

“The Next Generation of Power & Energy measurements”

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Talk Overview

- Social and Economic Drivers.
- Governmental/Industrial Response.
- Metrology Challenges.
- JRP Objectives.
- The Project Overview.
- User Committee.

Social and
Economic
Drivers



Government
and Industrial
Response



Metrology
Challenges



JRP
Power & Energy

Project Impact Flow

Social and
Economic
Drivers



Government
& Industrial
Response



Metrology
Challenges



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Climate change – reduce green-house
gas emissions.



High quality electricity supply – free
from disturbances and interruptions.



Energy gap – new electricity
generation plant required to replace
nuclear etc.



Security of Supply – Diversification of
energy sources.

CO₂ Challenges

- ½ of CO₂ emissions are due to electricity usage.
- Demand side energy efficiency can make a huge contribution to savings.
- Energy savings of 30% could save 1000 x 1GW generator plants world-wide – 50% of the electrical CO₂ production.
- Energy efficiency requires accurate power measurements to quantify savings and iteratively improve designs.

(source IEC)

The Price of ...



Social and
Economic
Drivers



Government
& Industrial
Response



Metrology
Challenges



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Energy



Development & installation of
renewable generation plant/smart grids



Formulation of normative standards for
products & equipment.



Regulation of power quality through the
EMC directive.



Development & Installation low loss
transmission & distribution equipment .

CO₂ Targets and Renewable Growth

Social and
Economic
Drivers

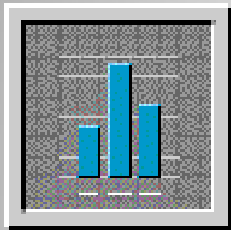
Government
& Industrial
Response

Metrology
Challenges

JRP
Power &
Energy

- Renewable energies target: A binding 20% share of renewable energy sources in overall EU energy consumption by 2020
- Likely to mean 6 fold increase in onshore wind turbines and 50 fold increase in offshore wind
- Growth of micro-generation and Combined Heat & Power (CHP)
- Smart Grids to integrate renewables.
- HVDC Links.

Power Quality: International Standards



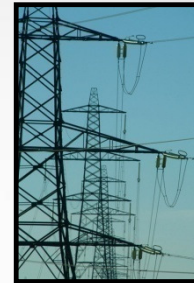
Current
Harmonics

IEC61000-3-2
IEC61000-4-7
IEC61000-3-12
G5/4
ER G59/1
IEC 61000-3-6



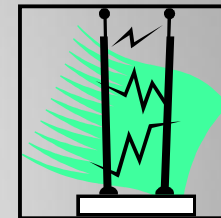
Flicker

IEC61000-3-3
IEC61000-4-15
IEC61000-3-11
IEC60725
IEC 61000-3-7



Power/PQ
Measurement

IEC61000-4-30
IEEE 1459
IEEE 1547
IEC 61400-21



Interharmonics

IEC61000-4-13

Social and
Economic
Drivers



Government
& Industrial
Response



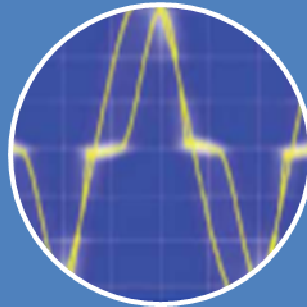
Metrology
Challenges



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Efficiency
measurements
of renewable
generation
plant.



Complex power
quality
measurements
involving
multiple
parameters.



Traceability to
underpin new
normative
standards &
directives.



On-site
verification of
the efficiency
of low loss
equipment.



CO₂ Reduction → Power Metrology

- High efficiency products require electrical power measurements to **assess efficiency**.
- Often these measurements are difficult to make due to **complex waveforms**.
- Renewable plant waveforms can be complex and require measurements in **hostile environments** (High voltage – noisy).

→ On-Site Measurements

The Cost of Incorrect PQ Testing

To the Electricity Industry

Generated Power in the UK is about 200TWh per year (€ 15Bn).

