MicroCHP – Updated market projections

Report, prepared by the Domestic CHP Section of the SBGI

March 2006

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About the SBGI…

The SBGI is a trade association that represents virtually all the major players in the main sectors of the UK onshore gas industry and the also the broader heating industry. The scope of membership ranges from gas suppliers, shippers and transporters, metering, distribution equipment and contracting companies and service providers to controls and appliance manufacturers, including central heating and microCHP.

Since 2001 there has been a membership Section specifically for potential players in the domestic CHP market. The broad aim of the Section is to provide a forum for all companies with an interest in microCHP to identify what needs to be done to enable the market to develop as rapidly as possible and to initiate whatever collective action is appropriate to help achieve this.

Executive Summary

These updated projections are based on market research undertaken by a leading heating industry market research agency, and on up to date intelligence on product availability from leading microCHP players in the market. The projections conclude that, with a combination of the right products available and the right policy framework:

- MicroCHP can realistically take 30% share of the boiler replacement market by 2015.

- 5.6 million homes could have microCHP installed by 2020.

    - This is equivalent to 6.2 GW of winter peak generating capacity. This equates to almost half of today's nuclear generating capacity, and is the equivalent of 8 (750 MW) new Combined Cycle Gas Turbine (CCGT) power stations.
    - Annual carbon savings would be up to 1.1MtC by 2020 – equivalent to around quarter of all the expected carbon savings from domestic energy efficiency between 2010 and 2020[1].

- MicroCHP produces twice as much electricity as a large CCGT, for each additional unit of gas consumed[2]. Therefore, each additional kWh of gas consumed in a microCHP displaces nearly two kWh used in a conventional CCGT.

These projections update a previous SBGI report "MicroCHP – Delivering a Low Carbon Future". This reviewed the opportunities and challenges for microCHP and provided market projections for the uptake of microCHP products in the UK, and is recognised as probably the most comprehensive and authoritative market assessment for microCHP.

This report clearly demonstrates that microCHP, can and should play a significant role in the future energy policy of the UK. In particular it can help to inform debate about future options regarding both energy demand and energy supply in the context of the Energy Review currently being conducted by the Department of Trade and Industry.

This potential will however only be realised if:

- Clear signals are given by Government that it expects microgeneration to play a major role in meeting the country's future energy needs, by setting targets for the uptake of microgeneration.
- The Government continues to work in partnership with the microgeneration industry and energy suppliers to remove remaining regulatory barriers.

[1] The Energy White Paper 2003 indicates that the Government expects 4-6MtC from domestic energy efficiency during the period 2010 - 2020

[2] Additional when compared to gas consumed to deliver the same heat load using a condensing boiler.

1: Introduction

It is now widely accepted that microCHP has the potential deliver major improvements in household energy efficiency in the UK. This report provides an objective assessment of the market for microCHP to inform discussion about how the potential offered by microCHP can be most effectively realised within the challenging targets that the Government has set to help combat climate change. In particular it can help to inform debate about future options about both energy demand and energy supply that have been raised in the DTI energy review consultation "Our Energy Challenge" published in January 2006.

MicroCHP has the benefit of being equally well suited to use in new and existing homes. It is well known that in the housing sector, it is existing homes that offer the greatest potential for carbon savings. As a direct replacement for a conventional central heating boiler, microCHP offers the opportunity for occupiers of existing homes to make a major contribution to carbon saving.

In 2003 SBGI published a report "MicroCHP – Delivering a Low Carbon Future". This reviewed the opportunities and challenges for microCHP and provided market projections for the uptake of microCHP products in the UK. This study was recognised as probably the most comprehensive and authoritative market assessment for microCHP.

Since the first SBGI study was published there have been a number of significant developments which could impact on both the extent and the timing of the market take up of the technology. A further study was therefore commissioned by the SBGI Domestic CHP Section to take account of these developments and to provide an up to date market assessment.

The new study was carried out using an updated version of the market model used for the previous study and also takes account of the consumer and installer research which was part of that study. These updated projections are based on market research undertaken by a leading heating industry market research agency, and on up to date intelligence on product availability from leading microCHP players in the market.

