



National Metrology Institute of Turkey



Dr. Ahmet MEREV
High Voltage Laboratory



November 19, 2015

TÜBİTAK UME: Mission




"To conduct research and development in the area of metrology towards the goal of ensuring uniformity and reliability in measurements through the development, improvement, maintenance and dissemination of internationally accepted reference measurement standards and techniques for the purpose of contributing to the nation's quality of life and economic competitiveness."


TÜBİTAK UME: Activities

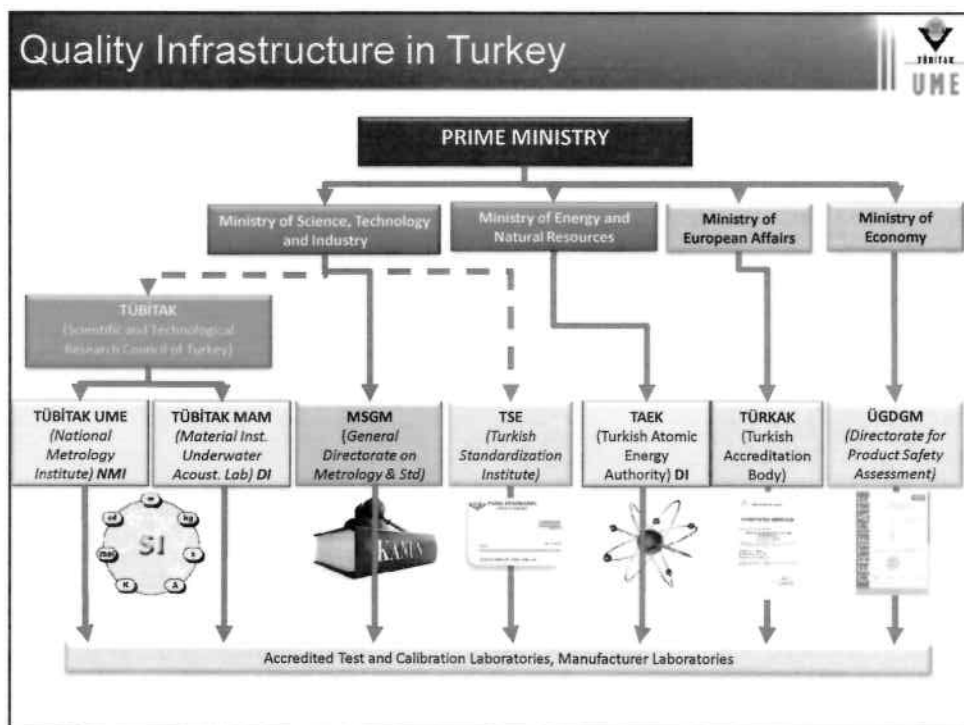
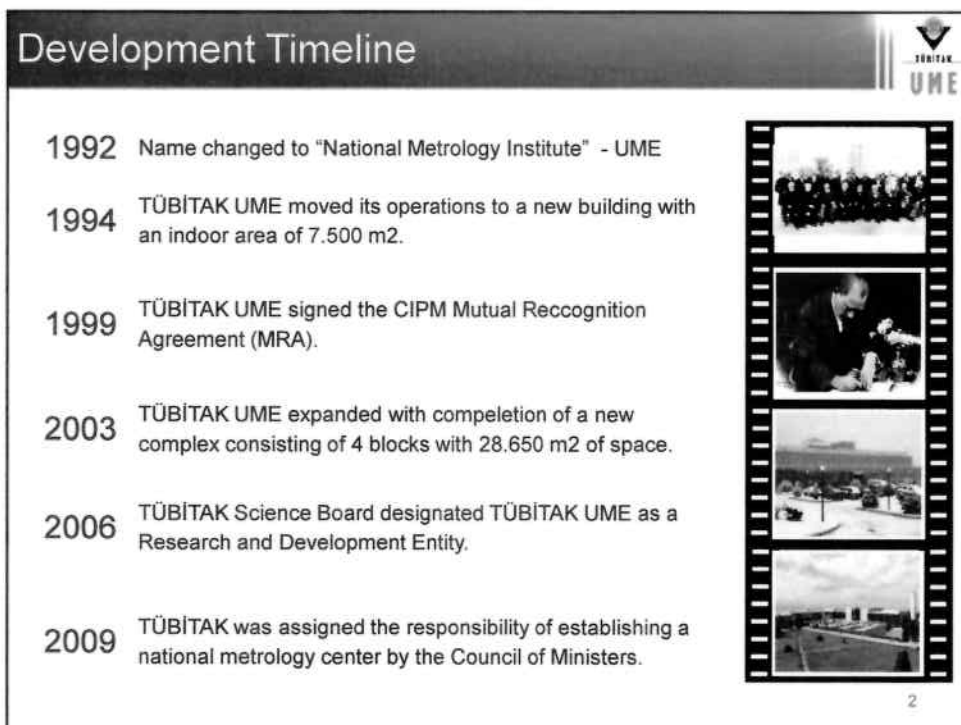
- Establishment and maintenance of national reference measurement standards traceable to SI units,
- Dissemination of measurement traceability nationwide through calibration services, ILCs and PTs offered to accredited laboratories, industry and public agencies,
- Provision of training and consulting services,
- Development and production of metrological instruments and reference materials,
- Performance of research and development towards developing new measurement techniques and standards, providing solutions for industrial measurement needs and enabling new production technologies,
- Representation of Turkey in international metrology and other organizations

