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**Programme Area:** Distributed Energy

**Project:** Macro DE

**Title:** Macro DE Technology Assessment Criteria

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**Abstract:**

This deliverable is number 1 of 3 in Work Package 3. Its objective is to define a set of assessment criteria to be used across 10 different types of distributed energy generation equipment. These assessment criteria will be used as a basis for modelling and identification of technology development opportunities within the remainder of the project.

**Context:**

This project quantified the opportunity for Macro level Distributed Energy (DE) across the UK and accelerate the development of appropriate technology by 2020 for the purposes of significant implementation by 2030. The project studied energy demand such as residential accommodation, local services, hospitals, business parks and equipment, and is developing a software methodology to analyse local combinations of sites and technologies. This enabled the design of optimised distributed energy delivery solutions for these areas. The project identified a number of larger scale technology development and demonstration projects for the ETI to consider developing. The findings from this project is now being distilled into our Smart Systems and Heat programme. The ETI acknowledges that the project was undertaken and reports produced by Caterpillar, EDF, and the University of Manchester.

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## **WP3 Process**

**Type 1** – heat and/or power generation (Fuel in; heat out; power out). Heat recovery systems will be included as part of the capital costs for all generation equipment.

- Gas engine
  - NG and LEG
- Diesel engine
  - ULSD and B100
- Turbine
  - NG
- Boiler
  - NG
- Fuel Cell
  - NG and ADG
- Heat storage
  - Hot water in, hot water out
- Heat pump
  - Electricity

**Type 2** – Devices dependant on season

- Solar Heating – solar energy in, hot water out
  - Separate table for each STOD

**Type 3** – heat distribution devices (heat in, heat out) - *MKN*

- Piping
  - temperature decrease vs length
- Total distribution costs will be related to the energy density of the characteristic zone
- Control and metering equipment – part of district heating system
- Conversion equipment required at user interface

## **CO<sub>2(eq)</sub> of Manufacture**

CO<sub>2</sub> of manufacture will be calculated by Caterpillar's Life Cycle Analysis group according to the following process:

- Review of energy/carbon footprint studies of distributed energy technologies
- Utilization of internal data, where possible, and
- Consensus on average manufacturing CO<sub>2</sub> for given distributed energy technologies.

**Input to the Tool:**

General	Model			
	Total kWe			
	Fuel Type			
	Fuel heat value, MJ/Nm <sup>3</sup>			
	Cost of energy input, £/Nm <sup>3</sup>			
	Fuel CO <sub>2</sub> generation, kg/Nm <sup>3</sup>			
Capital Costs	Capex (Installed Cost), £/kW			
	Expected lifespan, h (average)			
	Footprint (Package), m x m			
	Availability of the Technology, %			
Operating Costs	Fixed Maintenance Cost, £/yr			
	Variable Maintenance Cost, £/kWh			
Performance	CO <sub>2</sub> manufacture, g/kW			
	Load, %	Fuel consumption, Nm <sup>3</sup> /h	Electrical output, kWe	Thermal output at 99 deg C, kWth
	100			
	75			
	50			