2: Recent developments

The principal regulatory, market and technical developments that have taken place since the publication of the 2003 report and which have been included in the new study are as follows:

- Government decision to reduce VAT on microCHP installations.
- Introduction of a 50% EEC enhancement for microCHP from April 2005.
- Progress made on the development of microCHP technology with:

- One Stirling engine powered product now being sold and installed on a commercial basis into the domestic heating market.
- Further substantial investments made into other Stirling engine powered technologies in preparation for product launch.
- Significant investment into Rankine cycle powered microCHP products has now made the availability of such products a realistic prospect.

- Further growth in the sales of new and replacement boilers which in turn has increased the total potential for microCHP sales.

3: Projected uptake of microCHP products

The study considered a wide range of data and scenarios and from this has developed projections for a realistically achievable uptake of microCHP in the period up to 2020. This projected uptake scenario assumed the following:

- A range of products is available to satisfy market needs.

- Much of the installation complexity is quickly overcome through the resolution of outstanding regulatory issues.

- Consumers receive a credit for power exports equivalent to 40% of unit purchase price.

- Grants through EEC or other means are available to reduce the differential cost of a microCHP installation over that of a condensing boiler to £400 until such time as the effect of large scale manufacture of microCHP products reduces the gap.

- The combination of these factors begins to create a snowball effect which makes microCHP an accepted alternative to a boiler by the wider heating industry and the consumer.

Table 1: Projected uptake of market potential

	2010	2015	2020
New microCHP installations ('000s)	117	540	938
Installed base (000's)	233	1950	5600
Reduction in carbon emissions (MtC/year)	0.0	0.4	1.1
Cumulative carbon saving (MtC)	0.1	1.1	5.0

The table shows how microCHP products would take a steadily growing share of the mass boiler market. By 2015 microCHP products would have displaced over 30% of boiler installations and by 2020 the share of the market would have grown to almost 50%.

By 2020 the power generation capacity of microCHP products installed in homes across the UK would be 5.6 GW. This is equivalent to 6.2 GW of winter peak generating capacity, equating to almost half of today's nuclear generating capacity, and the equivalent of 8 (750 MW) new Combined Cycle Gas Turbine (CCGT) power stations.

Achieving the levels of market penetration shown in Table 1 will be very challenging but is realistically achievable provided that:

- Industry remains committed to:
    - Continued major investment into product development
    - New investment into market entry and market development.
- Government gives its commitment to:
    - Removal of the regulatory barriers which complicate installation and hinder take up in the market.
    - Further financial support to help offset the higher costs of microCHP products until the effects of mass manufacture, further product innovation and competition closes the cost gap to an economically acceptable level.

These factors are interdependent and so Government and industry will need to cooperate closely if microCHP is to deliver its potential.

4: Alternative Scenarios

a) Low Support Scenario

The study has also considered a low support scenario in which:

- Regulatory issues relating to electricity supply connections remain unresolved
- Consumers receive no credit for exported power
- EEC enhancements are not continued after 2008

Table 2: Projected uptake of market potential with low support

	2010	2015	2020
New microCHP installations ('000s)	19	66	117
Installed base (000's)	67	266	715
Reduction in carbon emissions (MtC/year)	0.0	0.1	0.2
Cumulative carbon saving (MtC)	0.0	0.2	0.8

Projections for the low support scenario show that use of microCHP products will be restricted to niche markets. This situation is consistent with the introduction of new technologies where the failure to overcome barriers such as higher costs, installation complexity and fear of the unknown, results in very limited take up by consumers. By 2020 microCHP products will have only displaced 6% of boiler sales.

It is not surprising that this forecast demand for microCHP is very similar to the actual take up of condensing boilers in the 1980's and 90's prior to any serious intervention and encouragement by Government. Faced with such a scenario, industry may well review the levels of investment that it is prepared to make on microCHP. There are real prospects of the low scenario projections becoming reality if industry alone has to make the running on microCHP and that the regulatory obstacles are not overcome

b) High Support Scenario

A high support scenario was also considered to assess the maximum market penetration that microCHP might achieve:

- Regulatory constraints are removed and export power credits are widely available as in the 'realistically achievable' scenario.

