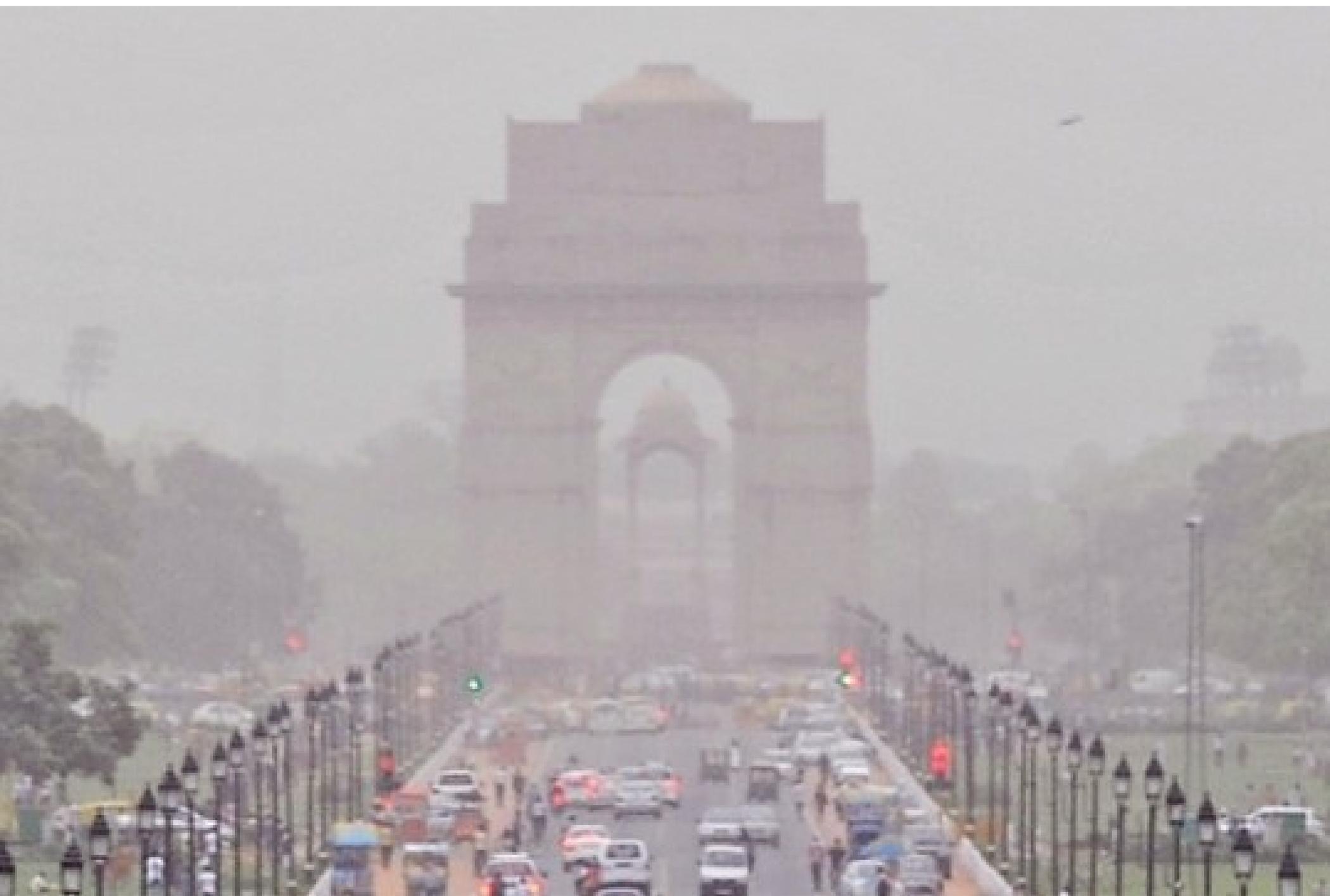


# **National Quality Infrastructure of India**

**D.K. Aswal**

**CSIR-National Physical Laboratory, New Delhi**











सामान  
LUGGAGE

34 NC 98730

SECOND CLASS



**PETROL PUMP  
RACKET  
UNEARTHED  
IN UP**



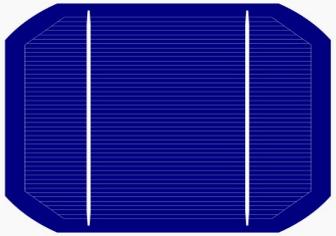


**JAGO GRAHAK  
JAGO**

**BEWARE OF FAKES**

**Why no noble prize in science in India after independence**

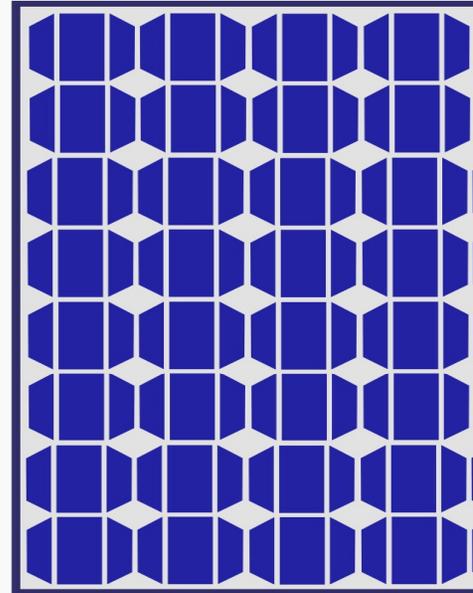
# From a solar cell to a PV System



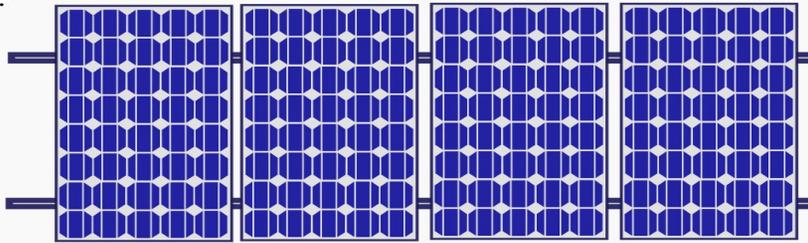
Solar Cell



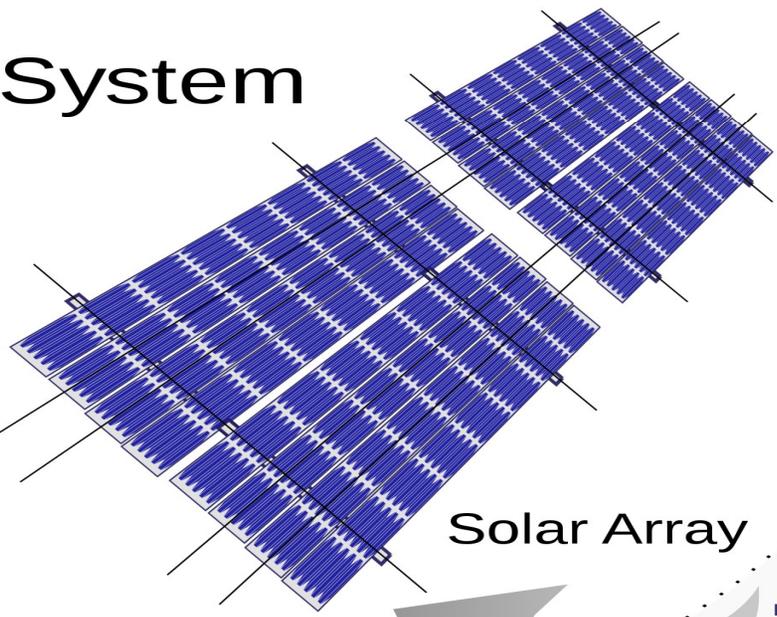
Solar Modul



Solar Panel



Solar Array



PV-System

- Electricity Meter
- AC Isolator
- Fusebox
- verter
- tery
- arge Controller
- eneration Meter
- DC Isolator
- Cabling
- Mounting
- Tracking System

## Electrical Data

measured at Standard Test Conditions (STC): irradiance of 1000W/m<sup>2</sup>, AM 1.5, and cell temperature 25° C

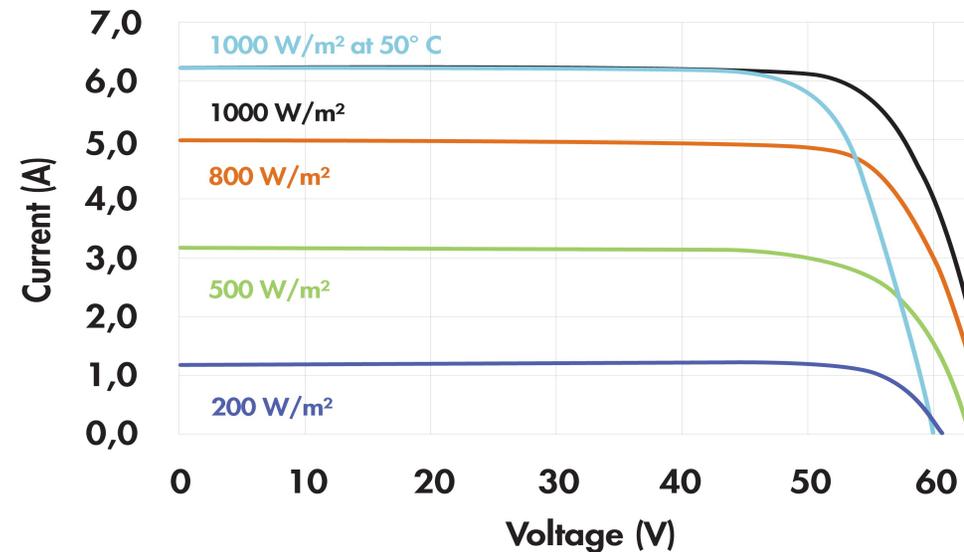
Power (+5/-3%)	P <sub>max</sub>	315 W
Voltage	V <sub>mpp</sub>	54.7 V
Current	I <sub>mpp</sub>	5.76 A
Circuit Voltage	V <sub>OC</sub>	64.6 V
Circuit Current	I <sub>sc</sub>	6.14 A
Maximum System Voltage	UL	600 V

Temperature Coefficients		
	Power	-0.38% / K
	Voltage (V <sub>OC</sub> )	-176.6mV / K
	Current (I <sub>sc</sub> )	3.5mA / K
		45° C +/-2° C
Surge Rating		15 A

## Mechanical Data

Cells	96 SunPower all-back contact monocrystalline