Power Generation and Distribution Plant is Valued at € 50Bn.

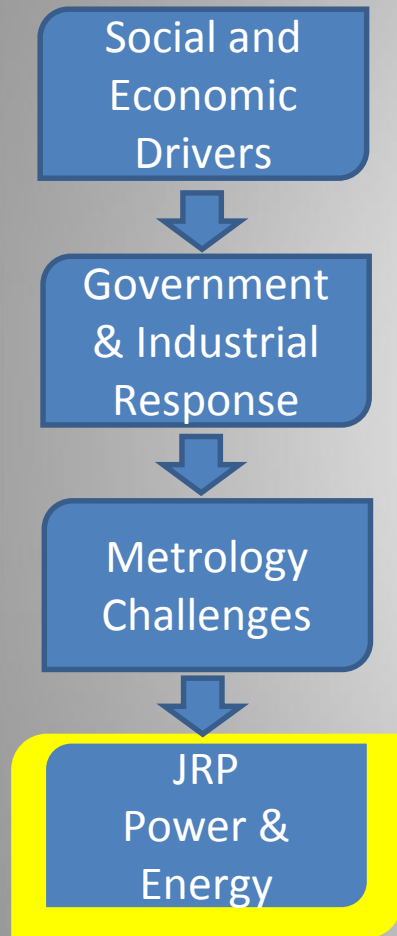
To Manufacturing Industry

UK market for Computers € 18Bn

UK Market for TVs € 15Bn

White Goods € 1bn

JRP Objectives



- Accurately measure highly distorted, non-stationary waveforms.
- Develop mathematical transforms to accurately analyse these waveforms.
- Measurements on fixed installations under hostile conditions.
- Determine the propagation of uncertainties through complex mathematics.

JRP Challenges

- Pan-European challenges.
- Requires a new measurement infrastructure.
- Harmonized approach to calibrations and testing.
- A coordinated European Approach providing Critical Mass.

On-Site Metrology Challenge

- Synchronisation issues.
- Noise.
- Variable frequency – Grid limits are $\pm 1\%$.
- Fluctuating harmonics.
- Transducers and Digitisers – Portable for field measurements + High accuracy.
- Complexity – not just accuracy.



The Power and Energy JRP

- April 2008 to March 2011.
- 16 NMI partners.
- Approx 30% EU FP7 Funding.
- 7 Work Packages.