- Grants are available that provide parity between the cost of a microCHP system and that of a condensing boiler until such time as this gap is closed through large scale manufacture.

- Legislation is progressively introduced to require the use of microCHP for both new and replacement boiler installations in suitable UK households.

- Strong snowball effect that encourages many new entrants and the early availability of a wide range of products.

Table 3: Projected uptake of market potential with high support

	2010	2015	2020
New microCHP installations ('000s)	580	1340	1450
Installed base (000's)	1090	6340	12500
Reduction in carbon emissions (MtC/year)	0.2	1.1	2.2
Cumulative carbon saving (MtC)	0.3	3.8	12.6

In this case by 2015 microCHP would have displaced 78% of boiler sales and would be providing very large savings in carbon through the widespread substitution of centrally generated power.

By 2020 the power generation capacity of microCHP would be a massive 12.5 GW, which is about 15% of the UK's existing capacity. Although it would require substantial resources and commitment to achieve such very high penetration of microCHP within this relatively short time period, the levels of investment needed could well be much less than for the alternative options.

5: Conclusions

This market assessment has provided further evidence that microCHP can deliver substantial carbon savings from the housing market. This potential will however only be realised if:

- Clear signals are given by Government that it expects microgeneration to play a major role in meeting the country's future energy needs, by setting targets for the uptake of microgeneration.

- The Government continues to work in partnership with the microgeneration industry and energy suppliers to remove remaining regulatory barriers.

- Without this support, microCHP will at best become a niche market product with very little impact on energy efficiency and carbon reduction.

However the projections conclude that, with a combination of the right products available and the right policy framework:

- MicroCHP can realistically take 30% share of the boiler replacement market by 2015.

- 5.6 million homes could have microCHP installed by 2020:

- This is equivalent to 6.2 GW of winter peak generating capacity – equivalent to almost half of today's nuclear generating capacity, and the equivalent of 8 (750 MW) new Combined Cycle Gas Turbine (CCGT) power stations.
- Annual carbon savings would be up to 1.1MtC by 2020 – equivalent to around quarter of all the expected carbon savings from domestic energy efficiency between 2010 and 2020.

- MicroCHP produces twice as much electricity as a large CCGT, for each additional unit of gas consumed therefore, each additional kWh of gas consumed in a microCHP displaces nearly two kWh used in a conventional CCGT.

This report clearly demonstrates that that microCHP can and should play a significant role in the future energy policy of the UK. In particular it can help to inform debate about future options about both energy demand and energy supply in the context of the Energy Review currently being conducted by the Department of Trade and Industry.

APPENDIX 1
DEMAND ANALYSIS MODEL

1 THE MODEL

A complex model has been constructed to predict the rate of uptake of market potential and allow the possible influence of various strategies and policies to be assessed.

The model considers the impact of microCHP on energy use (gas, electricity imported, electricity exported) for a range of different house types, standards of insulation (age of dwelling) and allows for random variation in levels of usage and other factors such as type of cooking and electric showers. The predicted patterns of heat demand and power use are considered in detail. Predictions for energy prices, maintenance costs and the installed cost of different types of microCHP unit are used to simulate market conditions by generating a large number of individual scenarios. Uptake of microCHP will depend on millions of individual decisions by householders and fewer but individually more significant decisions by developers and landlords. Research results have been used to predict how rational choices based on the attractiveness of the product might be made and might vary in response to influencing factors.

Insight has been gained into how these factors will be brought to bear and the effects have been broadly divided into two categories:

- "Attractiveness" or economic case factors;
- "Barrier / Support" factors

1.1 "ATTRACTIVENESS" / ECONOMIC CASE FACTORS

"Attractiveness" or economic case factors are those that influence the basic attraction of the product. These include:

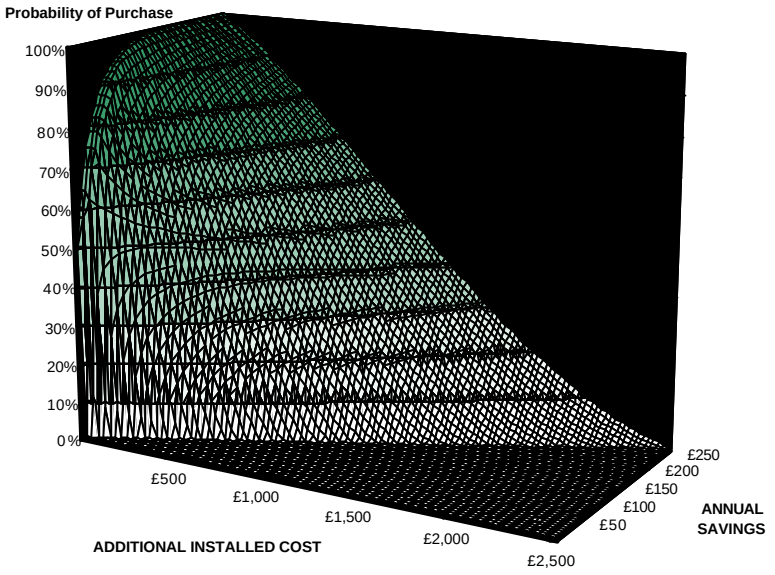
- Usage patterns; performance; availability and cost of units (including installation and maintenance):
- Incentives, regulations, taxation etc.
- Fuel tariffs (or value of carbon savings to social or "green" end users) etc.

These affect the expected level of demand. Research has revealed that the cost of the installation is the most important factor affecting the purchase decision. This is closely followed by consideration of running cost and potential savings with other factors of relatively minor importance. When the case is well presented, a payback argument is attractive. Householders are able to suggest what might be an acceptable payback period and how this might vary with the scale of the additional investment. This has been modelled by relating the probability of the

proposition being attractive to the expected payback and scale of investment in the particular case considered.

Figure 1 is a representation of the demand surface relating additional investment and anticipated annual savings to probability of purchase by householders. This relationship has also been modelled for other decision makers – social landlords, developers and private landlords. In the case of social landlords it has been assumed that payback is considered in terms of the notional value of a tonne of CO_2 saved.

Figure 1: Householders Demand Surface



In addition to the predicted uptake derived from application of the demand surface, demand may also be determined by overriding factors. Overriding factors could include:

- Regulations (including guidance for social landlords etc.).
- Other attractive features such as the possibility of stand-by power (Not considered of great value at present).
- A "snowball" effect related to fashion/"keeping up with the Joneses", coming into play when penetration reaches significant levels.

Changes / Strategies that affect "Attractiveness" or economic case factors have an increasing effect on cumulative sales and thus annual energy and carbon savings.

1.2 "BARRIER / SUPPORT" FACTORS

"Barrier / Support" factors are those which influence the rate of growth in uptake of the product. These include:

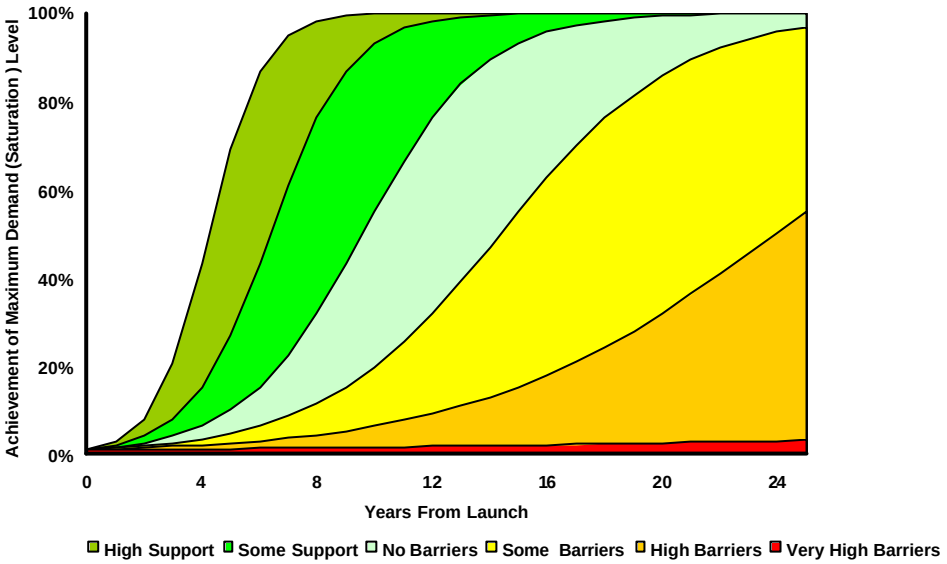
- Availability and quality of installation and maintenance skills (including implications for training / qualifications).
- Attitudes to the products amongst trade professionals and others.
- Routes to market and promotional activity.
- The effect of support and promotion by Government, Energy Supply Companies and others on the attitudes and involvement of householders and other decision makers.