Glass	High transmission tempered glass with anti-reflective (AR) coating
Box	IP-65 rated with 3 bypass diodes Dimensions: 32 x 155 x 128 (mm)
Cables	1000mm length cables / MultiContact (MC4) connectors Anodized aluminum alloy type 6063 (black); stacking pins 41.0 lbs (18.6 kg)

## I-V Curve



Current/voltage characteristics with dependence on irradiance and module temperature

## Tested Operating Conditions

Temperature	-40° F to +185° F (-40° C to + 85° C)
Max load	50 psf 245 kg/m <sup>2</sup> (2400 Pa) front and wind
Impact Resistance	Hail 1 in (25 mm) at 52mph (23 m/s)

## Warranties and Certifications

Warranties	25 year limited power warranty 10 year limited product warranty
Certifications	Tested to UL 1703. Class C Fire Rating

Power output for photovoltaic devices : **Watt Peak (Wp) Value**, under standard conditions (STC), - the reliability of this value and its associated uncertainty are of great importance to manufacturers, operators and investors.

valid

Each measurement has to demonstrate an unbroken traceability chain to international primary standards and calculation of measurement uncertainty for each transfer in the chain.

Without either of the two, the measurement is purely indicative and has no legal value. i.e. it would not be acceptable in any kind of dispute.

power target of 100 GW by 2022!!

High estimate shows that every 1% uncertainty on peak power corresponds to a cost of ~Rs. 5000 crore (assuming 20% efficiency @ Rs. 100/Wp).