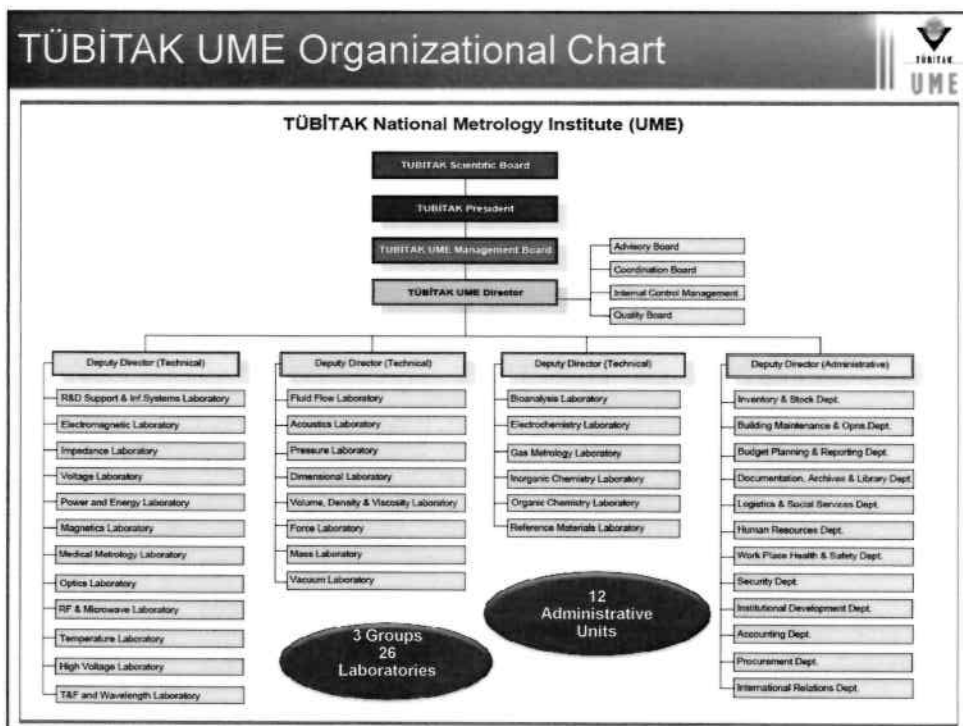
Development Timeline



1875	The Meter Convention was signed on May 20, 1875.	
1931	Law No. 1782 on 'Weights and Measures' was signed and usage of the metric system became mandatory on March 26, 1931.	
1981	TÜBİTAK was assigned the responsibility of establishing a national metrology center by the Council of Ministers.	
1984	The Council of Ministers' decision on the establishment of a primary level "Industrial Metrology and Calibration Laboratory" was published in the Official Gazette.	
1986	The 'National Physics and Technical Measurement Standards Center' began operations in 226 m ² of space consisting of two laboratories.	

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Physical Infrastructure


- 50.000 m² total area
- 26 laboratories over 10.500 m²
- 126 separate laboratory spaces

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Services




Capability to measure **104 different measurement quantities** based on **117 primary level reference standards**

