

20% Carbon Emissions Reduction Feasibility for all new domestic dwellings built within North Tawton

A Merton style Rule will also act as an incentive for architects and engineers to begin designing more energy efficient buildings - with the core rationale that the more energy efficient the building the less renewable energy is required to meet a percentage target.

We have based the below carbon saving equations and financial viability on the Standard Assessment Procedure assessment of the newest domestic dwellings built to current building regulation standards in North Tawton (construction in 2015/2016 by Wain Homes Ltd). We wished to use a new dwelling built within our locality as a basis to give the most realistic case study for the incorporation of low carbon technologies.

Average UK Domestic Home Energy Consumption

Average existing domestic UK household electrical use is 3,800kWh per year

Average existing domestic UK household gas use is 15,000kWh per year

Total requirement of 18,800 kWh

10% = 1,880 kWh per annum

20% = 3,760 kWh per annum

Carbon conversion factor – electricity - 0.496 kg/CO₂/kWh

Carbon conversion factor – mains gas - 0.184 kg/CO₂/kWh

Average emissions – electricity – 1,885 kg (1.89 tonnes)

Average emissions – gas – 2,760 kg (2.76 tonnes)

Total emissions of 4,645 kg (4.65 tonnes) per year

10% = 465 kg

20% = 929 kg

North Tawton New Build Property 2015/2016

Thirteen properties and their carbon emissions footprint were examined as part of this process. They included a top floor flat, semi-detached and detached properties, ranging from floor areas of 54m² to 118m² and emissions of 1.8 tonnes to 1 tonne per annum. Therefore an average of 1.3 tonnes of carbon emissions has been used for the purposes of calculations within this analysis, with a target reduction figure of 20% equating to 0.26 tonnes (260kg).

Technology	kWhs generated	Kg of CO2 emissions	% saved	Cost per property
1kW roof mounted photovoltaic array	950 kWh per year	471 kg	36%	£1,250
2kW roof mounted photovoltaic array	1,900 kWh per year	942 kg	73%	£2,500
4kW roof mounted photovoltaic array	3,800 kWh	1884 kg	145%	£5,000
6kW Wind Turbine – supply 5 houses	10,000 kWh (2,000 kWh per property)	4960 kg 992 kg per property	76%	£4,200-£6,000 per dwelling.
Automated wood pellet boiler	15,000 kWh per annum	2760kg	212%	£9,000
Air Source Heat Pump	6750 kWh	3348 kg	258%	£7,000 to £11,000
Ground source heat pump	7,500 kWh	3720kg	286%	£13,000-£20,000
Solar Thermal	1467kWh	270 kg	20.7%	£3,000 - £5,000

Electricity

Solar

A 2kW roof mounted photovoltaic array with an orientation of South with a pitch of 35 degrees would produce 1,900 kWh per year (in North Tawton) and save emissions of 942 kg of CO² each year (73% of average carbon emissions). The cost for each property would be approximately £2,500 for a 2kW system, and is likely to be much less as they can be added during construction requiring no additional scaffolding charges associated with retrofit.

A 4kW roof mounted photovoltaic array with an orientation of South with a pitch of 35 degrees would produce 3,800 kWh per year (in North Tawton) and save emissions of 1884 kg of CO² each year (145% of average carbon emissions). The cost for each property would be approximately £5,000 for a 4kW system.

Wind

A well-sited 6kW turbine can generate around 10,000kWh and save the equivalent of around 4.96 tonnes of carbon dioxide a year. A 6kW pole-mounted system costs between £21,000 and £30,000. Such a turbine could provide a 76% carbon saving for 5 houses; at a cost of £4,200-£6,000 per dwelling.

Heat

Biomass

For boilers, an automatically fed pellet boiler for an average home costs around £9,000, including installation, flue, fuel store. This would provide 100% of heating and hot water requirement, generating 15,000 kWh per annum and save emissions of 2760kg of CO² each year.

Air Source Heat Pump

An air source heat pump could conservatively provide all space heating requirement for a home (assumed as 75% of total heating fuel requirement), providing 11,250kWh per annum. However an ASHP requires electricity to operate, if we assume a coefficient of performance of 2.5:1, this would require 4,500kWh of grid electricity with a carbon intensity of 2,232kg per annum. This will result in an overall average saving of 6750 kWh) and save emissions of 3348 kg of CO² each year. Installing a typical system costs around £7,000 to £11,000, which may be preferable to paying for gas connection to a site and individual boilers. The carbon saving has been based on offsetting a traditional electrical heating system, assuming that a site was not connected to the gas grid system.

Ground Source Heat Pump

An ground source heat pump could conservatively provide all space heating requirement for a home (assumed as 75% of total gas requirement), providing 11,250kWh per annum. However an GSHP requires electricity to operate, if we assume a coefficient of performance of 3:1, this would require 3750kWh of grid electricity with a carbon intensity of 1860kg per annum. This will result in an overall average saving of 7500 kWh and save emissions of 3720 kg of CO² each year. Installing a typical system costs around £13,000-£20,000, which may be preferable to paying for gas connection to a site and individual boilers, and may be cheaper if the site is already being excavated for ground works etc. The carbon saving has been based on offsetting a traditional electrical heating system, assuming that a site was not connected to the gas grid system.

Solar Thermal

The cost of installing a typical solar water heating system is £3,000 - £5,000 (including VAT at 5 per cent for 3.6m² system). Savings are moderate - the system can provide most of your hot water in the summer, but much less during colder weather. Saving on average are in the region of 1467kWh and save emissions of 270 kg of CO² each year (20.7% of average carbon emissions).

Conclusion

As can be seen from the above analysis it is both technically and financially feasible for a new build property being constructed within North Tawton to install low carbon technologies to provide a 20% carbon emissions reduction target without placing an unreasonable burden upon the property developer or individual.