# Interactive Challenges

**Growth**

**Environment**



**Quantification of “Influence Factors”**

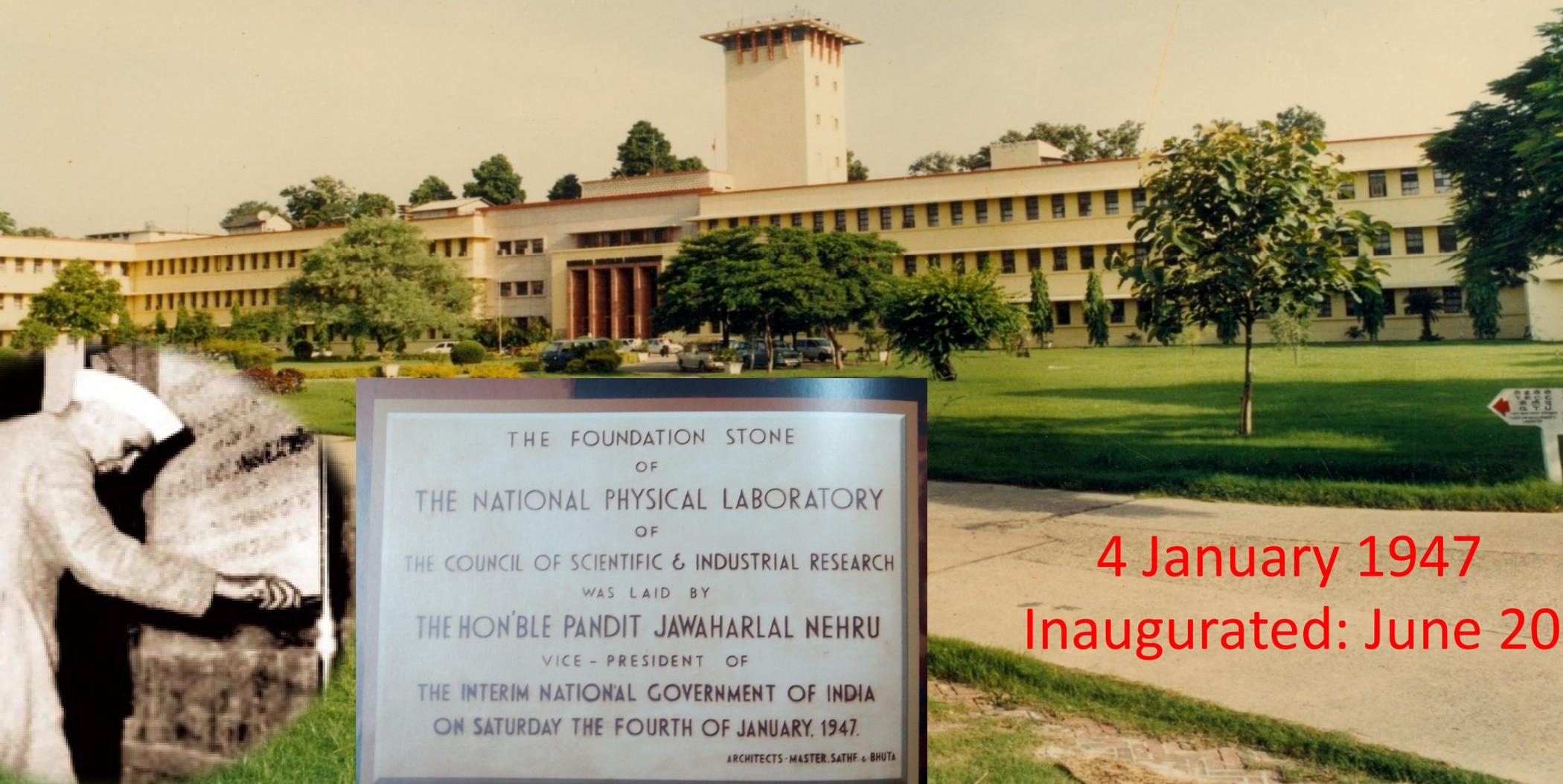
**Credible, internationally accepted measurement and testing**

to control, monitor, regulate or to take socio-political decisions

resolution of cross-border disputes, and national vs international interests

# National Physical Laboratory

**Metrology: Measured Once; Accepted Everywhere**



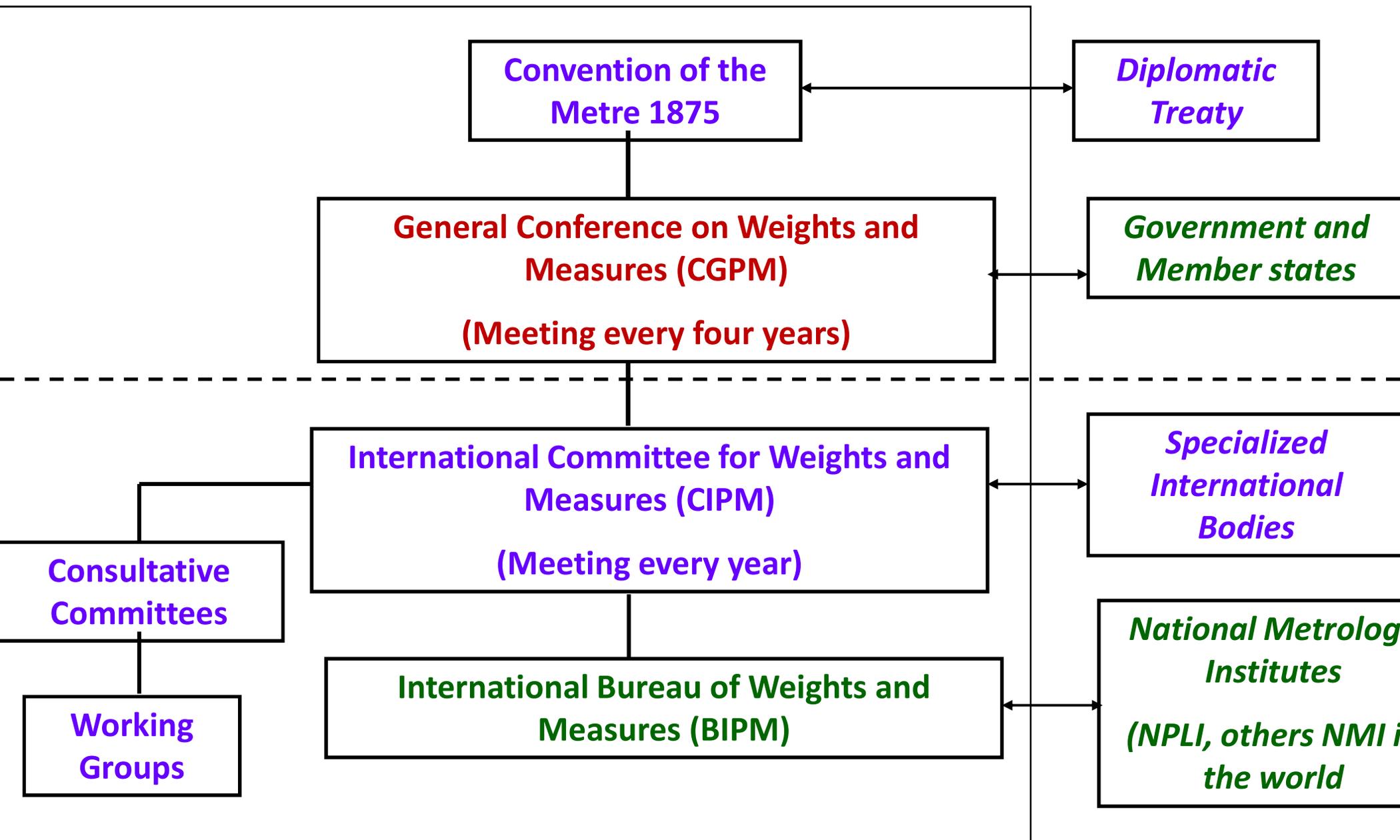
THE FOUNDATION STONE  
OF  
THE NATIONAL PHYSICAL LABORATORY  
OF  
THE COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH  
WAS LAID BY  
THE HON'BLE PANDIT JAWAHARLAL NEHRU  
VICE - PRESIDENT OF  
THE INTERIM NATIONAL GOVERNMENT OF INDIA  
ON SATURDAY THE FOURTH OF JANUARY, 1947.