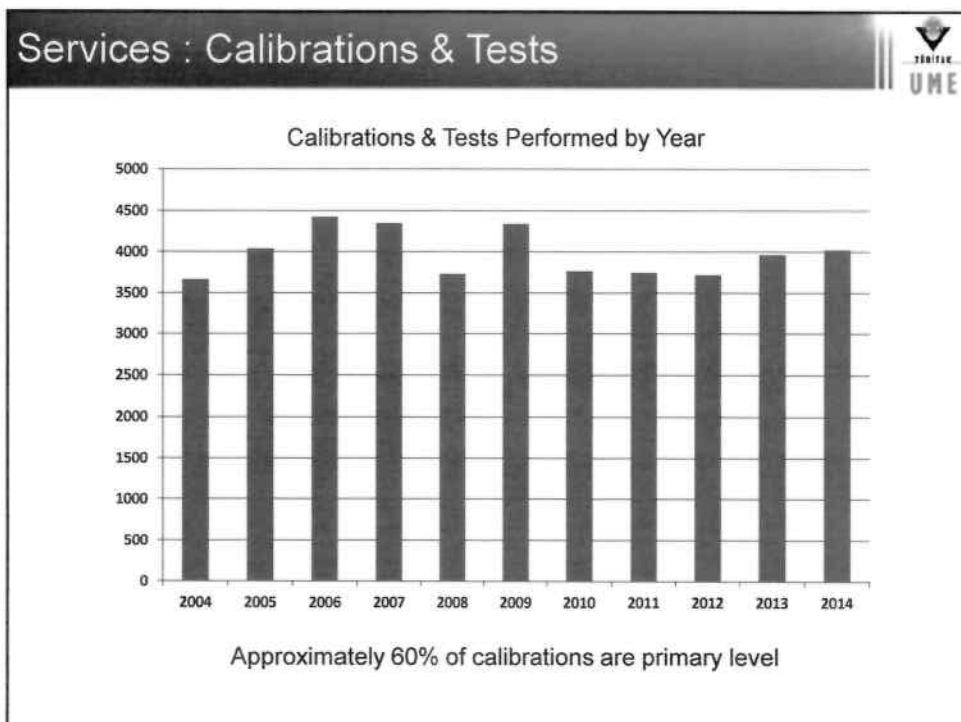


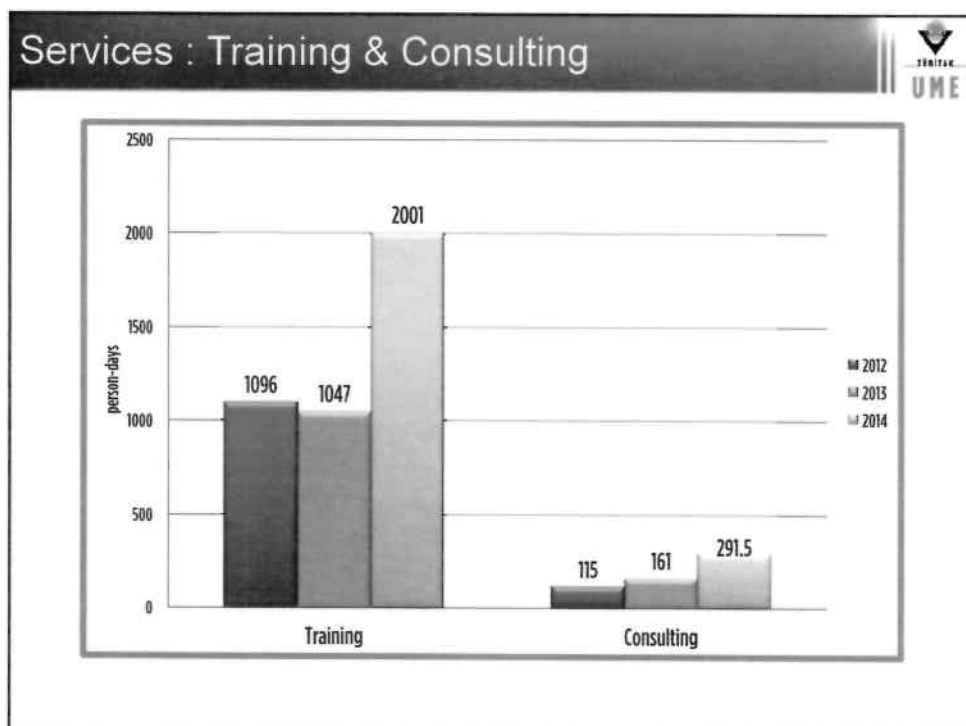
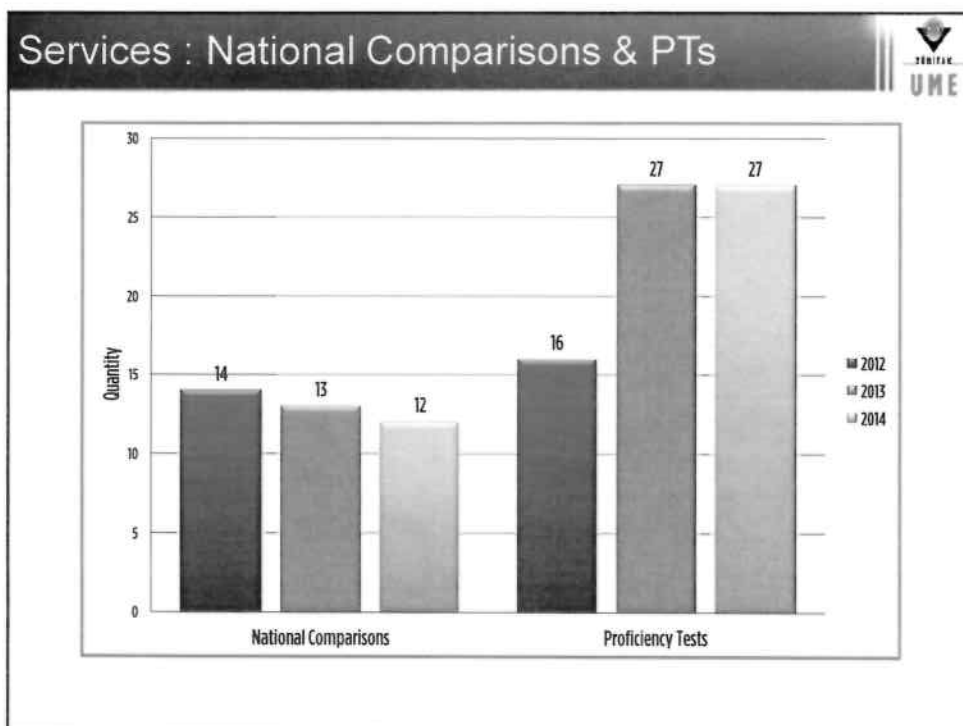
3600 calibrations performed per year on average

