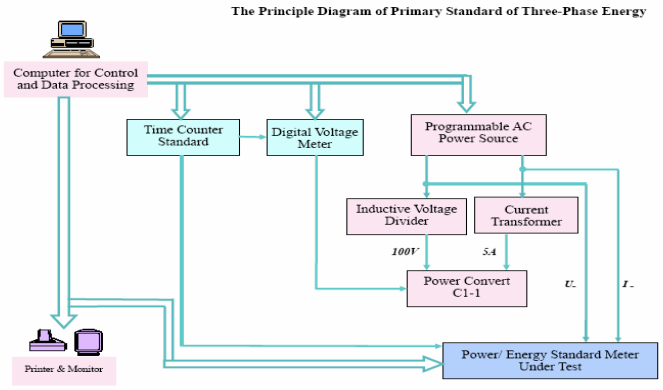
- *Range:*

Voltage 60 volts to 380 volts

Current is from 200 mill amperes to 100 Amperes

Power factor is from 0.5 lead to unity to 0.5 lag Total uncertainty 33ppm, *k*=3

Three phase Energy Standard



Brief Introduction of Chinese Electricity Meters

- Main types of Electricity Meters

  single phase meters, three-phase electronic meters, mechanical meters

  single phase and three-phase multi-rate meters single phase and three-phase prepay meters

  three-phase multifunctional electronic meters

Introduction of Chinese Electronic Meters

•Accuracy classes of meters and the national standards for approval of type testing

Active energy include Class 1 and 2 GB/T17215-2002 Alternating current static watt-hour meters for active energy (classes 1and 2) being equal to IEC61036-2000

Reactive energy include class 2 and 3 GB/T17882-1999 Alternating current static watt-hour meters for reactive energy(classes 2and 3) being equel to IEC61268-1995

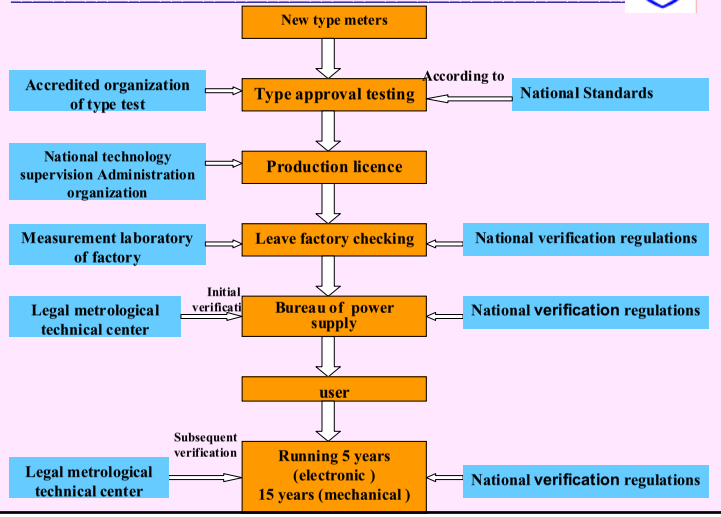
Introduction of Chinese Electronic Meters

Accuracy classes of electronic meters and the national standards for approval of type testing

Active engergy calsses is :0.2S% and 0.5S%

GB/T17883-1999 Alternating current static watt-hour meters for active energy (classes 0.2Sand 0.5S) being equel to IEC60687-1992

Introduction of Chinese Electronic Meters



Introduction of Chinese Electronic Meters

Organization performing approval of type testing

Experts organized by General Administration of Quality Supervision , Inspection and Quarantine of the People's Republic of China assess the technological testing organization.

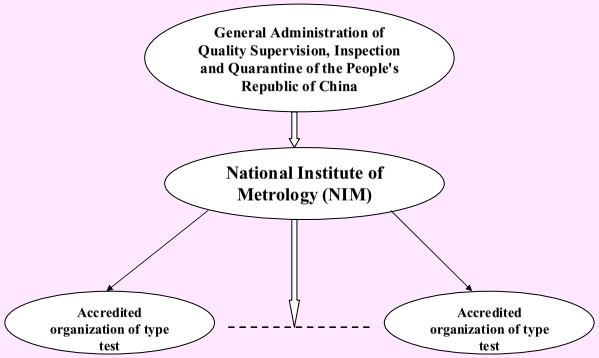
At present, there are 20 accredited technological inspecting organization performing approval of type testing in China.

The energy measurement laboratory of National Institute of Metrology (NIM) is one of them,but having its' own special mission：

1. ensuring quantity value dissemination uniform of different testing organizations
2. performing approval of type testing for imported meters
3. performing approval of type testing for exported meters

Introduction of Chinese Electronic Meters

Organization structure of performing approval of type testing



Contact us

- **Energy Measurement Laboratory of National Institute of Metrology**

  Address: No. 18, Bei San Huan Dong Lu, Beijing 100013, China

  Website: www.nim.ac.cn

  E-mail: zlyq_dc@nim.ac.cn

  Tel: 0086-10-64211631-2414

  Fax: 0086-10-64218629

Thank you !

TRAINING COURSES
ON
ELECTRICITY METERS
COUNTRY REPORT OF LEGAL METROLOGY IN INDONESIA

The Legal Metrology in Indonesia

- Directorate of Metrology in Jalan Pasteur 27 Bandung provinces of West Java is institution that handles legal Metrology problems, under the Directorate General of Domestic Trade, Ministry of Trade.

- Legal Metrology activities in Indonesia started with the passing of the "IJK Ordonnantie"(Weight and Measures Law), which was revised and in 1981 the Legal Metrology Law came into force.

- Basically, Directorate of Metrology function and it's Regional Metrology Units, is to manage standard measurement, to verify and re-verify measuring instruments, to supervise legal measuring instruments and packaging also giving elucidation about metrology.

- Indonesia became a member of the International Legal Metrology Organization (OIML) in September in 1960, and also the member of Asia Pacific Legal Metrology Forum (APLMF) since it's establishment in 1994.

METROLOGICAL SERVICES

The Directorate of Metrology, under The Directorate General of Domestic Trade, Ministry of Trade is to manage and regulated standard measurement, to the measurement of electricity for legal metrology measuring instrument.

The Legal units of measure for the sale of electricity meters (single phase and three phase meters) is a kilowatt-hour or Watt – hour.

■ TYPE OF APPROVAL

The Directorate of Metrology is the institution that has the authority to issue license for imported measuring instruments and factory license for local measuring instrument.

And the electricity meters for Legal Metrology measuring instrument require type of approval by The Directorate of Metrology in Bandung.

■ VERIFICATION AND REVERIFICATION

Verification and re-verification is examining legal metrology measuring instruments by the Inspector of Metrology to see if it is appropriate enough with the technical certainty, and legalized by sealing it with validity mark and or attaching the examination result.

Verification and re-verification testing for the Electricity meters, these are organized in every metrology offices through out Indonesia or Regional offices of Metrology.

Re-verification interval for electricity meters is 10 years.

■ CALIBRATION

Calibration is to determine metrological characteristic of measuring instrument by comparing it with a traceable standards. Besides doing Verification tests in the Metrology offices, gives calibration services for electricity meters in service at the industrial measuring instruments.

■ SUPERVISION AND ELUCIDATION

Supervising and elucidation will be given by Inspectors, Civil Services Metrology Investigator and the entire Legal Metrology functionary.

Violation criminal act on Legal Metrology constitution is sanctioned by maximum one year imprisonment and or fined.

Supervision and elucidation will be given at commercial areas, measuring and weighing places for public, delivery area and places for determine wages based on weight and measured.

Inspectors of Metrology will be given calibration services for the measurement complaint on the electricity meters.