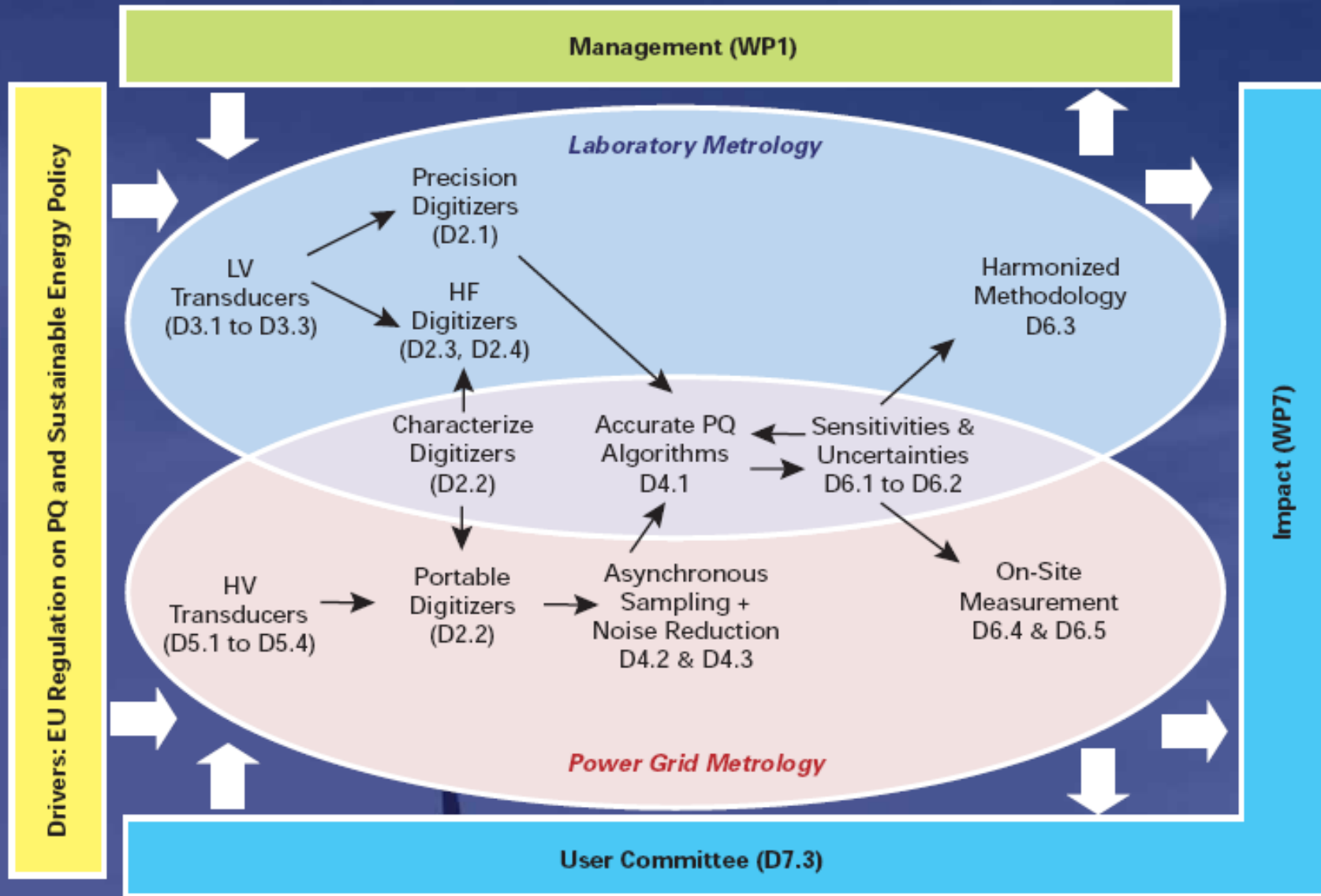
Nations of NMI's Participating in the JRP



7 Work Packages

WP	Title	MM	Deliverables
WP1	JRP Management and Coordination	8	8
WP2	Metrology Grade Digitising Technology for Power Quality Measurements	55	6
WP3	Precision Transducers For Laboratory Measurements of Power and Power Quality.	53	3
WP4	The Development of Accurate Sampling Techniques and Analysis Algorithms in Support of Power Quality	55	3
WP5	The Development and Characterization of High Current and High Voltage Transducers	58	4
WP6	A Harmonised Methodology and Implementation of the Traceable Measurement of Power Quality Parameters	47	5
WP7	IMPACT: exploitation, dissemination and knowledge transfer	4	6

Workpackages and deliverables



Impact - Exploitation, KT and Dissemination activities

**Final
Workshop**

**15
Conference
Papers**

**5
Industry
Journals**



**Perform
on-site
measurement**

**10
Peer Reviewed
Papers**

**Agreed
Power Quality
Protocol**

Impact in Images



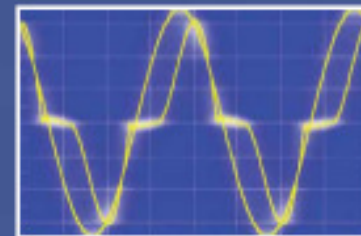
*Energy Saving
Evaluation*



*Renewable Energy
Performance*



*Transmission &
Distribution Efficiency*



*Power Quality
Compliance*



Reduced Blackouts



*Accurate Electricity
Metering*



Reduced Failures

Summary

- Challenges for energy Industry – low emissions, high efficiency, Power Quality.
- Research is driven by needs of industry and regulation.
- Complexity – not just accuracy.