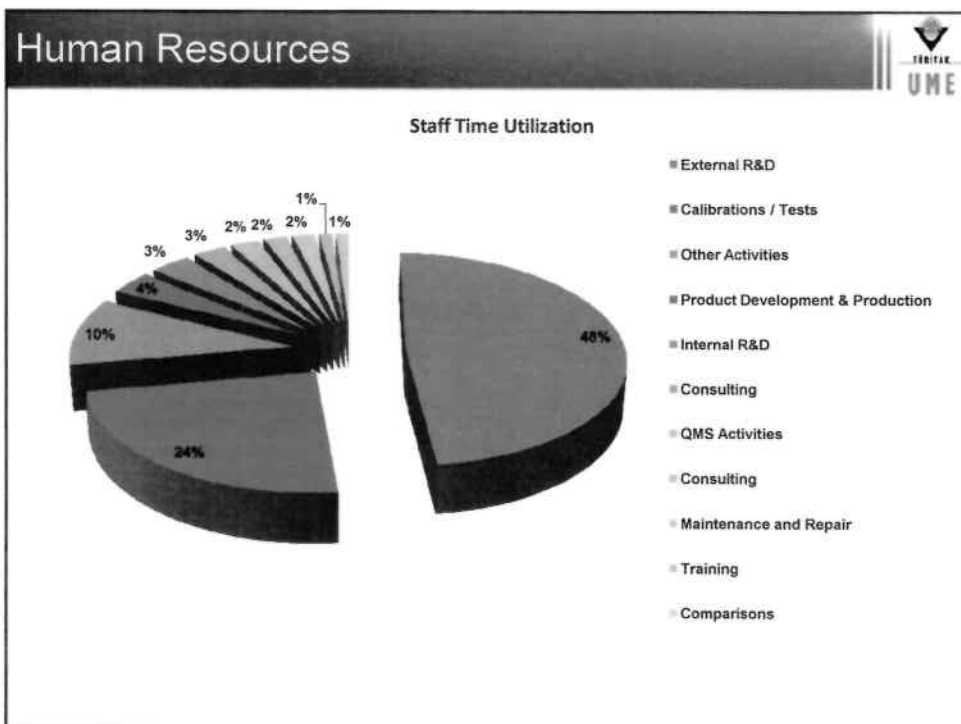
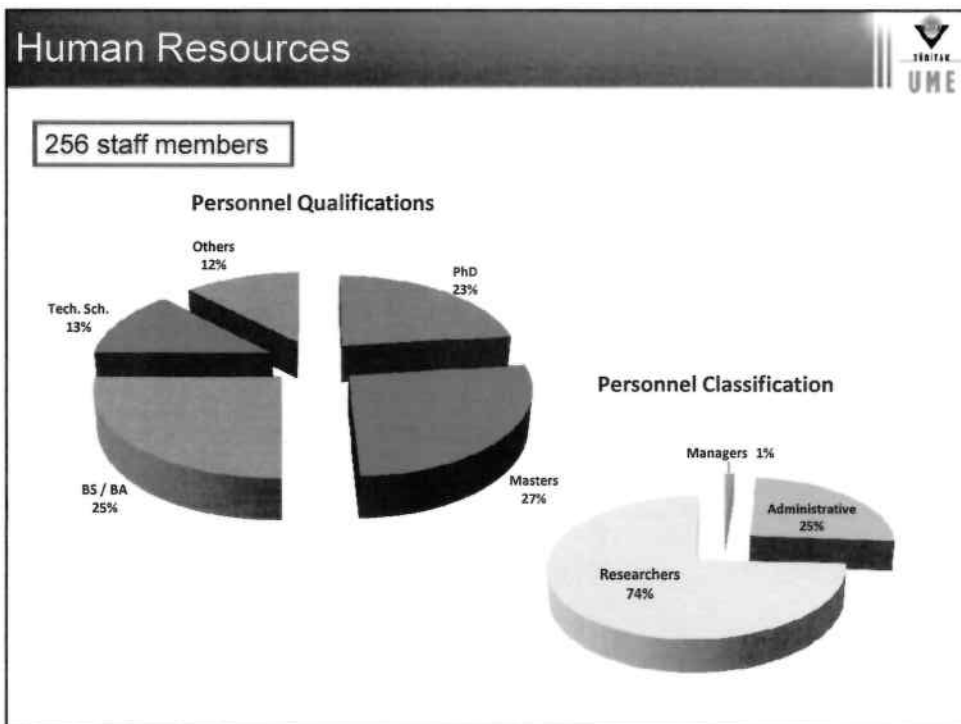
Training offered in **70 different areas** of metrology

