EPG Power Hour: Metering for Fame, Fortune, and Happiness
Tenant Billing: Calculating Production Costs for Heating and Cooling Produced On-Site

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12 July 2018
3 Best-Practice Objectives for Billing (ensuring fame, fortune, and happiness!)

• Fair and reasonable
  – Most leases contain this language

• Clear and transparent
  – Reduces billing queries from tenants

• Cost-neutral
  – Particularly important for residential tenants
  – “Reasonable” admin costs may be recovered
Direct Billing and Production Costs

• For electricity, natural gas and water, direct billing is relatively straightforward
  – usage (kWh) x tariff (£/kWh) = cost (£)

• What happens with heating and cooling?
  – The “production cost” is the money spent (£/kWh) to generate heating and cooling and deliver it to each tenant’s demise.
    – A thermal meter within the demise measures the heating (or cooling) used by the tenant
      – usage (kWh) x production cost (£/kWh) = cost (£)
Site with Energy Centre

Energy Centre (heating and cooling)

Block A  Block B  Block C

Boiler 1  Boiler 2  Boiler 3  Boiler 4  GSHP  CHP

Chiller 1  Chiller 2  Chiller 3  Chiller 4

Heating and DHW pumps Block A  Heating pumps Block B  DHW pumps Block B  Heating and DHW pumps Block C  Heating and DHW pumps Block D  Heating and DHW pumps Block E

Cooling pumps Block A  Cooling pumps Block B  Cooling pumps Block C  Cooling pumps Block D

AHU Block A  AHU Block B  AHU Block C  AHU Block D

Block D  Block E affordable
CHP engines need fixed, permanent, MID-approved meters measuring:

- gas going in
- heat coming out
- electricity coming out
Heating Production Costs

Meter Key:
- M = gas meter
- M = electricity meter
- M = thermal meter
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Heating Production Costs

Cost of LTHW in the common header (£) =

\[ M_1:cost + M_2:cost \times \left[ \frac{M_{CHP:heat}}{(M_{CHP:heat} + M_{CHP:elec})} \right] \]

Cost of heating to Block B =

\[ M_{GSHP:elec:cost} \times \left[ \frac{M_{GSHP:heat}}{(M_{GSHP:heat} + M_{GSHP:cooling})} \right] \]

Total Heating and DHWS Cost =

Common LTHW header cost + Block B heating cost
Heating Costs to Each Block

\[ M_{4:cost} + M_{10:cost} + M_{11:cost} = \text{Gen & Del to Block A (\£)} \]

\[ M_{5:cost} + M_{12:cost} + M_{13:cost} = \text{Gen & Del to Block C (\£)} \]

\[ M_{6:cost} + M_{14:cost} + M_{15:cost} = \text{Gen & Del to Block D (\£)} \]

\[ M_{8:cost} + M_{9:cost} + M_{16:cost} + M_{17:cost} + M_{18:cost} = \text{Gen & Del to Block B (\£)} \]

\[ M_{7:Cost} = \text{Generation to Block E (\£)} \]
Heating Costs to Each Flat

\[
\text{\£/kWh heating cost for Block A (£) = } \frac{\text{Gen & Del to Block A (£)}}{(M_{19} + ... + M_{51})}
\]

\[
\text{\£/kWh heating cost for Block C (£) = } \frac{\text{Gen & Del to Block C (£)}}{(M_{52} + ... + M_{124})}
\]

\[
\text{\£/kWh heating cost for Block D (£) = } \frac{\text{Gen & Del to Block D (£)}}{(M_{125} + ... + M_{177})}
\]

\[
\text{\£/kWh heating cost for Block B (£) = } \frac{\text{Gen & Del to Block B (£)}}{(VM_1 + ... + VM_{58})}
\]
Heat Network Notification

\[ M_4 + M_5 + M_6 + M_7 + M_8 + M_9 = \text{Generation (kWh)} \]

\[ M_{19} \ldots M_{177} + VM_1 \ldots VM_{28} + [\text{sum of meters in Block E flats}] = \text{Delivered Heating and Domestic Hot Water Service (kWh)} \]
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