ARCHITECTS - MASTER, SATHI & BHUTA

4 January 1947

Inaugurated: June 20

# International Convention on SI and derived units and formation of National Metrology Institutes (NMIs)



# DEPARTMENT OF CONSUMER AFFAIRS

(Ministry of Consumer Affairs, Food & Public Distribution,  
Krishi Bhavan, New Delhi, Government of India)

R. 1076(E) - Section 83 of the standards of Weights and Measures Act, 1976 (60 of 1976)

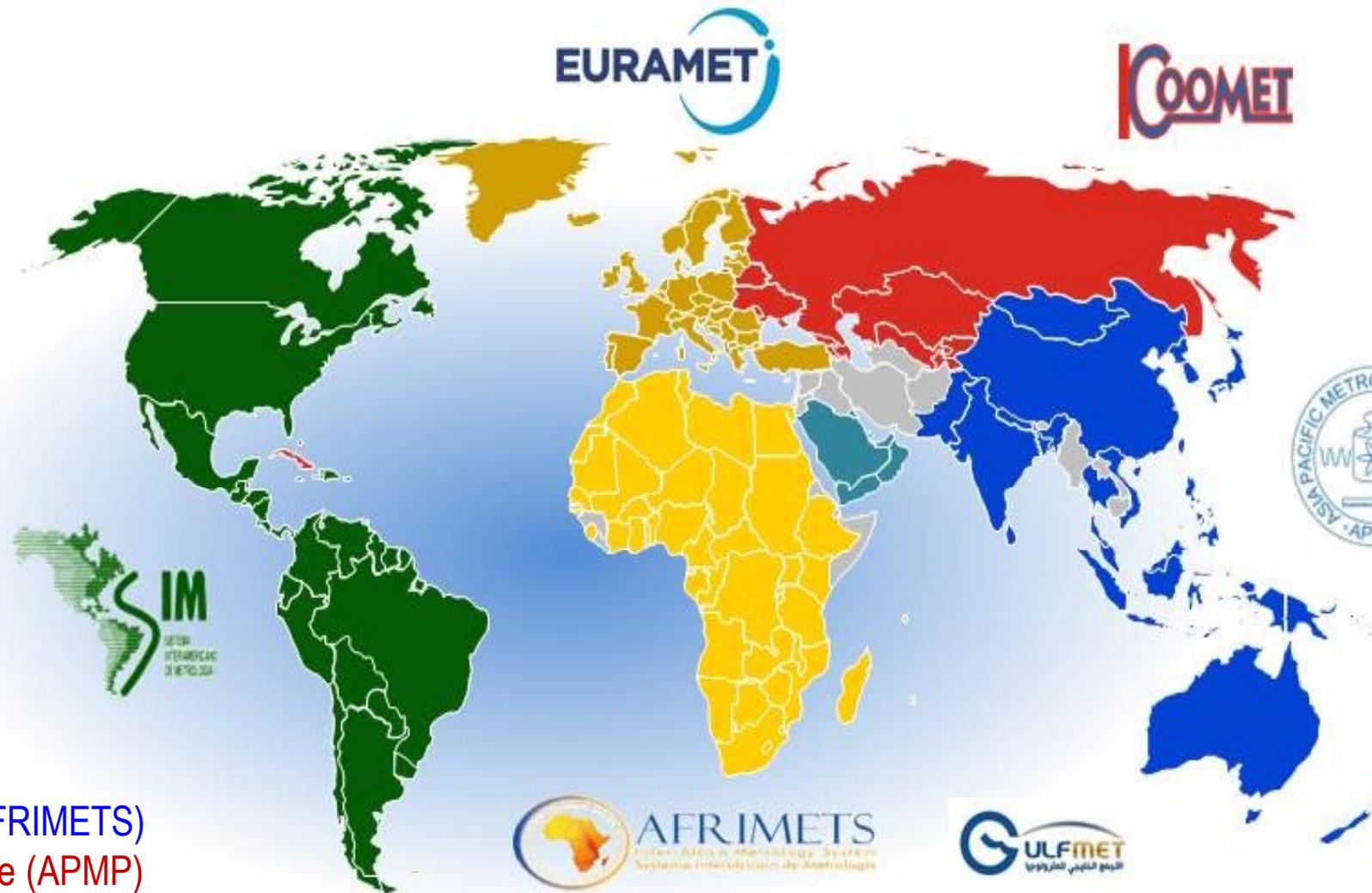
## CHAPTER III

### NATIONAL STANDARDS

Work relating to the realization, establishment, custody, maintenance, determination, production and updating of **national standards** of weights and measures shall, on the commencement of these rules, be the responsibility of the National Physical Laboratory

Central Government may call for such reports from, or issue such directions to, the National Physical Laboratory as it may think fit, in relation to all or any of the matters specified in sub-rule (1).