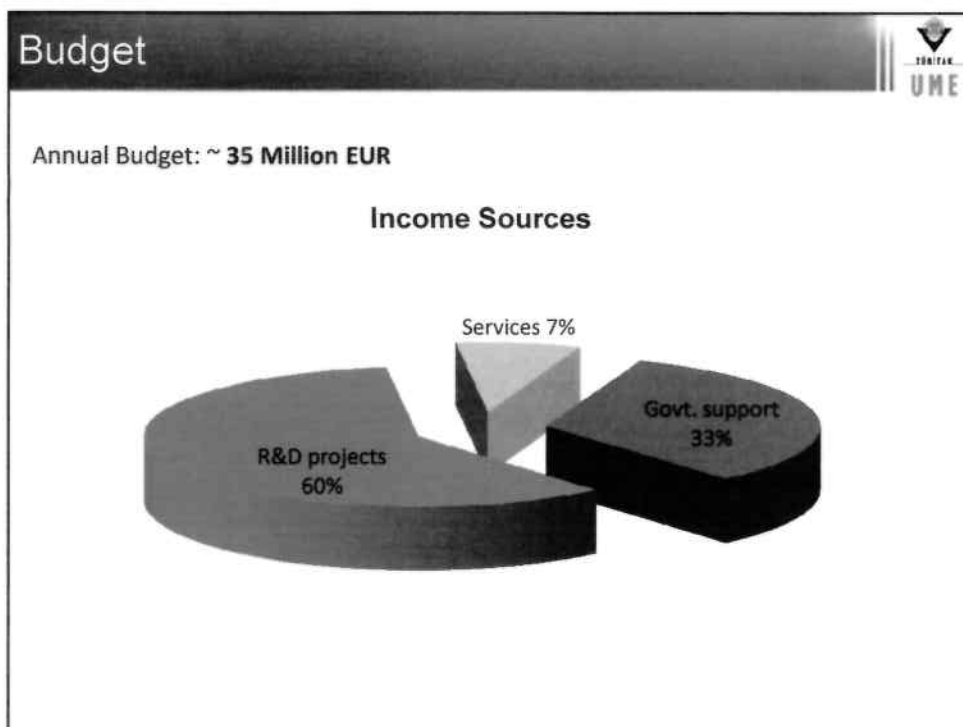


A diverse customer portfolio consisting of over **700 establishments** in Turkey and abroad










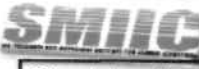




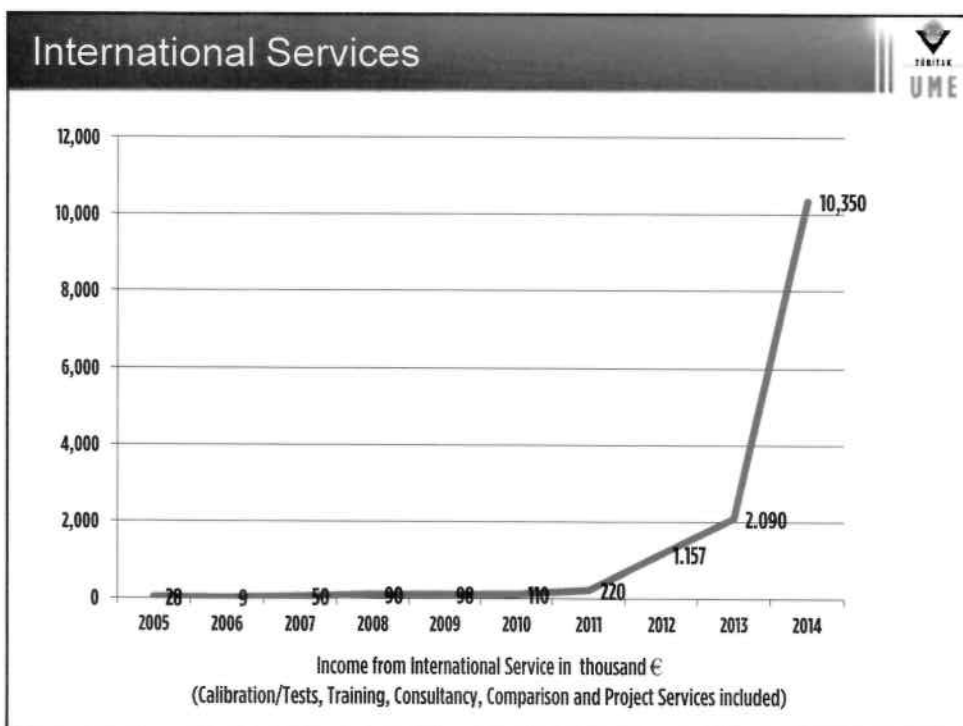
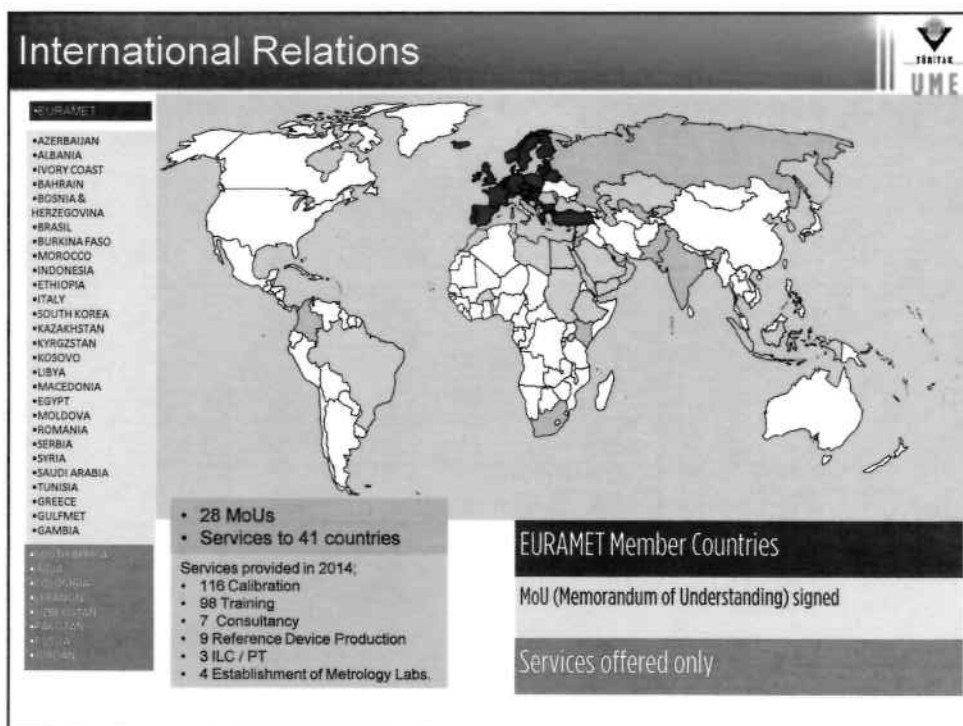