********** Thank You Very Much **********

LAOS

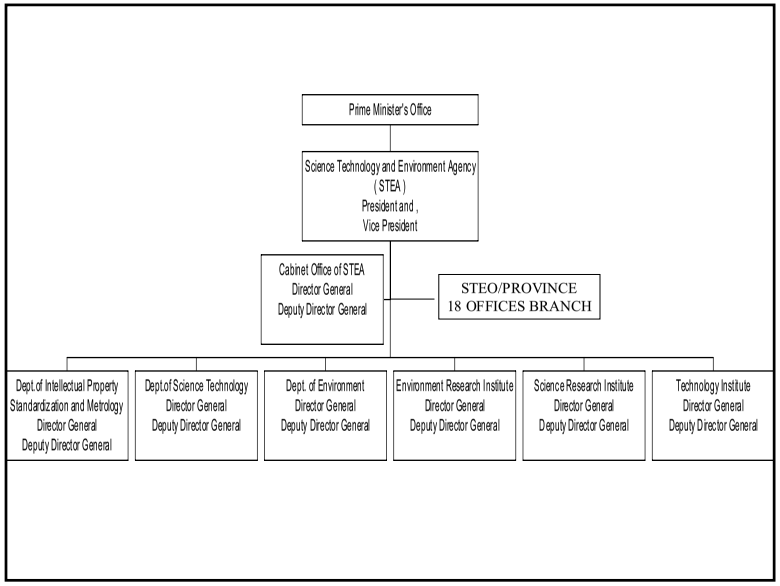
The Official Name:
Lao People's Democratic Republic

Capital : Vientiane

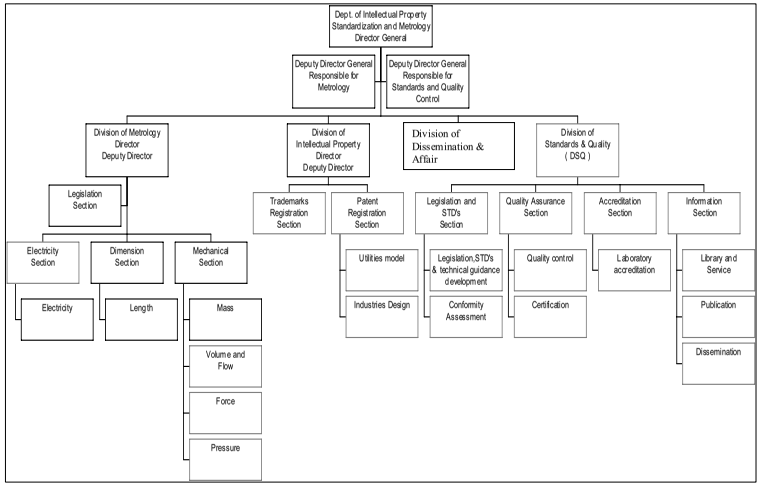
Area : 236,800 square kilometers
91,430 square miles

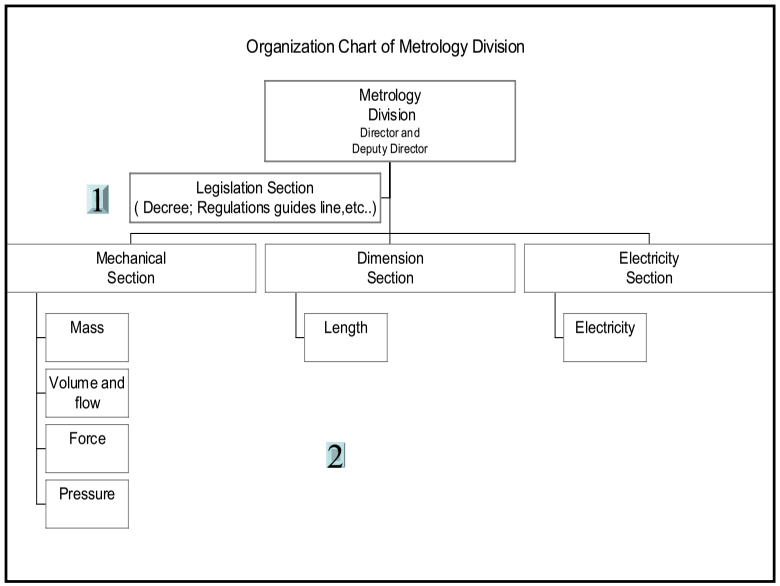
Population : 5,406,0415 (1999 estimate)
(With a Population growth rate of 2.76 percent)

Population density : 22 persons per square kilometer
58 persons per square mile



Organization Chart of DISM

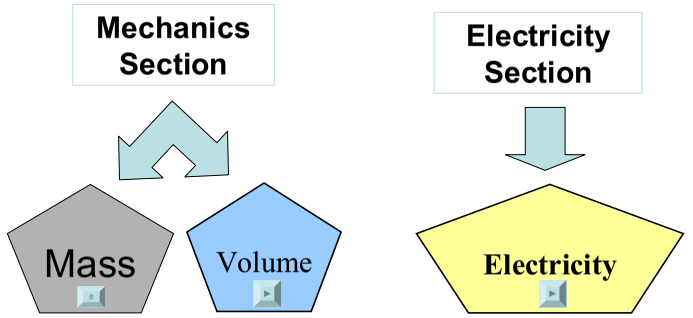


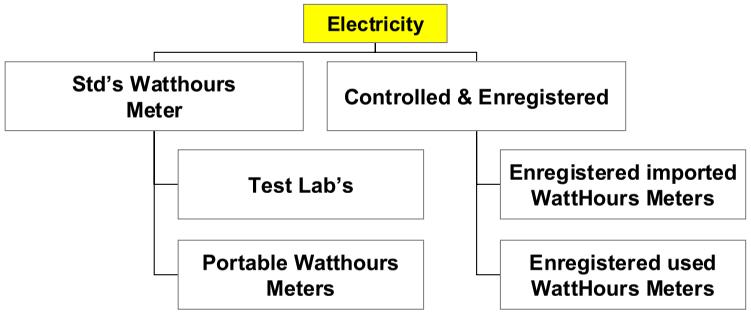


Metrology (Legislations)

- Decree on metrology management issued on 26 October 1993
- Regulation on Registration of measuring instruments issued on 2 November 1995.
- Guides lines on Registration of fuel dispensers pump issued on 2001.
- Prepackages goods and registration of trucks fuel tanks are still drafted

Currently activities on Metrology





Electricity laboratory of Electricite Du Laos (EDL)

Summary

1. What organization (s) regulate the measurement economy?

   Referred to the decree of the Prime Minister Office No 68/PM issued on year 1995, it was the Department of Intellectual Property Standardization and Metrology as well as the Science Technology and Environment Agency who regulate the measurement economy.

2. What are the legal units of measure for the sale of electricity ?

   the Legal unit of measure for the sale of electricity is kilowatt-hour (KWh).

3. Do electricity meters require the approval of type?

   No, they don't because they are imported.

- What organization performs approval of type testing ?

  It is the Department of Intellectual Property Standardization and Metrology

- Is meter verification testing required ?

- What organization performs the meter verification tests?

  It is the Department of Intellectual Property Standardization and Metrology

- Are tests performed on meters in service?

  Yes, they are.

-Are meters given a re-verification interval? (8 years,12years).

- 02 Years

-Are there as measurement complain/dispute resolution process?

-Yes there are

Overview of Measurement System & Current Situation of Electricity Meters in Malaysia

Nazri Marzuki
National Metrology Laboratory
SIRIM Berhad, MALAYSIA

Wednesday, March 9 2005

Overview of Energy Industry in Malaysia

Energy Commission

-Established under Energy Commission Act 2001 on 1st May 2001
-Responsible to regulate the energy supply activities in Malaysia to enforce energy supply laws
-Promote further development of the energy

3 main utilities

Tenaga National Berhad (TNB)

-Main power utility in Peninsular Malaysia
-Established in September 1990 through corporatization and privatization by government
-Formerly known as National Electricity Board (NEB) in 1965
-Core activities are in the generation, transmission and distribution of electric energy
-Under the distribution, electricity meters is one of the main activity

Sabah Electricity Sdn. Bhd. (SESB)

Sarawak Electricity Supply Corp.(SESCO)

Independent Power Provider (IPP)

-supply to main utilities about 40% in 2002
-19 IPPs

Measurement Law in Malaysia

Weights and Measure Act 1972

-Prescribes S.I units as the only legal units to be used throughout Malaysia
-Provides for the establishment of national measurement standards of physical quantities based on the S.I units

Enforcement

Ministry of Domestic Trade and Consumer Affair- Enforcement Division

- It is gazette as Inspector of Weights and Measures

4 amendments: 1981, 1985, 1990 & 1992

Amendment in 1985

-Electricity meters, taxi meters, water meter and billing systems in telecommunication industry are exempted from verification and inspection by Inspector of Weights and Measures

-These instruments are instead to be verified and tested by the respective designated authorities

-In the case of electricity meters, verification and inspection are conducted by Tenaga National Berhad (TNB)

Measurement System in Malaysia

NML-SIRIM Berhad

-Responsible of establishment and maintenance of national primary standards of measurement
-All measurement used in trade transactions and other fields of legal metrology are traceable to NML
-Electrical – smoke meters, radar gun, lux meter, stop watches and also pattern approval of parking meter
-Mechanical – weight, balance, rulers
-Flow-volume, capacity, prover tank
-Chemistry-breath analyzer

Accredited Laboratory

-About 4 accredited laboratories in electric meters including TNB through its subsidiary, TNB Metering Sdn. Bhd.
-Reference standards used for verification and testing of electricity meters are traceable to NML

Government Enforcement Agencies

-Such as MDTC, police, Road and Transport Department, Environmental Department
-Measurement instruments used in law enforcement are traceable to NML

Industry

-None trade measurement used for manufacturing, industrial and scientific purposes are traceable to NML directly or to accredited laboratory

Legal unit

-The legal unit used in sale of electricity is kilowatt hour (kWh)

Pattern Approval

-Pattern approval of electricity meters is compulsory and performed by TNB.
-Adopting IEC standard which is depending on class of the meter.
-The electricity meter's manufacturers are required to attach the results from certified independent laboratory.