# International Committee for Weights and Measures (CIPM)



Africa Metrology System (AFRIMETS)

Pacific Metrology Programme (APMP)

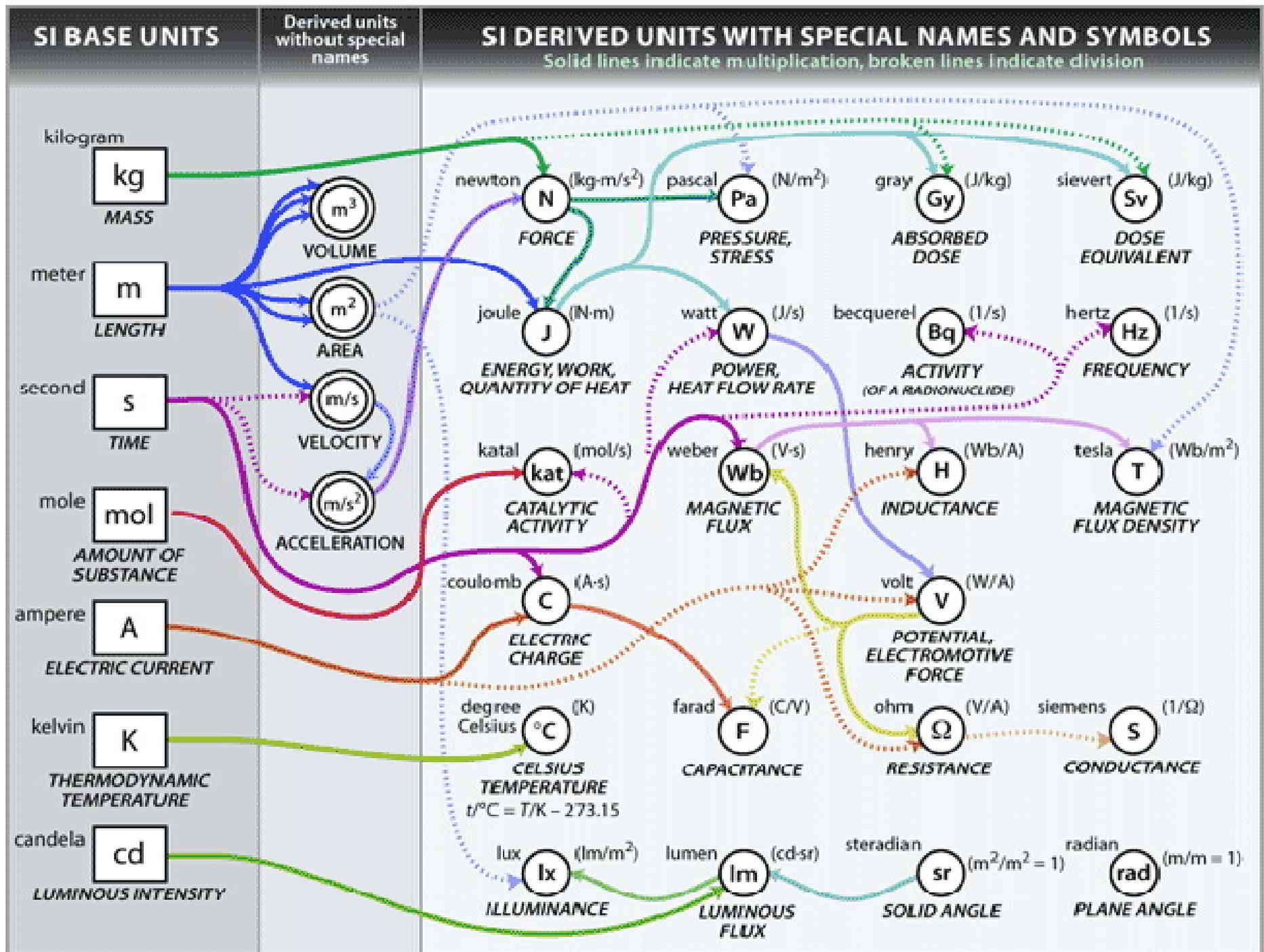
Asian Cooperation of National Metrological Institutions (COOMET)

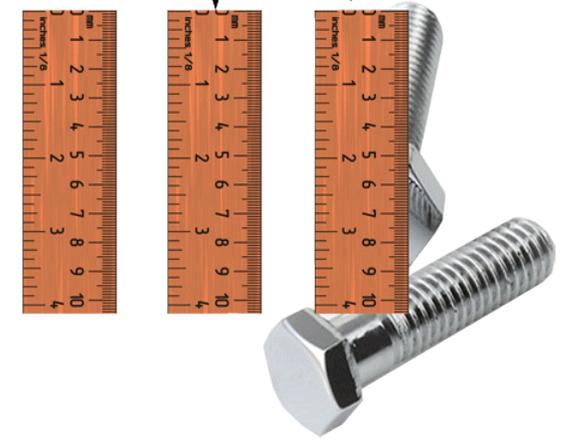
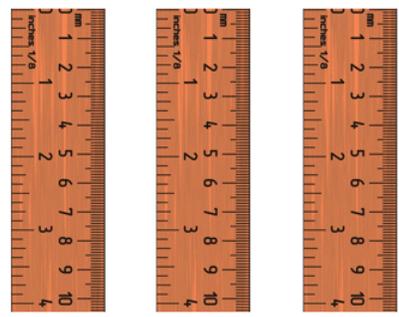
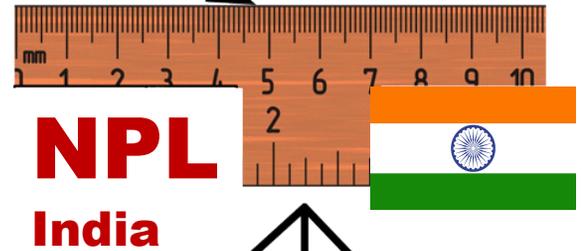
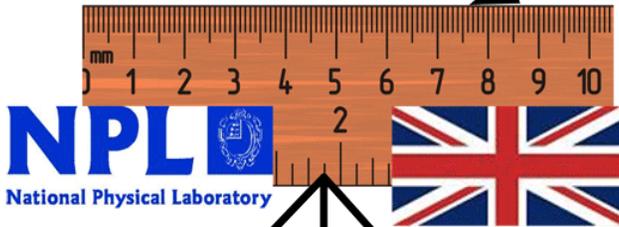
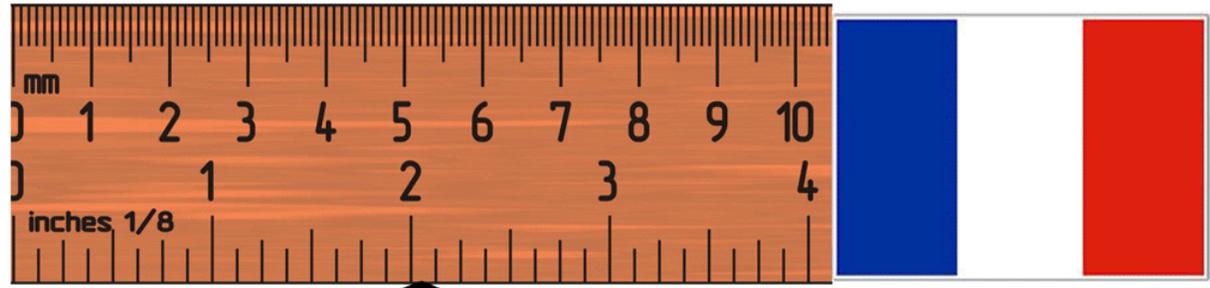
European Association of Metrology Institutes (EURAMET)

Association for Metrology (GULFMET)

Inter-American Metrology System (SIM)









SI Units

CSIR-  
National Physical  
Laboratory

(National Measurement Institute  
of India)

Accredited Laboratories  
and  
Government, Strategic, Public  
and Private Sectors

(STQC, BIS, DRDO, ISRO, RRSL, Pharma etc.)