International Relations



	CIPM Mutual Recognition Arrangement signed in 1999
	415 calibration and measurement capabilities recognized in 93 countries: http://www.bipm.org/kcdb
	International Measurement Confederation, 1997
	Member of EURAMET, 2007
	Associate Member of COOMET, 2014
	Associate Member of GULFMET, 2013
	Chair Person of SMIIC Metrology Committee, 2013
	
	
Other International Organizations	



International Technical Assistance



TÜBİTAK UME has undertaken activities in countries such as Saudi Arabia, Azerbaijan, Kosovo, Bosnia – Hercegovina, Macedonia, and Kyrgyzstan to develop the physical infrastructure and human resources of national metrology institutions. Services provided include:

- Assessment of needs for metrology services
- Consulting on technical requirements for new laboratories and drafting of technical specifications of required equipment
- Provision of equipment, installation and operation
- Training of technical personnel
- Consulting on quality management system requirements
- Turnkey establishment of new laboratories

Funding sources vary depending on national government resources, availability of financing options from international and regional development agencies.

High Voltage Laboratory



TÜBİTAK UME High Voltage Lab.

- 1000 kV LI and SI
- 400 kV AC High Voltage (50 Hz)
- 400 kV DC High Voltage
- Capacitance/tan δ Measurement
- PD Measurement

The image shows a large industrial laboratory with high-voltage testing equipment. A prominent feature is a large spherical capacitor in the foreground. The room is filled with various electrical apparatus, including what appears to be a high-voltage transformer or generator, and other specialized measurement equipment. The walls are lined with metal panels, and the floor is concrete. The TÜBİTAK UME logo is visible in the top right corner of the slide.

TÜBİTAK UME High Voltage Lab.

A close-up photograph of high-voltage testing equipment. Two large, dark, spherical capacitors are suspended from a metal frame. In the background, a white sign with the text "YÜKSEK GERİLİM LABORATUVARI" (High Voltage Laboratory) and the TÜBİTAK UME logo is visible. The TÜBİTAK UME logo is also present in the top right corner of the slide.

Bureau International des Poids et Mesures

EURAMET

TÜRKİYE

CIgRE Türkiye

IEC

TSE

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TÜBİTAK UME High Voltage Lab.



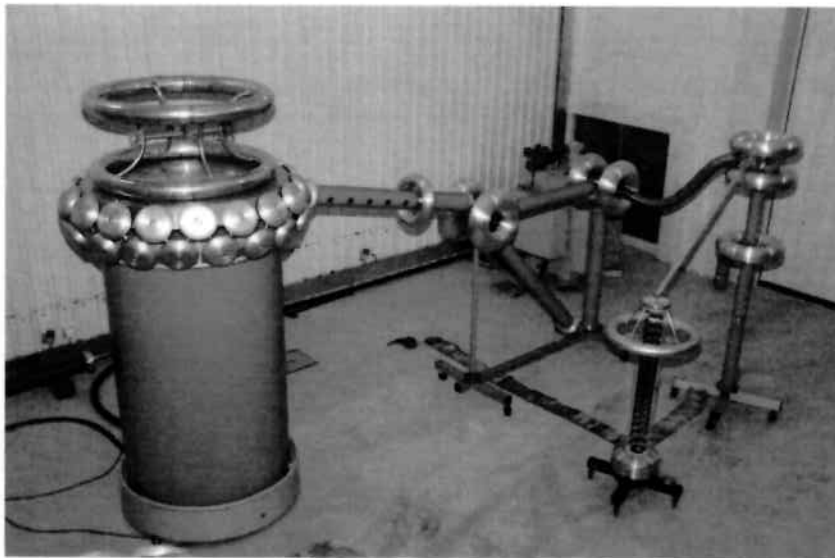
- AC High Voltage Calibration and Testing System: 400 kV



TÜBİTAK UME High Voltage Lab.



- DC High Voltage Calibration and Testing System: 400 kV



TÜBİTAK UME High Voltage Lab.



- High Voltage Lightning Impulse Calibration and Testing System: 1000 kV
- High Voltage Switching Impulse Calibration and Testing System: 800 kV



TÜBİTAK UME High Voltage Lab.



- Partial Discharge (PD) Measuring and Testing System: PD >2 pC / 400 kV



TÜBİTAK UME High Voltage Lab.