Electricity Meters Verification

-Electricity meters verification is performed by TNB.
-For medium and high voltage consumer which electricity meters used of transformer, the verification interval is once a year.
-For low voltage consumer, in single phase or three phase electricity meters, there is no specific verification interval. The verifications test is done where there is some differences in bill statistic or complain by the consumers.

Future Planning

-A National Measurement System Act (NMSA) is in the process of being drafted

-NMSA will provide for the establishment of national measurement standards laboratory and ensures a coherent system of traceability for all measurements whether for legal enforcement, industrial or scientific purposes.

-NMSA will also provide for the establishment of national measurement council to formulate national measurement policy to meet the current and future needs of Malaysia.

Thank You

Overview of the Electrical Metering Market in APLMF HANOI

- **Presented by**

- **Víctor Manuel Álvarez Chávez**
  Metering Manager

- **ECONOMY SECRETARIAT**

1

ECONOMY SECRETARIAT

APPROVAL OF MODEL OR PROTOTYPE OF MEASURING INSTRUMENTS INITIAL VERIFICATION

PERIODIC VERIFICATION
EXTRAORDINARY VERIFICATION

ENERGY SECRETARIAT
SAVING AND EFFECTIVE USE OF ENERGY, PRODUCTION, COMMERCIALIZATION, TRANSACTION AND PROVISION OF ENERGY

2
UNITS OF THE INTERNATIONAL SYSTEM (SI)

KILOWATT/HOUR, VAR/HOUR, VOLTS SQUARE HOURS, KILOVOLTS AMPERES SQUARE HOUR AND AMPERES HOURS

3
IF THE APPROVAL OF MODEL OR PROTOTYPE

4
THE TESTS APPLY THE CREDITED AND APPROVED LABORATORIES TO THEM, TERMS OF THE EFFECTIVE LAW.

5
TO THE DATE NO, IN THE IMMEDIATE FUTURE IF, AT THE MOMENT THE CORRESPONDING NORM IS REVIEWED TO INCLUDE A VERIFICATION METHOD.

6
THE PRIVATE ORGANISM NORMALIZATION AND ELECTRONIC CERTIFICATION, A. C.

7
THE MEASURERS IN GOOD CONDITION VERIFY THE PROVIDER TO THEM OF THE ELECTRICAL ENERGY

8
THE APPROVAL OF MODEL IS GRANTED BY 2 YEARS AND THE VERIFICATION HAD BEEN GLIDED TO APPLY EVERY 5 YEARS OR WHENEVER COMPLAINT OF ANY CONSUMER EXISTS.

9
IF MECHANISMS EXIST TO TAKE CARE OF THE COMPLAINTS OF THE CONSUMERS (BY MEASUREMENT OR COLLECTION IN EXCESS)

Thanks for your attention!

Víctor Manuel Álvarez Chávez
Metering Manager
Secretaría de Economía

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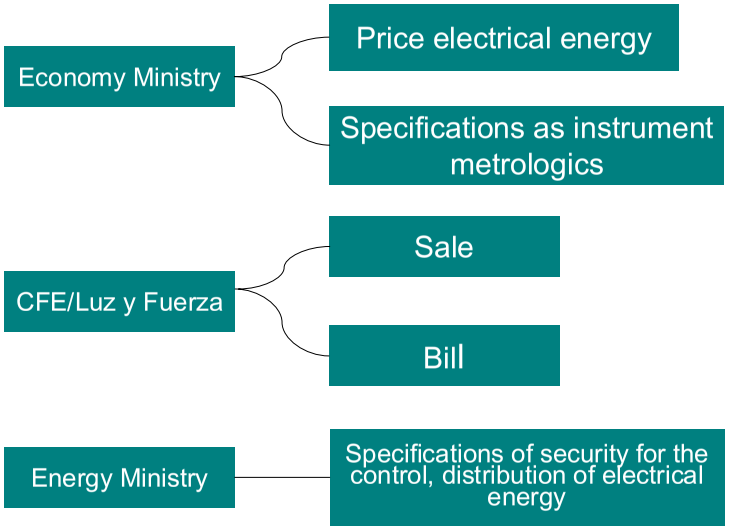
Current Situation in Legal Metrology on Electricity Meters in México

- Presented by

- Victor Manuel Álvarez Chávez
  Director of Metrology

- **ECONOMY SECRETARIAT**



What organization(s) regulate the measurement of electricity in your economy?

ECONOMY SECRETARIAT

APPROVAL OF MODEL OR PROTOTYPE OF MEASURING INSTRUMENTS INITIAL VERIFICATION

PERIODIC VERIFICATION
EXTRAORDINARY VERIFICATION

ENERGY SECRETARIAT
SAVING AND EFFECTIVE USE OF ENERGY, PRODUCTION, COMMERCIALIZATION, TRANSACTION AND PROVISION OF ENERGY

What are the legal units of measure for the sale of electricity?

UNITS OF THE INTERNATIONAL SYSTEM (SI)

KILOWATT/HOUR, VAR/HOUR, VOLTS SQUARE HOURS, KILOVOLTS AMPERES SQUARE HOUR AND AMPERES HOURS

Do electricity meters require approval of type?
IF THE APPROVAL OF MODEL OR PROTOTYPE

What organization performs approval of type Testing?
THE TESTS APPLY THE CREDITED AND PPROVED LABORATORIES TO THEM, TERMS OF THE EFFECTIVE LAW.

Is meter verification testing required?
TO THE DATE NO, IN THE IMMEDIATE FUTURE IF, AT THE MOMENT THE CORRESPONDING NORM IS REVIEWED TO INCLUDE A VERIFICATION METHOD.

What organization performs the meter verification tests?
THE PRIVATE ORGANISM NORMALIZATION AND ELECTRONIC CERTIFICATION, A. C.

Are tests performed on meters in service?
THE MEASURERS IN GOOD CONDITION VERIFY THE PROVIDER TO THEM OF THE ELECTRICAL ENERGY

Are meters given a reverification interval? (8 years? 12 years?)
THE APPROVAL OF MODEL IS GRANTED BY 2 YEARS AND THE VERIFICATION HAD BEEN GLIDED TO APPLY EVERY 5 YEARS OR WHENEVER COMPLAINT OF ANY CONSUMER EXISTS.

Is there as measurement complaint/dispute resolution process?
IF MECHANISMS EXIST WE TRY TO TAKE CARE OF THE COMPLAINTS OF THE CONSUMERS
(BY MEASUREMENT OR COLLECTION IN EXCESS)

Thanks for your attention!

Víctor Manuel Álvarez Chávez
Director of Metrology

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Mongolian Agency for Standardization and Metrology

Mongolian Agency for Standardisation and Metrology (MASM) is the state central metrology organisation.

MASM responsibilities are:

- Administration of metrological policies
- Management the legal metrology system in Mongolia,
- Coordination the national calibration system for measuring instruments.
- Establishment, maintenance and dissemination of national measurement standards
- Regulation on metrology and supervision of their implementation
- Verification of instruments as required by respective law

- According the law, electricity meters subject to the state verification

- Today in the electrical field about 180 thousand electricity meters are used in Mongolia

Most of them is mechanic electricity meters.

From last year by the Energy Authority's project 80 thousands of mechanics electricity meters starting to replaced by the new electronic meters

- the verification interval is 3 -8 years

Electrical measurement laboratory

The electrical measurement laboratory is one of first laboratory of MASM and established in 1963

About 60 thousand electricity meters verifying annually and over 7 state verification officers are executing this work

- In the energy sector using modern testing equipment from the companies such as Shlumberger and MTE.
- They compare with the high accuracy power standard comparator at MASM

There are 26 repair and maintenance laboratories serving throughout Mongolia

Our goal is to be in line with the current development of metrology in the World.


Thank you

TRAINING COURSE ON ELECTRICITY METERS HANOI, VIETNAM

- COUNTRY: PERU
- ORGANIZATION: INDECOPI - NATIONAL METROLOGY SERVICE
- TRAINER: Jorge Soriano Zafra.

LOCATION

PERU IS PART OF LATIN AMERICA.