Manufacturers & End Users  
(Automobile, Petro-chemical, Electrical and Electronics,  
Food and Beverage, Home Appliances etc.)

Unbroken Chain of Measurements for Quality

Primary /  
National Standards

Secondary Standards

Reference Standards

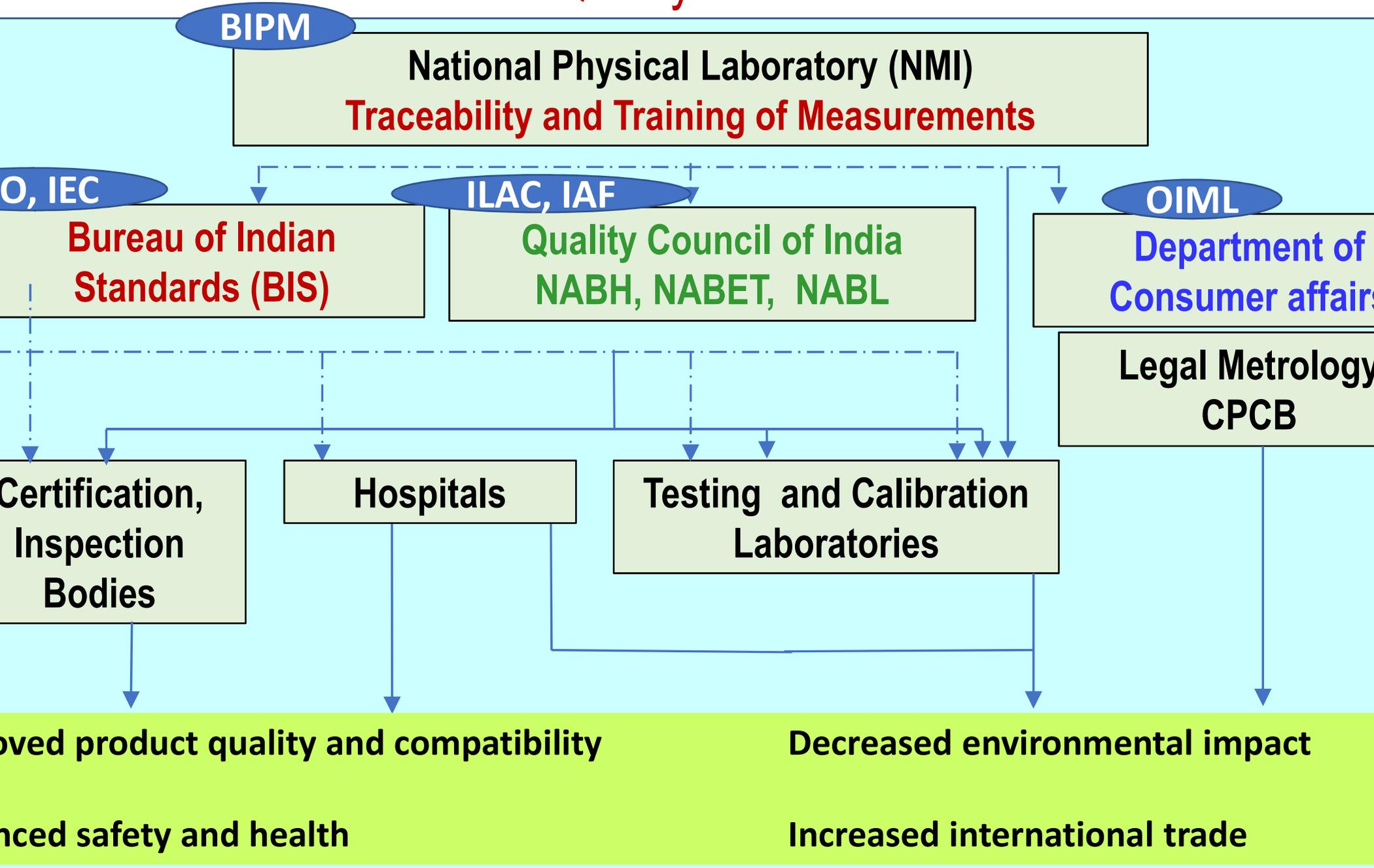
Working Standards

Measuring Instruments

Traceability Pyramid

119

# National Quality Infrastructure



## Some of the glorious achievements of CSIR-NPL

Traceability of SI units to Indian Industries for International Trade



Formula of Indelible Ink for Indian Elections



Licensed to Mysore Paints & Varnish Ltd

Providing accurate Indian Standard Time (IST) to the country



Caesium Atomic Clock at CSIR-NPL

Maitri : India's research station in Antarctica



for Indian Antarctic Programme

Advanced carbon products for Strategic applications



For nuclear reactors

Indian Reference Materials



भारतीय निर्देशक द्रव्य  
BHARATIYA NIRDESHAK DRAYYAS

**NPL as “Growth Engine” of the country: Select list of organizations to whom support, advices and apex calibration services were provided.**

**Government/Semi-government organizations:** Air Force; Air India; Bharat Electronics; BHEL; Bhilai Steel Plant; Bureau of Standards; Central Pollution Control Board; Central Power Research Institute; Central Public Works Department; Central Information System; Central Institute of Mining and Fuel Research; Defense Electronics Applications Laboratory; Directorate of Border Security Force; Hindustan Aeronautic Limited; Indian Oil; ISRO Inertial Systems Unit; Jharkhand State Electricity; Micro, Small and Medium Enterprise Testing Center; NTPC; Nuclear Fuel Complex (DAEC); Ordnance Factory; Rail Coach Factory; etc.