- Capacitance Measurement up to 400 kV AC (50 Hz)



Completed Project



- **"TÜBİTAK UME Yüksek Gerilim Laboratuvarı Kurulumu"** TÜBİTAK UME Proje No: 2002UME01, 2004.
- **"Referans ve Transfer Darbe Yüksek Gerilim Bölücülerinin Tasarımı ve Yapımı"** TÜBİTAK 1001, Proje No: 108E179, 2008-2010.
- **"Metrology for High-Voltage Direct Current (HVDC)", EMRP (European Metrology Research Programme) Proje No: ENG07, 2010-2013.**
- **"AC ve DC Yüksek Gerilim Probları ve Tepe Değer Voltmetresi Yapımı"** TÜBİTAK 1001, Proje No: 110E179, 2010-2012.
- **"200 kV LI Ölçüm Sistemi Yapımı"** TÜBİTAK UME, Proje No: G1YG-07, 2010-2011, Endüstriyel Hizmet Projesi.
- **"Darbe Yüksek Gerilim Kaydedicisi Tasarımı ve Yapımı"** TÜBİTAK UME, Proje No: G1YG-08, 2011, Endüstriyel Hizmet Projesi.
- **"Investigating of alternative method based on shunt type bandgap voltage reference for measuring HVDC (high voltage direct current)"** ENG-07: RMG1: HVDC Zener, 2012.
- **"Primer Yıldırım ve Anahtarlama Darbe Ölçüm Sistemlerinin Oluşturulması"** TÜBİTAK UME, Proje No: G1YG-YOG0003
- **"Primer PD Ölçüm Sisteminin Oluşturulması"** TÜBİTAK UME, Proje No: G1YG-YOG0002.

Metrology for HVDC

JRP15: Metrology for HVDC

Objectives

Social-economic drivers

- Support high and ultra-power systems
- Global interoperability
- Harmonized metrology infrastructure
- Improved metrological services to customers

Policy and technical response

- Harmonized metrology infrastructure development
- New support for metrology services
- New metrology infrastructure
- Harmonized metrology infrastructure

Scientific and technical excellence

- Primary standards for HV range up to 100kV with accuracy of 100%
- High voltage metrology systems, ready for metrology for HVDC
- New metrology infrastructure
- New metrology infrastructure

Impact through world-class state facilities

Scientific and technical excellence

- Primary standards for HV range up to 100kV with accuracy of 100%
- High voltage metrology systems, ready for metrology for HVDC
- New metrology infrastructure
- New metrology infrastructure

Participants in the JRP

- BIPM
- NIST
- PTB
- VIM
- METAS
- NPL
- NIM
- NMIJ
- NMIC
- NMISA
- NMV
- NMWB
- NMW
- NMZ
- NMU
- NMV
- NMW
- NMZ
- NMU

Metrology for HVDC

**UNCERTAINTY BUDGET FOR SCALE FACTOR
CALIBRATION AT 1000-KV DC**

	Type	Uncertainty in 10 ⁶
Statistical spread	A	5
Determination of LV arm resistance	B	1.5
Determination of HV arm resistance	B	3.5
Uncertainty of voltage coefficient correction [15]	B	2
Uncertainty for (21 ± 3) °C temperature range [15]	B	2.5
Non-linearity due to corona and leakage current	B	2.5
Self-heating effect	B	1
Uncertainty of DMM reading	B	1
Uncertainty due to DMM input resistance	B	1
Combined standard uncertainty		8
Combined extended uncertainty (k=2)	A and B	16

ILCs and PTs



International Comparisons

- *Traceability of DC High Voltage Reference Measuring Systems up to 200 kV*, EURAMET.EM-S29, 2010
- *Traceability of AC High Voltage Reference Measuring Systems up to 200 kV*, EURAMET.EM-S33, 2012
- *Traceability in high voltage capacitance and lost dissipation factor measurements*, EURAMET.EM-S34, 2012

National Comparisons/Proficiency Testing

- *36 kV Dahili Tip Porselen Mesnet İzolatörünün (50 Hz) ve Yıldırım Darbe Yüksek Gerilim Altında Atlama Geriliminin Belirlenmesi Yeterlilik Deneyi*, UME-EM-10-01, 2010
- *Transformatörlerde Kullanılan Sıkıştırılmış (Pressboard) ve Tabakalı Sıkıştırılmış Kartonların (Laminated Pressboard) Elektriksel Dayanımlarının Belirlenmesi Yeterlilik Deneyi*, UME-EM-11-01, 2011
- *Transformatörün Yükte ve Boşta Kayıplarının Belirlenmesi Yeterlilik Deneyi*, UME-EM-14-01, 2014
- *AC Yüksek Gerilim Karşılaştırması*, UME-G1YG-15-01, 2015

Technical Committee



- EURAMET (European Association of National Metrology Institutes)- High Voltage Experts Group (Turkish Delegation)
- CIGRE (International Council on Large Electric Systems) SC D1-Materials and Emerging Test Techniques (Working Group Member)
- IEC TC42 High Voltage and High Current Test Techniques (Turkish Delegation)
- CIGRE Turkish National Committee Membership (Vice President of Executive Committee)
- TSE MTC144: Mirror Committee of High Voltage and High Current Test Techniques (President)
- TURKAK (Electrical Experts and Assessor)
- EMO The Chamber of Electrical Engineering in Turkey (Member)