IT IS LOCATED IN THE CENTRAL AND OCCIDENTAL PART OF SOUTH AMERICA

Peru is the land of the famous old INCAS Empire

INFORMATION

- Country (long form) Republic of Peru
- Capital Lima
- Total Area 1 285 220,00 square kilometers
- Population 27 483 864 (July 2001 est.)
- Languages Spanish (official), Quechua (official), Aymara
- Literacy 88.7 % total, 94.5 % male, 83 % female (1995 est.)
- Religions Roman Catholic 90 %
- Government Type Constitutional Republic
- Currency 1 Nuevo Sol (S/.) = 100 centimos
- Industry mining of metals, petroleum, fishing, textiles, clothing, food processing, cement, auto assembly, steel, shipbuilding, metal fabrication
- Agriculture coffee, cotton, sugarcane, rice, wheat, potatoes, plantains, coca; poultry, beef, dairy products, wool; fish
- Arable Land 3 %
- Peru has the biggest biodiversity of the world
- Natural Resources copper, silver, gold, petroleum, timber, fish, iron ore, coal, phosphate, potash, hydropower

INDECOPI - NATIONAL METROLOGY SERVICE (SNM)

Address:

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San Borja

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(+ + 51-1) 224-7777

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http://www.indecopi.gob.pe

NATIONAL STANDARD WATT HOUR METERS

TRACEABILITY: NIST

Measurement System and Current Situation about Electricity Meters in PERU

What organization(s) regulate the measurement of electricity in your economy?

The Ministry of Energy and Mines through the Electricity General Direction.

Measurement System and Current Situation about Electricity Meters in PERU

What are the legal units of measure for the sale of electricity?

The legal units of measure for the sale of electricity in Peru is the kilowatt-hour, symbol: *kWh* .

Measurement System and Current Situation about Electricity Meters in PERU

Do electricity meters require approval of type?

Yes, we have the peruvian metrological standard NMP 006-1997 "Class 0,5; 1 and 2 alternating-current watt-hour meters" for induction meters.
For static meters we use the spanish standard UNE-EN 61036;1997 "Alternating current static watt-hour meters for active energy (class 1 and 2)"; using only the equivalent tests for induction meters.

Measurement System and Current Situation about Electricity Meters in PERU

What organization performs approval of type testing?

INDECOPI through the National Metrology Service SNM.

Measurement System and Current Situation about Electricity Meters in PERU

Is meter verification testing required?

Yes. The regulating institution is named OSINERG .

Measurement System and Current Situation about Electricity Meters in PERU

What organization performs the meter verification tests?

The Electricity meters contrasting enterprises which have calibrated testing equipments traceables to the National Metrology Service, INDECOPI.

Measurement System and Current Situation about Electricity Meters in PERU

Are tests performed on meters in service?

Yes, through the contrasting enterprises.

Measurement System and Current Situation about Electricity Meters in PERU

Are meters given a reverification interval? (8 years? 12 years?)

Yes, 10 years, as established by OSINERG in its "Procedure for the supervision of contrast and/or verification of Electricity meters".

Measurement System and Current Situation about Electricity Meters in PERU

Is there a measurement complaint/dispute resolution process?

Yes, it is established by the Ministerial Resolution No. 012-2003, which approved the technical standard "Contrast of the measuring system of Electric Energy" and the OSINERG's directive No. 001-2002-OS/CD.

I. Company Background

The Manila Electric Company (Meralco), after a century of operating solely in the area was once again given the rights to distribute electricity in the franchise for the next 25 years. This area covers 81% of Luzon or 59.7 % of the whole country, thus making us the biggest electric utility company out of the 142 electric distributors in the Philippines. Our market accounts for 50% of the country's Gross Domestic Product (GDP, with 30% solely coming from the nation's capital, Metro Manila.

The Philippines is divided into 3 main groups of Islands, namely Visayas, Mindanao and Luzon, the largest of the three. Meralco serves part of Luzon, which is located in the northern part of the country. Our franchise covers 9,337 square km of land area, where 20 million people or about a quarter of the total Philippine population resides. To date, we have over 4.2 Million customers in 23 cities and 88 municipalities.

Table 1. Breakdown of MERALCO's customer base according to customer classification and electric sales

CUSTOMER CLASS	NUMBER OF CUSTOMERS	% of Total	ELECTRIC SALES (Million KWh)	% of Total
Residential	3,823,325	90.83%	8,631.11	35.00%
Commercial	370,716	8.81%	8,877.71	36.00%
Industrial	10,760	0.26%	6,904.88	28.00%
Flat Streelights	4,429	0.11%	246.60	1.00%
Total	4,209,230	100.00%	24,660.30	100.00%

The statistics in Table 1 is the product of the company's continuous expansion to neighbouring provinces & municipalities though it's 101 years of existence. Incidentally, we will be celebrating our 102nd year anniversary on the 14th of March.

II. Electric Distribution in the Philippines

Currently, the electric power industry in the Philippines is transforming to a deregulated environment. This was brought about by the Electric Power Industry Reforms Act of 2001 or EPIRA, which was signed into law last June 8, 2001.

Seeing the importance of Distribution Revenue Metering, the authors of the EPIRA devoted a whole chapter to this topic, Chapter 8 which specifies *the technical requirements pertaining to the measurement of electrical quantities associated with the supply of electricity and the procedures for providing metering data for billing and settlement.*

This section also states that *the Distributor shall be responsible for the design, installation, operation, and maintenance of the metering system and the component parts to ensure the integrity and accuracy of the metering system.*

Metering Requirements

- **Meters**

- Conform to type of circuit where it is installed
- Should measure and display KWH, KW, KVaR, and cumulative demand with optional features of time of use (TOU), maintenance records and pulse output

- **Instrument Transformer**
  - All potential and current transformer should comply with IEC or equivalent national standards for metering and has an accuracy class of 0.3% or better

- **Other Accessories**
  - Metering equipment should be enclosed in a cabinet and secured with seals and lock to prevent unauthorized access. The meter should still be visible for monitoring

III. Transformation of the Power Industry

Energy is generated by two main groups: the National Power Corporation - a government owned and controlled corporation and the Independent Power Producers or IPPs. It is then wheeled through the National Transmission Corporation's or Transco's 230 KV or 115 KV transmission lines in order to reach the various electric distributors & consumers.
Meralco which is a distribution company converts the 230 KV or 115 KV service to a primary line voltage of 34.5 KV line to line or 20 kv Line to ground in its own transmission lines. Eventually, this voltage will again be transformed to secondary distribution lines nominal voltage of 220 V at 60 Hz, the standard service voltage and frequency for / residential & business establishments.
Furthermore, the EPIRA paved the way for the creation of a regulatory body to be called Energy Regulatory Commission or ERC. Section 41 of the EPIRA mandates the ERC to balance the interests of the Consumers and Industry participants such that in compliance to this, a Consumer Affairs Group was created within the ERC. The same group later came up with the *Magna Carta for Residential Consumers*. The Magna Carta is explicit with its requirements on meter accuracy that is why our office, Corporate Meter, closely coordinates with ERC regarding this.

IV. ERC Responsibility

ERC also holds the responsibility of ensuring that all electric meters to be installed in the Philippines are accurate and are within the allowable tolerance. In the Magna Carta, it was further stressed through Article 9 – *Right to an Accurate Electric Watt-hour Meter* that every meter to be installed must have an ERC certification and an ERC seal installed in it. Our meter-testing laboratory in Meralco acknowledges this and therefore maintains close coordination with ERC engineers or representative in the testing, calibration & verification of all meters. **Article 9. Right to an Accurate Electric Watthour Meter; Determination of Average Error.** –

> *"No meter, including instrument transformers, shall be installed or placed in service unless it has been tested, certified and sealed by the ERC. All watt-hour meters regardless of make and type before being placed in service must be adjusted to as close as possible to the condition of zero error." The method provided in the Standard Rules and Regulations Governing the Operation of Electric Power Services (ERB Resolution 95-21, as amended)*

shall be used in the determination of average error. A seal is to be installed in the meter, as this is a warranty that it is an acceptable or accepted type and that it operates within the allowable limits of tolerance.

V. Corporate Meter Testing Procedures

In Meralco, we have the Metering Development & Standard Team, the research arm of our Office, which is responsible for the technical evaluation of meters available in the market and it's applicability to the company's needs. Meralco being a world class company envisions itself as the service provider of choice, that's why it continually keep itself abreast of the latest metering, testing and calibration technologies. In stock, we have two types of meters, the single phase and polyphase, which can either be electromechanical or electronic in make. We have been using electro-mechanical meters since 1903 and it is only in 2001 that we started to shift to electronic meters.