**Private:** ABB India; ACC; AIMIL Ltd.; Alstom India; Ambuja Cement; Binani Cement; Birla Tyres; Blue Star; Bureau of Standards; Crompton Greaves Limited; Diesel Locomotive Works; Essar Oil Ltd.; Godrej & Boyce Mfg. Co. Ltd; Havelock; Larsen & Toubro; International Zinc Association; J.K. White Cement; JK Lakshmi Cement; Kirloskar Brothers; Mitsui Bussan; Sanyo; Suzuki; Mysore Paints & Varnish; Philips India; Piramal Healthcare; Ranbaxy; Rapid Metro Rail Gurgaon; Samsung; etc.

**Nations:** Nepal Bureau of Standards & Metrology (MBSM), Nepal; Bangladesh Standards and Testing Institution (BSTI), Bangladesh; Measurement Units, Standards and Services Department (MUSSD), Sri Lanka; National Physical Laboratory (NPSL), Pakistan; Bhutan Standards Bureau (BSB), Bhutan; Afghanistan National Standards Authority (ANS), Afghanistan; Maldives Standards and Metrology Unit (MSMU), Maldives.

# Indian Standard Time (IST)



**“Punctual and Efficient India” : Synchronize to IST**

**“समयनिष्ठ और कुशल भारत” : IST के साथ तुल्यकालन**

BUREAU INTERNATIONAL DES POIDS ET MESURES  
 ORGANISATION INTERGOUVERNEMENTALE DE LA CONVENTION DU METRE  
 PAVILLON DE BRETEUIL F-92312 SEVRES CEDEX TEL. +33 1 45 07 70 70 tai@bipm.org

Computed values of [UTCr-UTC(k)]

Date 2015	0h UTC	JAN 12	JAN 13	JAN 14	JAN 15	JAN 16	JAN 17
MJD		57034	57035	57036	57037	57038	57039
Laboratory k		[UTCr-UTC(k)]/ns					
AOS (Borowiec)		0.6	-0.3	-0.8	-0.8	-1.2	-1.8
BEV (Wien)		14.0	13.3	11.1	9.8	11.0	10.6
CH (Bern-Wabern)		3.7	4.3	4.5	5.5	6.2	5.4
CNM (Queretaro)		-5.6	-3.0	-4.8	-4.5	-2.2	-3.4
CNMP (Panama)		16.0	23.1	20.5	30.9	33.2	38.8
DMDM (Belgrade)		4.8	6.0	3.4	5.1	4.1	2.9
DTAG (Frankfurt/M)		85.5	87.8	88.8	86.8	83.2	83.0
ESTC (Noordwijk)		0.5	-0.6	-1.2	-1.1	-1.4	-2.4
IFAG (Wettzell)		-1078.3	-1075.7	-1075.7	-1073.8	-1072.6	-1072.5
INTI (Buenos Aires)		13.9	8.9	2.0	-9.5	-18.2	-27.9
IT (Torino)		-6.1	-6.4	-6.9	-5.8	-5.8	-6.2
KRIS (Daejeon)		9.7	10.0	10.2	11.4	12.0	12.3
LT (Vilnius)		805.3	808.8	811.6	805.8	800.2	803.2
MSL (Lower Hutt)		252.5	251.1	243.9	246.9	248.0	253.5
MTC (Makkah)		12.3	11.0	6.5	8.1	4.9	5.5
NAO (Mizusawa)		-49.4	-48.1	-43.3	-39.6	-35.9	-29.3
NICT (Tokyo)		-2.8	-3.6	-4.6	-4.6	-4.7	-5.4
NIM (Beijing)		-1.8	-2.1	-2.5	-1.8	-1.6	-2.0
NIMT (Pathumthani)		-36.7	-38.9	-38.8	-37.7	-35.8	-37.4
NIST (Boulder)		2.9	2.4	2.1	2.4	2.5	2.2
NMIJ (Tsukuba)		-9.3	-9.3	-10.1	-10.7	-10.7	-11.5
NMLS (Sepang)		-223.6	-232.4	-240.2	-243.0	-249.7	-254.3
NPLI (New-Delhi)		-2.6	-2.5	-3.5	-2.0	-2.0	-2.0
NRC (Ottawa)		-58.5	-56.5	-54.8	-56.7	-54.7	-59.1
NRL (Washington DC)		-0.8	-3.6	-3.4	-2.2	-2.4	-2.7

JUNE 14, 2017 22:16 IST

JUNE 14, 2017 22:16 IST



## ...which needs nanosecond-level precision, will now have to pay NPL for time-keeping s

...nal Physical Lal  
...nd the only age  
...ne Primary Tim  
...ellite links, and  
...arliament, ban  
...chy of servers t  
...the process of  
...NPL, told *The H*

### Dr Harshvardhan, Dr Jitendra finalise MoU between ISRO and S&T

5/08/2017 by Dailyexcelsior



Excelsior Correspondent

NEW DELHI, Aug 4: In yet another landmark achievement, the Department of Space Technology / ISRO today has added one more distinction to its series of achievements by concluding a Memorandum of Understanding (MoU) with the union Ministry of Science & Technology.

The MoU was formally finalized with the signing of documents by senior scientists from ISRO and Science & Technology respectively in the presence of the concerned Ministers Dr Harshvardhan and Dr Jitendra Singh.

## Need for global metrological infrastructure

Global trade, globalized industry, world wide travelling of people, health safety and pollution control and possible climate change require reliable and comparable measurements

High economic and societal interest (global harmonization: components produced at another time somewhere else on the globe must fit together)

Removing away Technical Barriers to Trade (Non-reliable and non-comparable measurement and test results means non-acceptance by the consignee i.e. sale of exported products e.g. goods, food, medicines, etc.)

Improving good quality of life: New sources of energy (bio, hydrogen, nuclear); Nanotechnology, bio technology, advanced materials; Information and communications technology

Calibrators, Forensics, Security

# se-mapping at every airport to check noise pollution

y 3, 2017, 09.52 PM IST



NEW DELHI: Taking serious note of noise pollution from aircraft during take off and landing and also during its movements at airports, the National Physical Laboratory of the Council of Scientific and Industrial Research (CSIR) has decided to assist the Delhi International Airport (DIAL) and the Airport Authority of India for 'noise mapping' of all airports across the country and suggest suitable mitigation measures to minimise its impact.

Noise-mapping is a scientific method to understand existing and projected noise levels in a particular area. The mapping, usually done by calculating noise levels in different scenarios, helps in making an action plan for mitigation measures.

Importance of the issue was discussed during a workshop on noise pollution at the National Physical Laboratory (NPL) where the Central Pollution Control Board (CPCB) and the DIAL requested the Laboratory to conduct training programmes for staff and assist them for 'noise mapping'.

