The benefits of micro-CHP

A summary of the fundamentals and benefits of micro-CHP for Europe

- Empowering energy consumers
- Balancing renewables
- Decarbonising heat
- Providing energy security
- Fostering economic growth
What is micro-CHP?

With the ability to attain overall efficiencies above 90%, micro-CHP units meet the demand for heating, space heating and/or hot water (and potentially cooling) in buildings, while providing electricity to replace or supplement the grid supply.

As per the micro-CHP definition featured in the Energy Efficiency Directive, micro-CHP can be applied in private dwellings, public and commercial buildings to supply a range of heat usages.

The reduction in primary energy usage results in greenhouse gas (GHG) emission reductions and the mode of operation of the micro-CHP unit can support the grid integration of variable renewables.

The large majority of commercially available micro-CHP technologies are based on Stirling engine, Organic Rankine Cycle or internal combustion engine (ICE) technologies, characterised by high heat-to-power ratios. This makes them most suitable for installation in existing buildings. Newer technologies based on fuel cells are just being launched onto the market, with the largest field trial in Europe, ene.field, currently underway. The most highly-efficient fuel cell micro-CHP technologies can be operated according to electricity demand when installed in new low-energy buildings-but are also suitable for existing buildings.

This report comprises a main paper that summarises the benefits of micro-CHP - and five supporting papers based on the following five key themes:

- Empowering energy consumers
- Balancing renewables
- Decarbonising heat and electricity production
- Saving primary energy and supporting energy security
- Fostering economic growth: job creation through innovation

1 Ene.field is funded by the European Union’s Seventh Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Technology Initiative. It will deploy up to 1,000 residential fuel-cell Combined Heat and Power (micro-CHP) installations across 12 key Member States. More information can be found here: http://enefield.eu/
What are the key benefits of micro-CHP?

1. It empowers energy consumers. Micro-CHP can help transform European consumers into energy ‘prosumers’, putting them at the core of the future energy system, and giving them greater control over their energy bills.
2. It balances renewables. Micro-CHP generates electricity local to consumption at times of need, helping to balance renewables which can be intermittent and variable.
3. It decarbonises heat and electricity production. Micro-CHP is a highly efficient way of using gas for heating and power production. It saves carbon dioxide now, and can save even more in the future, due to the use of renewable fuels and/or biogas injection into gas networks.
4. It provides energy security. Micro-CHP reduces the amount of total primary energy needed, and can help to support the electricity grid.
5. It can help support Europe’s economy, creating and safeguarding jobs and adding value to the EU economy.

The 5 key themes of this study

- Empowering energy consumers
- Balancing renewables
- Decarbonising heat and electricity production
- Saving primary energy and supporting energy security
- Fostering economic growth: job creation through innovation

Worldwide micro-CHP sales

- 85% Rest of world (Japan)
- 15% Europe

Total cumulative sales to date of micro-CHP: 230,000 in Japan; 40,000 in Europe
Micro-CHP at EU and national levels, the way forward

The European Commission’s new Energy Union Strategic Framework for a “secure, sustainable, competitive and affordable” energy sector aims to put consumers at the core of the energy system. Reaching total system efficiencies of over 90%, micro-CHP technologies represent the next generation solution for replacing traditional gas boilers in much of the built environment where deep renovation and renewable energy solutions are not feasible. In addition, certain types of micro-CHP also represent a highly efficient alternative for new build. Micro-CHP technologies also allow for bio energy sources to be used efficiently. The roll-out of micro-CHP in households and small businesses gives consumers the opportunity to produce their own heat and electricity and become active participants in the energy sector.

The policy context is crucial for a mass-scale deployment of micro-CHP technologies: A fair, steady and predictable policy framework should reward the European heating sector’s contribution to a more efficient, reliable and cleaner energy system, through advanced products and new business models. Policy should inspire confidence in these market players to team up in the spirit of technological leadership and commercial innovation and develop a range of offerings to consumers and installers alike, empowering energy prosumers and creating green jobs.

Only a supportive policy framework can accelerate the transition of the micro-CHP sector from emerging technology to full-scale commercialisation.