Most of our meters were designed and manufactured using ANSI standards. Since Meralco's secondary distribution voltage level is 240 volts at 60 Hz, we use Form 2S meters for these applications.

• Single phase meter

The first electronic meter that we used was the centron meter manufactured by Schlumberger, followed by the GEM meter, then focus (Landis & GYR) and finally the I-210 also from GE. All these meters belong to the accuracy class of 0.5% for S-Base meter (for self-contained electronic meter), and 0.2 % for A-Base meter (house type or bottom connect electronic meter).

The Company took the direction of shifting to electronic meters because of:

1. Current industry trends
2. Price over functionality for electronic meter since the cost of electronic meters dropped down to a level comparable with electromechanical
3. Easier testing & calibration
4. Capability to perform many measurement needs and additional functions such as: TOU, LP, Remote Metering
5. Excellent accuracy performance
6. Low Starting Current - Enhanced response to light loads
   a) 50 mA for self-contained meters (Class 200)
   B) 5 mA for transformer-rated meters (Class 20)

With the large customer base that our company is serving, there is also a high demand for calibrated & tested meters. For 2004 alone, we have calibrated and tested about 468,000 single-phase meters, 59% of which are new electronic meters, while 41% are reconditioned meters.

• Polyphase Meters

For polyphase meters, we initially used electro-mechanical meters, then later shifted to hybrid meters and finally adopted electronic or solid state meters. Prior to the use of electronic

meters, we needed 3 different types of meter per customer. One for kWh measurement, one for kVAR and another for the Demand chart. When we shifted to electronic, a single meter has replaced all these three separate meters for us

Electronic polyphase meters can also perform other measurements such as:

1. Energy, demand, and time of use
2. interval by internal load survey
3. Reactive metering
4. Remote metering

Also, by adopting poly phase electronic meters, we were able to cut down our inventory level to a minimum, since a form 9S meter replaced FM 15S for Delta System & FM 16S for the Wye System. We have already installed about 13,000 3 phase meters, mostly for our Industrial and commercial customers. All these meters, whether new or reconditioned, are being tested by our trained meter technicians at the meter testing laboratory

• Meter Testing Procedures

For new 1-phase meters, we used to do acceptance-sampling tests based on the Military Std. 414 patterned after the North Carolina Power and Light. However, recently, we have tried looking into new methods such as doing 100% acceptance test on the entire population of new single-phase electronic meters with a tolerance of 0.5% (as stated in their bid) upon delivery. Once a meter exceeds this tolerance, it shall be returned to the supplier for re-calibration. All meters that passed the test will be sealed.

For 3-phase electro-mechanical and solid-state meters, we do 100% testing & calibration, only to verify/check the meter accuracy. The reason for this is based from experience, we saw that no matter how reputable the meter manufacturer is, there will always be a few outlying meters among the group which may have quality problems.

To do all these accepting testing, we use Comparative Testing as methodology.

• MAGNA CARTA - ERB Resolution 95-21

The Magna Carta further specifies that ERB Resolution 95-21 – Section 26, will be used as the basis for computing the Average Meter Accuracy or average error.

> ***ERB Resolution 95-21 states that Average Meter Error = 30% of the Light Load accuracy test + 70% Full Load accuracy test.***

Furthermore, we are only allowed a tolerance of ± 2% for new or recycled meters and ± 3% for installed meters. Despite this, Meralco maintains a stricter tolerance of ± 0.5% only.

• Sealing

After testing, meters are sealed with both ERC & Meralco seals. Seals protect the integrity of the inner part of the meter. The seal is vital in its role of protecting our meters from the tampering by unscrupulous individuals. We have several cover seal combinations which vary every year. This is confidential and is known only to a few meter personnel.

The ERC seal is a warranty that:
(1) The meter is an acceptable or accepted type and
(2) That it operates within the allowable limits of tolerance.

The consumer has a right to demand the production of the meter test report containing the findings of the authorized person who tested the said meter.

• Issuance of Meter to Customers

After the meters were tested, calibrated and sealed, we then forward these meters to our warehousing for issuance to various offices. From there, meters will be issued to our front liners who will install or replace meters according to their requirements. At present, we have 10 Distribution Centers, 30 Branch Offices, 23 Extension Offices, 3 Sales Offices and 12 Revenue Protection Office servicing 4.2 million customers.

Whenever the following occurs:

- A customer has meter related complaints;
- Revenue Protection office finds a meter with broken seal or broken glass;
- A customer is suspected of tampering their meters

The meters will be immediately replaced with a new one and the removed meter will be forwarded to the Verification Team for the verification testing procedure. This procedure determines whether the meter has suffered any abnormalities or defects.

The Customer has the option to witness the verification test procedures. ERC engineers shall be present throughout the whole proceedings. Distribution center and branch offices also conduct on site accuracy test of the installed meter upon request by the Customers.

• Verification Meter Test

The verification team is responsible for testing all types of meters that were removed from service and were therefore recommended for laboratory test. The Verification team's output is 2 fold, the detection of tampered meters and the identification of defective meters.

This task is highly critical in managing Meralco's non-technical system loss. It is also the source of Meralco's billing data especially in the area of Billing Adjustment or Estimate Billing due to meter defect findings. We have a standard procedure in handling meters for verification test. Meters are placed inside a plastic bag and sealed using a meter plastic bag seal. The customer signs on the said seal. Ensuring the customer that whatever condition the meter was in when removed from the customer premises, will be maintained until such time that the customer would witness the actual meter test.

- **Repair and Reconditioning of Meter**

After the meters were verified and the test results were encoded into our system. The meters will be transferred to the Repair Team for reconditioning and recycling. They will dis-assembled and parts will be cleaned. Irreparable meters will be junked or disposed The repairing of meters has reduced the company‘s annual single-phase meter requirement by more than 50%.

After reconditioning these meters, we will forward them for re-calibration after which the meters will be ready again for issue to our front liners.

- **Meter Test System**

Our Maintenance Team maintains our test equipments. They have a maintenance program for all our test tables and standards. We utilize state of the art test bench systems in conducting our calibration and verification meter testing.

These are some of our test benches.

1. 2 units - 6 meter position -WECO 2150 meter test system
2. 1 unit - WECO 1300 true three-phase meter test
3. 1 unit - EMH 40 position Single phase Meter Test System
4. 1 unit - EDI 40 position Single phase Meter Test system
5. 3 units - Schlumberger 20 position Poly phase Meter Test System

- **Traceabilty of Meter Standards**

The highest standard we have is the RD-22, which has an accuracy class of 0.005% and is traceable to NIST in the United States. We are sending it again to the US for re-calibration. We are using a RM-11 (Accuracy class - 0.025 as our transfer standard to check the calibration accuracy of our working standard. RM-10, RD-20, Meter standard for EDI / EMH test benches have an accuracy class of 0.05%.

Listed hereunder are the different Accuracy Class of our Reference and Working Standards:

Meter Test System	Working Standard	Class Accuracy
Reference Standard	RD-22-001	0.01%
40 Position - EDI	S 2001 /3B	0.05%
40 Position - EMH	SRS 121.3	0.05%
TB-7 WECO 2150	RD-20	0.05%
TB-8 WECO 2150	RD-20	0.05%
TB-9	KOM 200.3	0.01%
TBR-4	PRS 200.3	0.02%

VI. ISO/IEC 17025:2000 Certification

Last August 12, 2002, the Meter Testing laboratory of Meralco was accredited by the BPLAS & DTI *for having been assessed and found competent to perform tests and adjustments of electricity meters against the requirements of PNS/ISO/IEC/ 17025:2000*. Our accreditation will expire in August of this year, and we are now busy preparing for our re-accreditation.

VII. The future of Electric KWH Meters in the Philippines

Due to the implications of the implementation of the upcoming deregulation, MERALCO has begun exploring the merits of AMR in 1998, which is becoming a trend among utilities for the improvement of customer service and the company's operational efficiency. Even without any clear indication of data requirements, we have tried several AMR technologies that involve the use of or a combination of PSTN (Public-Switched Telephone Network), GSM, two-way RF Mesh and PLC. These AMR options have been evaluated on the basis of initial investment, operations and maintenance costs, the data requirements of customer, and the service environment.

Our planned implementation of AMR concerns contestable customers (C&I customers with an annual demand of 1MW and above) and residential customers. For contestable customers, the use of PSTN and GSM is considered advantageous due to reliable communication and accessibility on meter data. While PLC and 2-way RF is considered for customers in rural/remote and populated areas respectively. To complete the planned AMR system, the MV-90 Translation System is intended for all data retrieval and processing.