A particular focus of the earlier field research was the influence of installers over one-off boiler installations for owner-occupiers. These installations represent the most significant element of the potential for microCHP. The research confirmed and expanded on previous findings that many householders have little involvement in choice of type of boiler, relying on a good choice of installer to dictate the product installed.

In the major one-off installations market the attitudes of installers is critical. Combination boilers and condensing boilers were considered in both consumer and trade research. Relating these findings to the history of these types of boiler allowed modelling of the way in which these factors might influence the shape of the growth curve for the product.

Figure 2 represents the way in which market growth might be affected by "Barrier/Support" factors.

Figure 2: Growth Rates related to "Barrier/Support" factors



"Barrier / Support" factors are likely to vary considerably for different routes to the market and are very much more important in the early stages of market development.

Changes / Strategies that affect "Barrier / Support" factors have an effect related to demand levels determined by prevailing "Attractiveness" / economic case factors. The proportional effect diminishes as sales grow towards expected demand levels.

2 POTENTIAL MARKET

The output of the model is considered in terms of the target market – homes with gas fired central heating systems (excluding warm air). Table 1 illustrates that these homes are expected to account for well over 80% of households by 2020. This will represent over 90% of domestic gas use, and over 50%, rising to over 60% by 2020, of domestic electricity use.

Table 1 Hydronic gas central heating

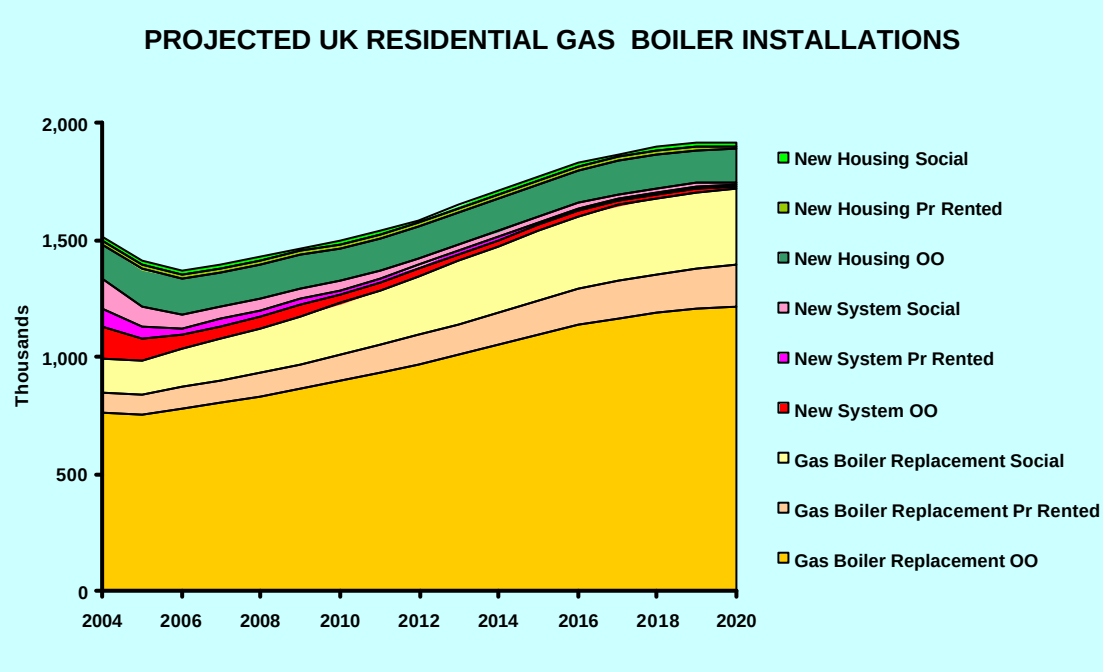
	2010	2015	2020
Total UK Households ('000)	26700	27600	28600
With Gas CH (hydronic) ('000)	21300	22400	23400
% of Total Households	80%	81%	82%

