



PERFORMER

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Project Acronym: PERFORMER

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Standard Instrumentation Plan Specification for PERFORMER Baseline Assessment

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STANDARD INSTRUMENTATION PLAN SPECIFICATION FOR PERFORMER BASELINE ASSESSMENT

Before implementing of PERFORMER solution, during the planning of an energy efficiency project or programme there will be defined goals of the project in terms of energy reduction targets such as a percentage drop of consumption by utility, decrease in energy density, a predetermined annual kWh reduction etc.

While energy simulation models will offer a forecast for energy consumption in a building, the premise of the PERFORMER project is that such models may be inaccurate for various reasons, including fundamental variations in the intrinsic building performance following the construction/ refurbishment process or different usage patterns to those predicted. As such, it is advisable that site specific baselines are established as soon as possible prior to the implementation of the PERFORMER solution, to provide a more accurate indication of real energy usage.

This document aims to discuss and propose specifications for establishing a standard baseline assessment for PERFORMER pilot buildings. The different levels of measurement required are summarised below:

- Fiscal quality metering of all electricity & fuel imports into the subject building and delivery records for bulk delivered fuels where applicable (e.g. oil, biomass, LPG)
- Fiscal quality metering of:
 - On-site electricity generation and exports from on-site renewables, CHP etc
 - Heat metering by end-use for any thermal renewable technology on site including export where applicable
- Sub-metering:
 - Electricity consumption to cover main end-uses: (heating & hot water where electrically generated, lighting, small power, ventilation & cooling, server rooms etc.)
 - All major gas & liquid fuel consuming plant on site where not already provided for by fiscal metering (e.g. meters on gas or oil fired plant, heating & hot water where gas generated, gas sub-meters for kitchens

etc. if needed) (again, separating out heating from hot water if gas/ liquid fuelled)

- Metering of heat generation for solid fuelled plant where metering of fuel consumption is not possible, e.g. biomass or coal fired plant
- Internal temperature logs from existing BMS or temporary loggers plus any additional useful sensor logs from existing BMS or similar system if available.

At the most basic level, total energy import can usually be taken from the fiscal meters at site. This can be accomplished by physically recording meter readings directly from the meter. Ideally for PERFORMER, if the building has half-hourly or AMR meter consumption could be recorded and monitored remotely by receiving the consumption data directly from the appropriate data collector. Fiscal meters may not always cover total energy import (e.g. on large campus sites or sites using bulk delivered fuels) in which case it will be necessary to fit fiscal quality meters at the point of entry of the energy supply to the site being studied, record bulk fuel deliveries and potentially install heat meters.

A further consideration is the impact of any on-site energy generation such as renewable energy systems, combined heat & power units or other on-site energy generation. In these cases it will be necessary to measure the amount of energy generated and any that has been exported. The remainder will leave the power that has been consumed from on-site generation. This can be added to the consumption from the main fiscal meters to establish a total kWh consumption at site.

At the next level, information of how the individual building services perform prior to implementation of a solution will be of importance to the project to develop baselines at a building service level as well as site level.

Accomplishing this for electricity is relatively simple to achieve through sub-metering of the major electrical services e.g. lighting, air-handling units, refrigeration, air conditioning plant, server rooms, small power etc. The UK Building Regulations Part L provide a potential starting point for specifying the required level of electricity sub-metering for PERFORMER.

Similarly, gas or liquid fuel use can be monitored relatively easily down-stream from the fiscal meter (if present) at the point of use via individual sub-meters on natural gas, oil or LPG fired plant, large kitchens or other fuel consuming processes.

Where solid fuels are used (e.g. biomass or coal) actual fuel consumption can only be monitored by recording bulk deliveries to site during the monitoring period. To provide the level of monitoring detail required for PERFORMER these records will have to be supplemented by heat metering to record heat generation by thermal plant during the monitoring period, ideally at half-hourly intervals to give the level of granularity that PERFORMER will require.

Below is a table illustrating monitoring points to be considered in establishing an energy baseline:

Level 1		
Fiscal Metering 1	Electricity	HH/AMR
	Gas	AMR
	Other fuel imports	Delivery records for oil, biomass etc.
Level 2		
Fiscal Metering 2	Electricity generation	Total generation
		Export meter
		CHP
	Heat metering	Thermal Renewables
Level 3		
Sub-metering	Electricity	Lighting (internal vs external lighting)
		Air Conditioning
		Air Handling Units
		Server Room
		Small Power
		Other Major services
		Recreational Areas (pools/saunas/etc.)

		Heading, Hot water (if electric)
	Gas / Liquid fuels	Kitchens
		Boilers
		Water heaters
		Gas burners
		Recreational Areas (pools/saunas/etc.)
	Heat metering	Solid fuelled plant (e.g. coal, biomass)
		District Heating
Level 4		
Internal Temperature logs	BMS (or alternative)	Sensor logs/ Heating & Cooling set points/ Locations of sensors
	Loggers	Temporary temperature loggers in situ.

In summary the equipment needed to establish an energy performance baseline at this level of detail would consist of the deployment of multiple fuel, electricity and heat meters at the points suggested as permanent installations. These having been used to monitor the baseline will also be useful in measuring post-solution implementation consumption.

As an alternative to fixed sub-metering of electrical building services, data loggers could be used to measure the consumption at these points. These would act as a non-invasive substitute by using split-CTs to monitor three-phase power at pre-defined locations. These may be fitted in a much shorter space of time than organising a sub-metering programme.