Pending the release of Implementing Rules and Regulations for the Deregulation, we still cannot fully implement AMR. The best that we can do as of the moment is to prepare ourselves by continuously exploring other AMR options and by purchasing solid-state meters with communication options such as RS-232, internal telephone modem, and RF module.

- COMPANY PROFILE
- METER TESTING PRACTICES

Business Overview

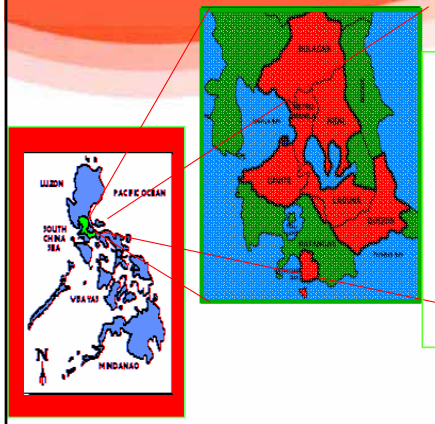
Primary Business — **Electricity Distribution**

- Biggest of 142 electric distributors throughout the Philippines

Industry Leadership

- Market accounts for 81% of Luzon and 59.7% of whole country
- Market produces 50% of the country's gross domestic product; 30% solely from Metro Manila

Franchise Area



Geographical Size: 9,337 sq. Km. (3% of total Philippines)

Customers : 4,209,230 (as of December 2004)

Population : 20.06 M (25% of total Philippines)

Electrification Level: 97.99%*
(As of December 2003)

Customer Sales Profile

(As of December 2004)

CUSTOMER CLASS	NUMBER OF CUSTOMERS	% of Total	ELECTRIC SALES (Million KWh)	% of Total
Residential	3,823,325	90.83%	8,631.11	35.00%
Commercial	370,716	8.81%	8,877.71	36.00%
Industrial	10,760	0.26%	6,904.88	28.00%
Flat Streelights	4,429	0.11%	246.60	1.00%
Total	4,209,230	100.00%	24,660.30	100.00%

R. A. 9136
ELECTRIC POWER INDUSTRY REFORM ACT of 2001
Distribution Code
(EPIRA)

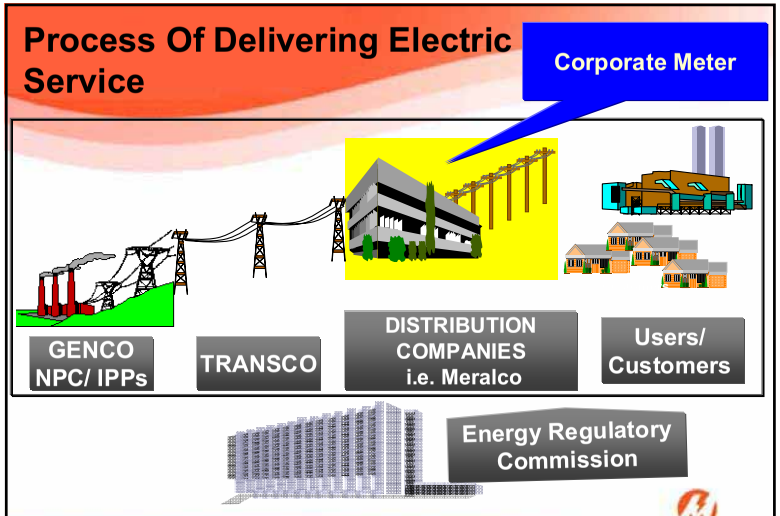
R. A. 9136 – EPIRA - Distribution Code

- Chapter 8 – Distribution Revenue Metering Requirements
  - Distributors responsible for the design, installation, operation and maintenance of Metering System and it's component parts
  - Metering Equipments required at each connection point as revenue meters

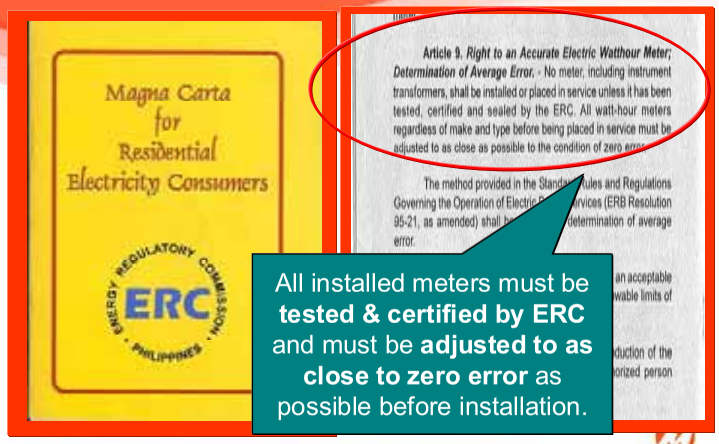
Metering Requirements

- **Meters**
  - Conform to type of circuit where it is installed
  - Should measure and display KWH, KW, KVaR, and cumulative demand with optional features of time of use (TOU), maintenance records and pulse output
- **Instrument Transformer**
  - All potential and current transformer should comply with IEC or equivalent national standards for metering and has an accuracy class of 0.3% or better
- **Other Accessories**
  - Metering equipment should be enclosed in a cabinet and secured with seals and lock to prevent unauthorized access. The meter should still be visible for monitoring

Process Of Delivering Electric Service



Magna Carta – Article 9

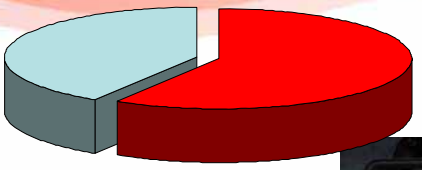


Life Cycle Of A Meter

New Meter

Different Types of Single-phase Meters

Singlephase Meter



467,970 Meters tested in 2004

Different Types of Poly-phase Meters

Electromechanical Meter

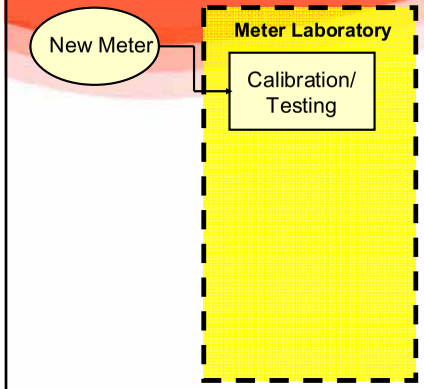
Electronic Hybrid Meter

Electronic Meter

Poly-phase Meter

13,057 Meters tested in 2004

Life Cycle Of A Meter



Calibation Team

Testing & Calibration Team - T&C of New & Recycled Meters

Meter Laboratory Practices

Testing Method:

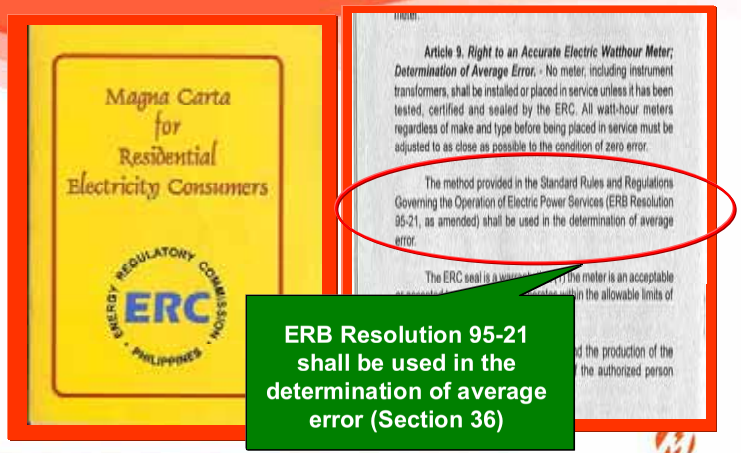
Comparative Test Method

1. Accuracy Test

Test Points	Revolution /Pulses	Voltage	Current	Power Factor
Light Load	2	Rated Voltage	10% of Rated Current	Unity P. F.
Full Load	10	Rated Voltage	Rated Current	Unity P. F.
Power Factor	5	Rated Voltage	Rated Current	0.5 % P.F.