The potential market for microCHP is all future installations of new and replacement gas-fired central heating boilers, as shown in Table 2.

Table 2 Potential market

	2010	2015	2020
New& replacement boiler installations (2005 on)	1500	1770	1920
Installed base	8320	15300	21200
% of Total Households	31%	55%	74%

Figure 3: Forecast New Boiler / Potential mCHP Installations 2004 to 2020



3 PREDICTED UPTAKE

The expected level of demand has been predicted based on rational choices by householders and other decision makers. This reflects the influence of economic case factors. These predictions are based on the assumption of some increase in prices for gas and electricity, particularly in immediate future. Costs of installation and maintenance are assumed to remain constant.
The base or mid-range scenario assumes:

- Effective action is taken to overcome regulatory and most other barriers to market uptake.

- Credit is given for exported power – at a rate of 3p/kWh which is over 40% of the imported power tariff.

- There will be a subsidy (probably in the form of special treatment under the EEC scheme) that reduces the installed cost of a domestic CHP installation by £200.

- Measures will be taken to encourage uptake in the social and private rented housing sectors (e.g. possible changes in capital allowances to facilitate the offer of rental/leasing options for systems).

Widely available flexible products and effective marketing activity are also assumed.

It will take some time for the expected level of demand to be reached and a "Best Outcome" growth pattern has been used to derive the projections shown in Table 3.

Table 3: Predicted mCHP Installations (Mid-Range Scenario) – Best Outcome

	2010	2015	2020
New microCHP installations ('000s)	384	1010	1100
Share of total boiler/microCHP installations (%)	23.3	57	57
Installed base (000's)	635	4420	9170
% Total household	2.4	16	32
Power generation capacity (GW)	0.6	4.4	9.2
Power generated (TWh/year)	1.8	12.1	24.6
Reduction in carbon emissions (MtC/year)	0.1	0.9	1.8
Cumulative carbon saving (MtC)	0.2	2.9	10.1

This level of uptake assumes that barriers such as installers' availability and attitudes are completely overcome and that the highest level of support is provided, with maximum penetration in all routes to market.

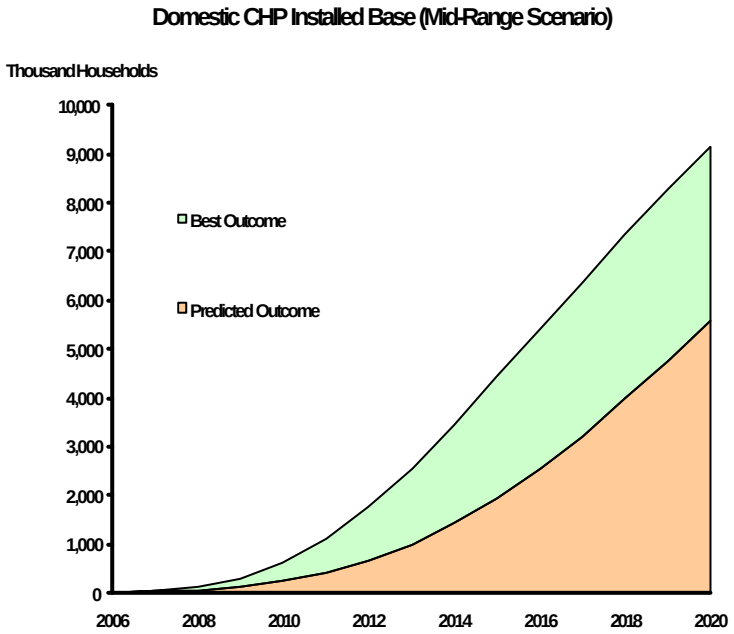
The level of uptake has also been predicted assuming lower initial market growth resulting from remaining barriers to adoption. The results in terms of installed base, power generation, gas and electricity use and carbon emissions are shown in Table 4 and this forms the SBGI "Projected Uptake scenario.