Future Plan/Project

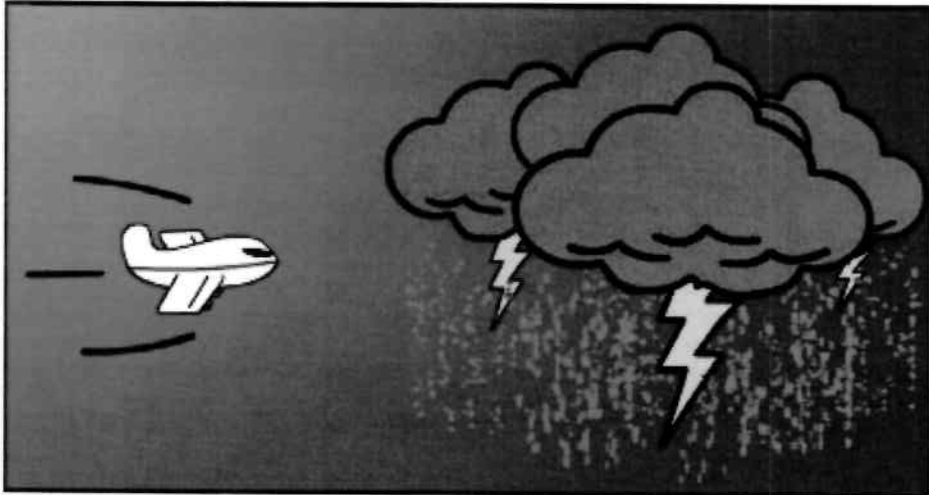
TRAIK
UME

Lightning Direct Effect Test System for Defense Industry

Savunma Sanayi Projesi

TRAIK
UME

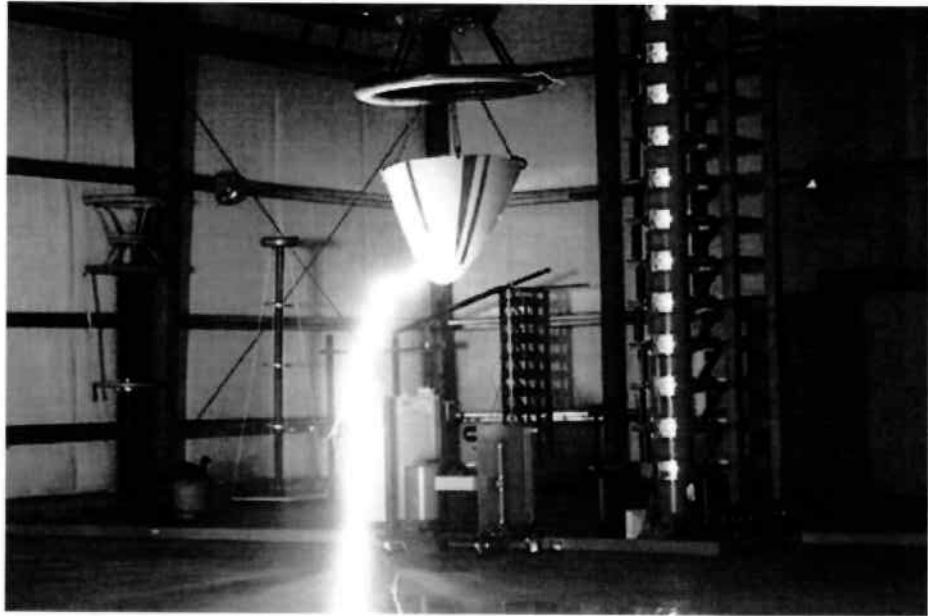
- Lightning Direct Effect



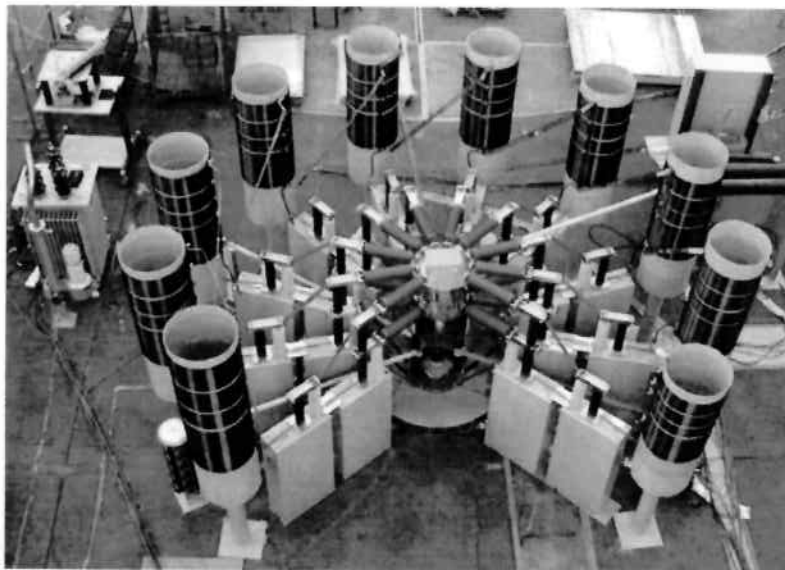
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The illustration shows a white airplane flying from left to right towards a large, dark, stormy cloud. Several lightning bolts are striking the cloud, and rain is falling from it. The background is dark, suggesting a night or stormy sky.

Lightning Direct Effect Testing-Voltage Effect



Lightning Direct Effect Testing-Current Effect



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Visiting Program

- Optical Laboratory
- Acoustic Laboratory
- Power and Energy Laboratory
- EMC Laboratory
- High Voltage Laboratory



Turkish Electricity System and Its Connections

Mehmet KARA

Planning and Strategic Management Dep.

TEİAŞ

- Turkish Power System
- Interconnections
- Turkey-ENTSO-E Connection
- Cross-Border Trade
- South East Europe Coordinated Auction Office (SEE CAO)
- Blackout on 31st March