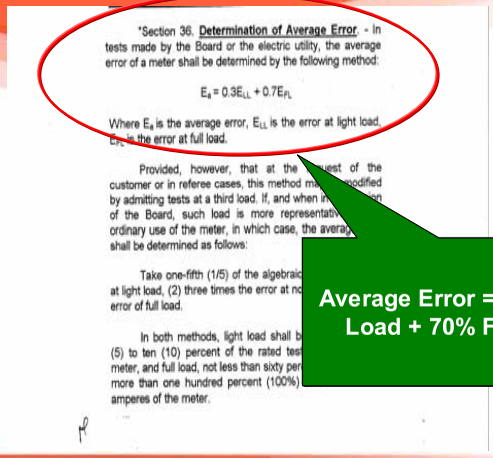
2. Registration/Dial Test

Magna Carta – Article 9



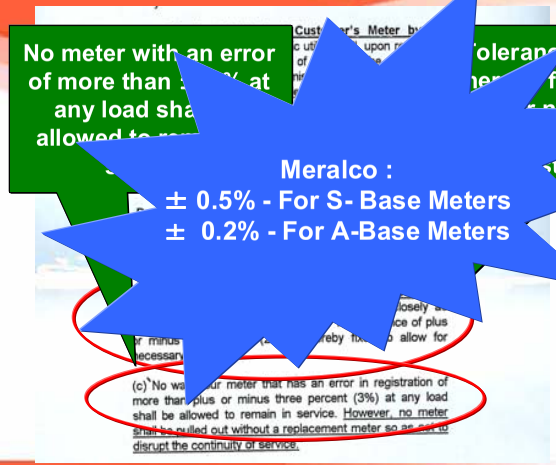
ERB Resolution 95-21 shall be used in the determination of average error (Section 36)

Determination of Average Error

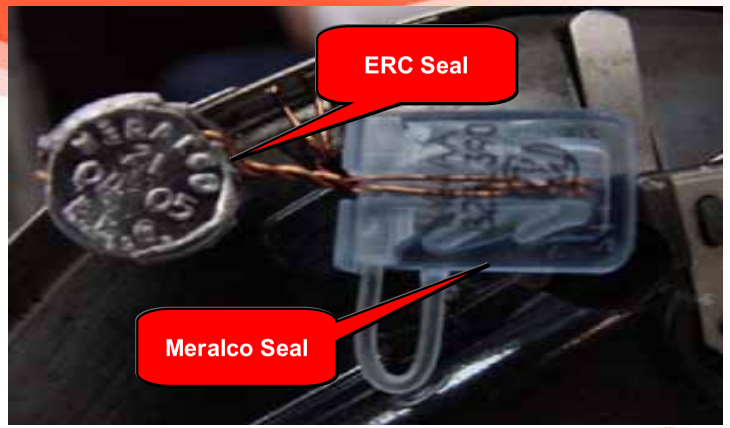


Average Error = 30% Light Load + 70% Full Load

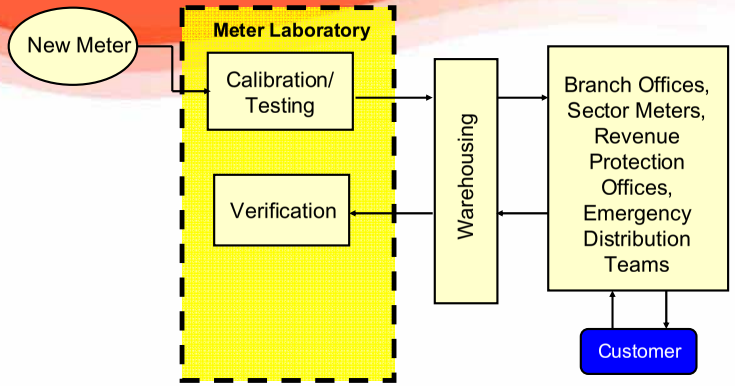
Government Regulatory Requirements



Sealing



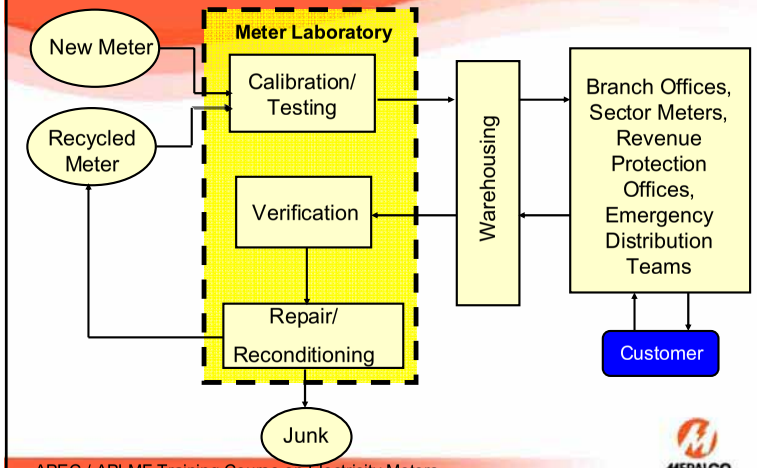
Life Cycle Of A Meter



Verification Team

Verification Team - Suspect Defective / Tampered Meters

Life Cycle Of A Meter



Meters For Repair

Maintenance Team

Meter Test Tables

Kwh Meter Measurement Traceability

Primary Standard

Reference Standard (RD-22)

Accuracy Class 0.005

Transfer Standard (RM-11)

Accuracy Class 0.025

Working Standard (RM-10)

Accuracy Class 0.05

ISO/IEC 17025:2000

Meralco – Corporate Meter was accredited by the Bureau of Product and Standards Laboratory Accreditation Scheme (BPSLAS), Department of Trade & Industry (DTI) for being assessed and found conforming to the requirements of PNS/ISO/IEC 17025:2000 last August 12, 2002 and is valid for 3 years.

dti BPS LAS

Certificate of Accreditation

End of Presentation

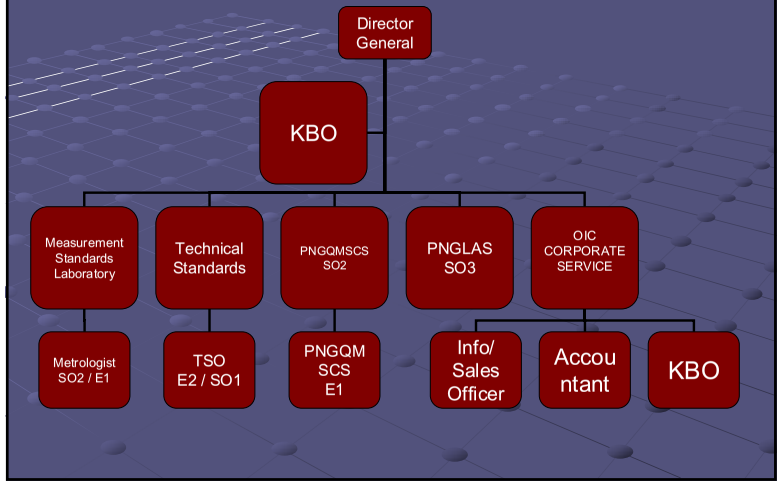
Thank You!

PAPUA NEW GUINEA NATIONAL INSTITUTE OF STANDARDS & INDUSTRIAL TECHNOLOGY (NISIT)

NISIT in Brief

- An Act Passed By Parliament in 1993 known as the NISIT Act 1993
- Measurement Standards Laboratory (MSL) – department in NISIT
  - Calibration and verification activities
  - Custodian of PNG National Physical Measurement Standards

The NISIT Structure



Overview of Measurement System on Electricity Meters in PNG

PNG Power (Regulator and supplier)

Legal Units of Measure
KWh (Kilowatt-hour) is the unit for measuring electricity

Approval Type
Two types of meters used
- ✓Sub-standard meter
- ✓Customer meter

Supplier – EMAIL METERS (Now ENERGEX) Accredited Laboratory by NATA

Verification Testing
Done on Sub-standard meter by ENERGEX – 2 year period
Customer meter done by PNG Power – application lodged by customer

Overview of Measurement System on Electricity Meters in PNG

- Complaint / Dispute Resolution Process

Do have complaints from customers relating to Energy Consumption Rate. Before a meter is checked / verified, the customer has to lodge in an application for the meter to be tested. If meter is faulty, the Energy lost is calculated and is credited to their account and meter is replaced.

END

Electricity Meters

By: Pattaraporn Surasit

Organization

- In Thailand, there is no organization that are responsible for the measurement of electricity directly

Organization

- Metropolitan Electricity Authority
- Provincial Electricity Authority

- Metropolitan Electricity Authority
- Provincial Electricity Authority

Verification :

Import : All meters have to be verified and standard are referring to the reference of country origin. Such as import meters from USA, their meters will be verified by ANSI standard.

Domestic : Reference base on IEC standard and verification by random

In service

- Each organization have to provide data for electricity meters before setting such as :place, date, type, etc,. After 20 years of installation, the meter will be checked and replaced by new meter. (For Metropolitan Electricity Authority 20 year and Provincial Electricity Authority 15 year)

Verification interval

has not Verification interval.