Table 4: Predicted mCHP Installations (Mid-Range Scenario) – "Projected Uptake"

	2010	2015	2020
New microCHP installations ('000s)	117	540	938
Share of total boiler/microCHP installations (%)	7.8	31	49
Installed base (000's)	233	1950	5600
% Total household	0.9	7	20
Power generation capacity (GW)	0.2	2.0	5.6
Power generated (TWh/year)	0.5	5.2	15.1
Reduction in carbon emissions (MtC/year)	0.0	0.4	1.1
Cumulative carbon saving (MtC)	0.1	1.1	5.0

Figure 4 compares expected growth in the installed base of microCHP using base assumptions for "Best Outcome" and "Predicted Outcome".

Figure 4: Growth in Installed Base of mCHP – Best and Predicted Outcomes.



3.1 LOW SCENARIO

Projections based on a low scenario have been produced. This scenario assumes:

- No subsidies for Domestic CHP.
- No removal of regulatory and other barriers to market uptake.
- No credit available for exported power.

It is also assumes that there will be limitations on product availability and marketing activity.

Table 5: LOW SCENARIO - mCHP Installations – Predicted Outcome

	2010	2015	2020
New microCHP installations ('000s)	19	66	117
Share of total boiler/microCHP installations (%)	1.3	4	8
Installed base (000's)	67	266	715
% Total household	0.3	1	3
Power generation capacity (GW)	0.1	0.3	0.7
Power generated (TWh/year)	0.1	0.7	2.3
Reduction in carbon emissions (MtC/year)	0.0	0.1	0.2
Cumulative carbon saving (MtC)	0.0	0.2	0.8

3.2 HIGH SCENARIO

A high or maximum uptake scenario has also been considered. This scenario assumes:

- All barriers to market uptake completely overcome.
- A subsidy that makes such an installation no more expensive than a boiler installation.
- Widely available flexible products.
- Heavy promotion by industry & Government.
- Very rapid market growth.

Table 6: HIGH SCENARIO - mCHP Installations – Best Outcome

	2010	2015	2020
New microCHP installations ('000s)	580	1340	1450
Share of total boiler/microCHP installations (%)	38.8	76	76
Installed base (000's)	1090	6340	12500
% Total household	4.1	23	44
Power generation capacity (GW)	1.1	6.3	12.5
Power generated (TWh/year)	2.5	15.2	30.4
Reduction in car bon emissions (MtC/year)	0.2	1.1	2.2
Cumulative carbon saving (MtC)	0.3	3.8	12.6

3.3 COMPARISON OF PROJECTIONS

Figure 5 illustrates the predicted installed base of domestic CHP for the three scenarios.