Regarding the impact of continuous high-intensity sound on the health of human beings, the CSIR-NPL director, D K Aswal, said that continuous exposure to noise above 85 decibels was harmful to hearing as per guidelines of OSHA (Occupational Safety and Health Administration). "Documented research has found that noise does not have to be that loud to lead to physiological changes in blood pressure, sleep, digestion and other stress-related disorders", said Aswal.



MAY 13, 2017 19:51 IST

MAY 13, 2017 19:51 IST

## **Bharatiya Nirdeshak Dravya weighs 20gm and has the dimensions of a 'Parle-G'**

Now has its own standard bar of gold that is 99.99% pure and can be used to verify the purity of gold sold in shops across the India being one of the largest markets for gold, goldsmiths so far depended on imported reference gold bars to check the purity of their biscuits, coins and jewellery.

The Bharatiya Nirdeshak Dravya (BND 4201), the bar, weighing 20gm and with the dimensions of a 'Parle-G' (the name of a biscuits brand owned by a scientists associated with its development), will mean that Indian jewellers will no longer need to import gold bars to check the purity of ornaments.

In November, the India Government Mint (IGM), a unit of Security Printing and Minting Corp of India Ltd, signed an agreement with the Bhabha Atomic Research Centre (BARC) and CSIR-National Physical Laboratory (NPL) to develop a new gold standard.

NPL is the repository of standard units – such as the kilogram, the second, the centimetre – in India and provides calibration services. So far, 200 gold bars – each 35mm long, 15 mm wide and 1.5mm thick – have been made, Director of NPL, Dinesh Aswal, told *The Hindu*. He added that these could be a major source of a major source of revenue

# Chhattisgarh capital Raipur 7th most polluted in world



13, 2016, 01:19 PM IST



Raipur: Chhattisgarh capital Raipur has earned the dubious distinction of being among seventh top polluted cities in the world—relegating Delhi to the eleventh spot—but the only solace is that the situation of air pollution here is better than Gwalior, Allahabad and Patna as per a World Health Organisation (WHO) report.

This is for the second consecutive time that WHO's urban air quality index base figures puts Raipur on highly polluted cities map. In 2014, WHO concluded that Raipur was the third worst city in India as the city found its way in the list of top 20 polluted cities in the world.

Raipur has overshadowed Delhi—earlier tagged as most polluted city in the world—seventh in the list of top twenty most polluted cities in the world with 144 microgram per cubic metres recorded in Raipur levels while Delhi ranks eleventh on the list. Scarier was Madhya Pradesh's Gwalior city that ranks second in the list of top 20 cities in the world with PM25 levels touching 176 microgram per cubic metre while Allahabad stood third and Patna rests at sixth.

# Air quality index doesn't give you correct picture

5, 2016, 04.43 AM IST



NEW DELHI: Lack of calibration of pollution-measuring instruments has been hampering efforts of the country's pollution watchdog to come up with accurate data on air pollution.

When Delhi experimented with car rationing (odd-even) schemes to tackle the problem of air pollution, people wondered why the different agencies showed different figures for emission level of pollutants in the capital.

It had intrigued even policy-makers. But scientists at the National Physical Laboratory (NPL) of the CSIR knew that the answers to many such questions lay with pollution measuring instruments which were not calibrated to standardised form.

As a result, in fact, no standardisation of such pollution-measuring instruments in India and therefore there was no calibration to the standard norms considering different functional parameters of such equipment.

Consequently, even the national air quality index, being released everyday by the Central Pollution Control Board (CPCB), does not give an absolutely correct picture of the level of pollution in different cities.

The government has now asked the country's central pollution watchdog -CPCB -and the pollution control boards of all states to calibrate their instruments with the standard fixed by it.

The NPL director, Dinesh K Aswal, told TOI that the laboratory has recently developed and patented its own PM2.5 sampling

# Govt asks pollution watchdogs to get their instruments calibrated to maintain accuracy

18, 2016, 09.13 PM IST



NEW DELHI: Admitting that most of the pollution measuring and biomedical equipment are "not calibrated as per standards in the country, which affects quality of the measured data", the Centre has asked pollution watchdogs - CPCB and SPCBs - to get their instruments calibrated periodically and also put specialized agency on job to calibrate biomedical machines to maintain instrumental accuracy.

Since calibration is the process of configuring an instrument to provide a uniform result for a particular sample, it is done keeping in view the geographical location and general climatic condition including temperature and pressure level. Though, biomedical equipment follows Bureau of Indian Standards (BIS) parameters, there has been no uniform

factor due to the absence of mandatory calibrations.

Regarding the problem that exists due to non-calibration of such equipment, the government had on Wednesday told the Parliament that the "National Physical Laboratory (NPL) of the Council of Scientific and Industrial Research (CSIR), being the National Metrology Institute (NMI), has initiated a programme for the calibration of pollution measuring and biomedical equipment."

# Can our plastic bottles and bags be turned into tiles?

Technology showcased at the Swachhta Abhiyaan exhibition can convert used plastic bottles and plastic bags into colourful tiles.

Environment ([HTTP://WWW.HINDUSTANTIMES.COM/ENVIRONMENT/](http://www.hindustantimes.com/environment/))

Updated: Sep 29, 2017 16:01 IST

Malavika Vyawahare



Big cities generate over 15,000 tonnes of plastic waste every day.(Satyabrata Tripathy/HT Photo))

They may look like pieces of art but the tiles developed by SK Dhawan and his group at the National Physical Laboratory are actually a robust example of 'wealth from waste.' The waste in this case is plastic bags, bottles, milk packets and other things that may ultimately find their way to a dump like Ghazipur, where two people were killed on Sept 1 when a part of the mountain of waste collapsed.

[www.hindustantimes.com/environment/can-our-millions-plastic-bottles-and-bags-be-turned-into-tiles/story-b0UtVCIZPHBbV5z278QjBO.html](http://www.hindustantimes.com/environment/can-our-millions-plastic-bottles-and-bags-be-turned-into-tiles/story-b0UtVCIZPHBbV5z278QjBO.html)

# Metrology for Smart Cities



**BND registration at NPL**  
(Thematic Wise)

- Synthesis of material
- homogenization, stabilization,
- Homogeneity testing
- Stability assessment
- Value assignment
- Certification

**NABL**  
accreditation of RM labs

**BIS**  
IS on RM labs

**Metals**

**Lab 1**

**Lab 2**

**Lab 3**

**Lab n..**

ng for National Standards??