Unit

Legal unit of measure is:

kilowatt per hour.

Type Approval

manufacturer have to send type test include his bid. Verification base on IEC521-1976.

Measurement complaint :

Both organizations find measurement complaint approximately 0.4% year

Measurement complaint :

However measurement complaint that occur will be proceed as follow, the doubted meter will be checked at laboratory meanwhile the officer replace a new meter at user's place

Measurement complaint :

If the meter-checked result is precise the user has to pay for checking fee.

Measurement complaint :

Other fees in case the meter is imprecise officer will do as follows

- The meter reading is more than the standard then the organization have to pay for surplus.
- The meter reading is less than the standard then the user have to pay for surplus.

DIRECTORATE FOR STANDARDS AND QUALITY (STAMEQ)

VIETNAM METROLOGY INSTITUTE (VMI)

YOU ARE WELCOME

2

DIRECTORATE FOR STANDARDS AND QUALITY (STAMEQ)

VIETNAM METROLOGY INSTITUTE

Training Courses in Legal Metrology

Training Course on Electricity

overview of the measurement system about electricity meters in Vietnam

March 9-12,2005 Hanoi -Vietnam.

-64 provinces & city

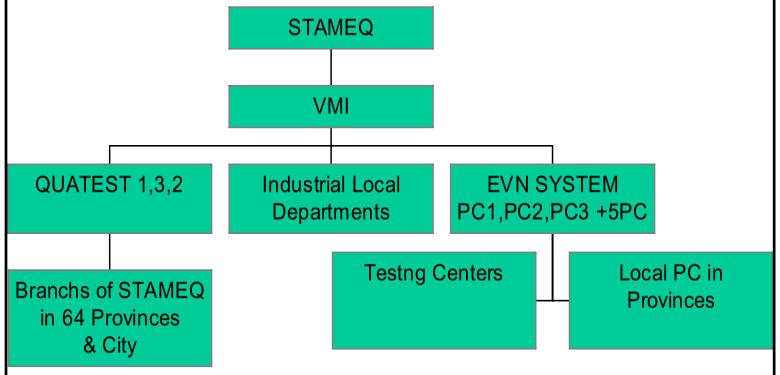
-3 regions:

-North (24 provinces + 2 city)

-Middle (23 provinces +1 city)

-South (12 provinces +3 city)

ADMINISTRASION METROLOGICAL SYSTEM IN VIETNAM



organizations regulate the measurement of electricity

- 64 Authorized Stations
  (Branches of STAMEQ in 64 Provinces & City)
- 61 Authorized Laboratories
  (belong to PC_s of the EVN System)
- 02 Authorized Laboratories
  (belong to local Industrial Departments)

LEGAL UNIT OF MEASURE
FOR THE SALE OF ELECTRICITY

-kWh (Kilowatt-Hour)

-kVArh (Kilovar-Hour)

STATISTIC OF Electricity Meters
FOR THE SALE OF ELECTRICITY (12-2004)

NN	organizations	Inductive 1 pha	Inductive 3 pha	Electronics	Summary
1	EVN	6,524,956	168,342	189,686	6,882,984
2	PC 1 (24 local PC)	1,570,882	62,680	5,867	1,639,429
3	PC 2 (12 Local PC)	1,941,699	17,151	6,552	1,965,402
4	PC 3 (23 Local PC)	914,915	31,832	2,415	949,162
5	HANOI PC	571,007	14,046	4,060	589,113
6	HAIPHONG PC	1,027,385	32,768	168,135	1,228,288
7	HOCHIMINH PC	204,499	6,325	543	211,367
8	DONGNAI PC	253,741	1,796	1,954	257,491
9	NINHBINH PC	40,828	1,744	160	42,732

APPROVAL OF TYPE :2 type
-Type Test :-Domestic (New design model of meters) -Import meters
-Veryfication test (Inspetion ,reverviewtion…)
REGULATIONS :
Follow to IEC 62053-21 (TCVN 6572-1999 & DLVN 07-2003)
IEC 62053-22 (TCVN 6571-1999 & DLVN 39-2004)

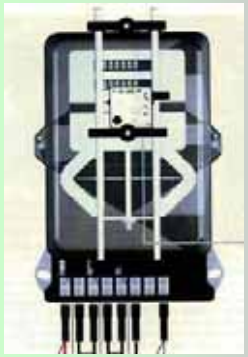
TYPICAL ELECTRICAL METERS OF USED

1-Reference (Electronic)
Classification : 0,005-0,01-0,02-0,1-0,2-0,5
Reverification Interval :1 year

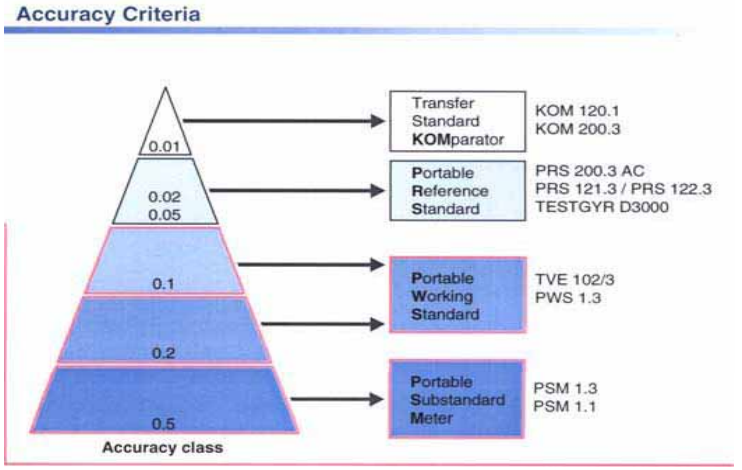
2-Consumers (Inductiv & Electronic type)
-1 pha (2 wire)
-3 pha (3 elements - 4wire , 2 elements - 3wire)
-3 pha multitariff
Classification : 0,5-1,0-2,0 (Follow to IEC)
Reverification Interval : 1 pha - 5 year
3 pha - 2 years

REFERENCS meters

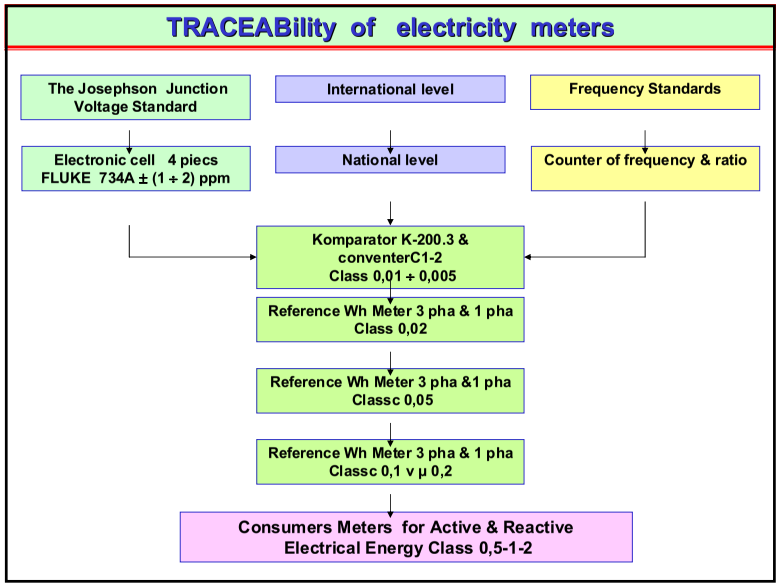
Consumers meters



ACCURACY CLASS OF REFERENCE METERS



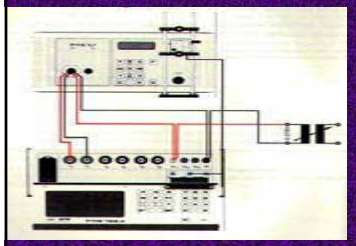
TRACEABility of electricity meters



TESTING BAND FOR ELECTRICAL METERS MADE BY VMI

On-site Supply & Reference Watthoumeter

process of checking



Complaint - Dispute Resolution Process

In Vietnam , meters used for the sale of electricity by constracts for purchasing electricity,all are propriety of EVN .When have complaints from customers relating to Energy account Rate. Custumer have to request by application to the local PC .Meter is checked to review by group of 3 representativies of organizations :Custumer , Local PC& Branch of STAMEQ in local province .

.If meter is faulty, the Energy lost is calculated and is credited to their account and meter is replaced by local PC.

Payment for checking by Whom have done not truth

-For big custumers decided by economical Law-court

VMI

DIRECTORATE FOR STANDARDS AND QUALITY (STAMEQ)

VIETNAM METROLOGY INSTITUTE (VMI)

Thank You

for your attention