Figure 5: Uptake of Domestic CHP

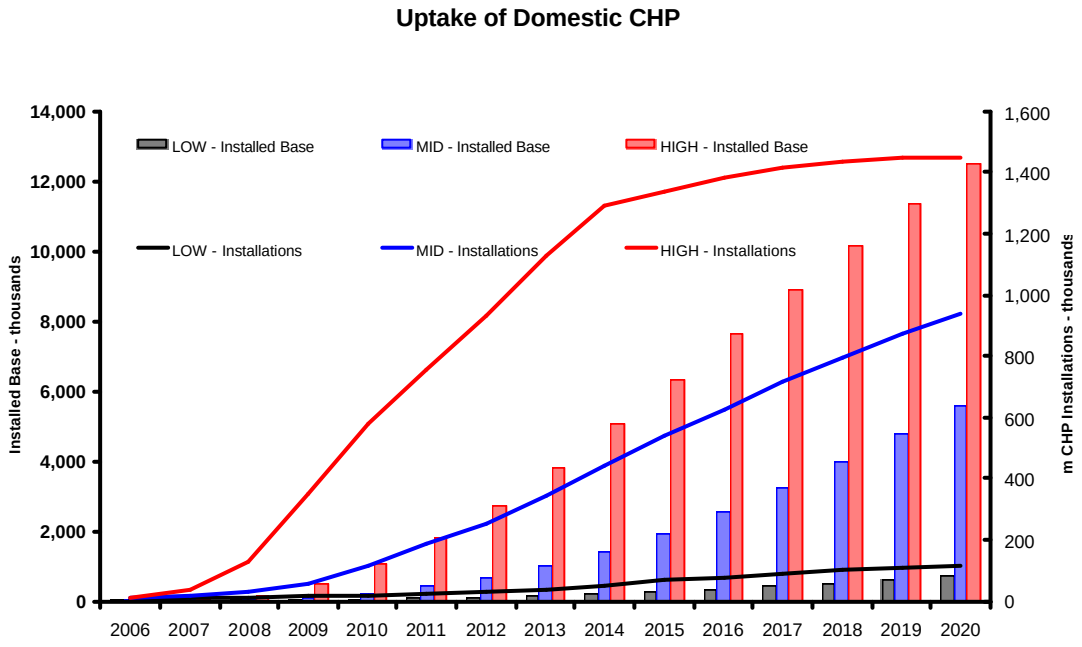


Figure 6 illustrates the power generation capability of domestic CHP for the three scenarios.

Figure 6: Power Generation from Domestic CHP

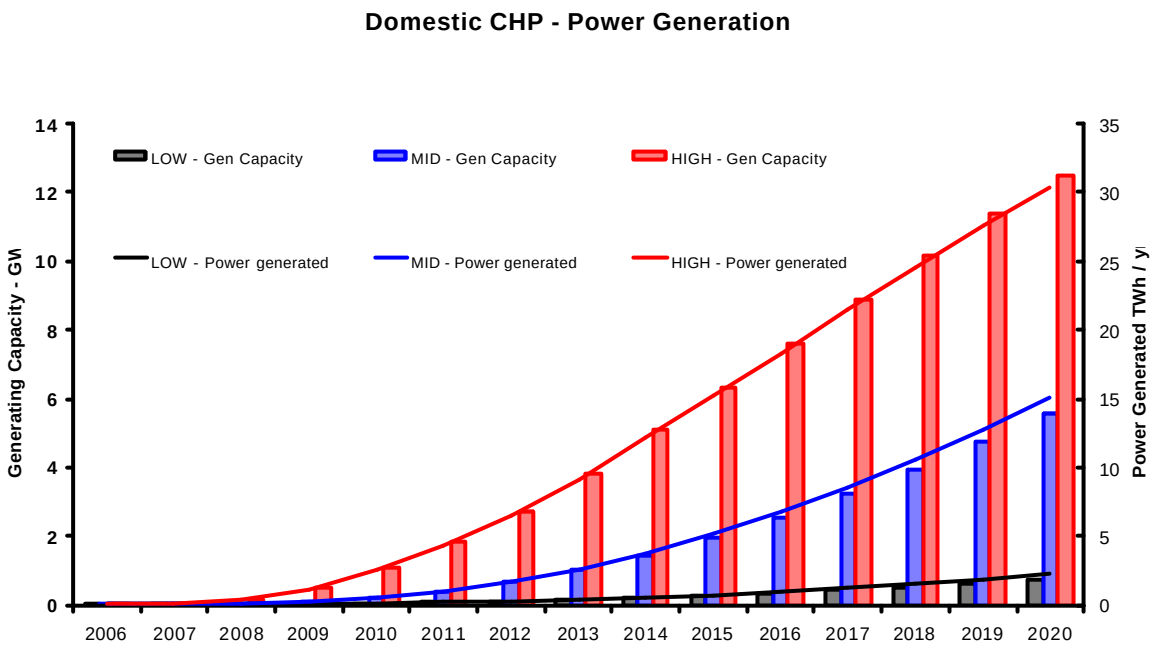


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Figure 7 illustrates predicted energy and carbon savings resulting from the uptake of domestic CHP under the three scenarios.

Figure 7: Energy and Carbon Savings from Domestic CHP