At EU level:

- Reinforcing the position of micro-CHP, as part of the tool-kit of supply-side measures that can help Member States meet building efficiency requirements under the Energy Performance of Buildings Directive (2010/31/EU), due for review by January 2017.
- Clarifying the energy labelling methodology (Regulation No. 813/2013) to fully reflect the primary energy savings of both the heat and electricity produced by micro-CHP.
- Micro-CHP systems are controllable technologies and can generate electricity during peak load times (or whenever the grid needs it), replacing a low efficiency and higher CO₂ intensity electricity mix compared to the average electricity sector. This should be considered in upcoming discussions on the review of the EU primary energy factor and related energy labelling review.
- A sustained commitment to support field trials for emerging high efficiency technologies like fuel cell micro-CHP until a critical mass is reached in terms of scale beyond the products can compete in the market. Large scale demonstration should be put in place to continue initiatives like ene.field, co-financed by the FCH JU, with the goal to reach market-readiness by 2020.

At national level:

- Ambitious implementation of the Energy Efficiency Directive (2010/31/EU) at the national level is key to realising the potential of micro-CHP by including the technology in the National Comprehensive Assessments (Article 14). In addition Member States should do more to facilitate grid connection and dispatch for high efficiency CHP, while promoting demand response and simplifying grid connection procedures for small and micro-CHP (Article 15) (see COGEN Europe position paper)
- Market uptake support for micro-CHP technologies, in line with their contributions towards energy efficiency, security of supply and climate objectives at the national level.
- Political commitment to field trials involving innovative products like fuel cell micro-CHPs.

This report was produced by Delta-ee for COGEN Europe

Delta-ee provides its clients with insight and expertise in the technologies, markets and policies on the ‘customer side of the meter’. We have unique knowledge and insight across a range of microgeneration and distributed energy technologies.

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COGEN Europe represents the interests of the cogeneration industry and users of CHP, promoting its benefits in the EU and wider Europe. On behalf of our members we promote the wider use of cogeneration as part of the EU’s energy strategy

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Empowering energy consumers

Micro-CHP can help transform Europeans from energy consumers to energy ‘prosumers’ (producer-consumers), putting them at the core of the future energy system.

- Micro-CHP gives consumers greater control over their energy use and production.
- Micro-CHP gives more choice to European consumers.
- High efficiency micro-CHP cuts energy bills and protects against rising costs.

Micro-CHP gives consumers greater control over their energy use and production.

Consumers now have the chance to become active participants in the energy system, to cut their carbon footprint and to be among Europe’s growing number of ‘prosumers’ (producer-consumers).

Micro-CHP is the only technology that can be used in the home to generate both power and heat. It can make consumers active players in the energy system while making them better off at the same time. As micro-CHP deployment accelerates in Europe, product costs are falling – boosting the affordability of becoming a ‘prosumer’.

Relevant policy documents:
- Strategic Energy Technology (SET) Plan (2014)
- European Parliament Resolution on microgeneration – small scale electricity and heat generation (2012/2930(RSP))
- Energy Labelling Directive (2010/30/EU)
Case studies:
Micro-CHP is already empowering Europe’s energy users and cutting their bills

Mr. Meyer, Uplengen-Remels:
“We have had a lot of experience of fuel cell micro-CHP. In day to day life, everything works like a normal boiler but with the difference that the system supplies heat as well as power. In operation, the noise of the new heating system working was low and barely noticeable. My energy bill was cut by around 30%.”

Mr. Boel, Hamburg
“With the fuel cell micro-CHP system, I was able to cover 72% of my electricity use by producing power myself. Compared to before, I save around €1,000 a year”

Smart Power City Project, Apeldoorn
The Netherlands “Smart Power City” project included more than 170 micro CHP boilers in a partnership involving the local community, local government, energy network operators, energy companies, and manufacturers.

“We were curious about both the user experience and the effect on the local gas and electricity networks. Overall, residents are enthusiastic and often proud of their ability to generate their own electricity. There is also an educational effect as residents act as ‘ambassadors’ for the technology, giving other residents tips on how to make best use of the micro-CHP in order to save as much energy as possible.”
Gerard Brugman, Executive Policy and Innovation, Woonmensen, Apeldoorn
Overall micro-CHP appeal per country

In 2014, customer research carried out across a number of key markets for micro-CHP revealed high appeal for micro-CHP.

Between 62% and 71% of homeowners in Germany, the UK and the Netherlands said they found micro-CHP “appealing”, when presented with product information and details of running costs.

Online survey, sample of 643 homeowners who were solely/jointly responsible for the heating system and fuel bills (research undertaken by Delta-ee, 2014).

Micro-CHP – among the leading products of the top efficiency classes.

Energy labelling helps consumers make better informed decisions when choosing more energy efficient appliances, like micro-CHP.

One measure the European Commission is using to stimulate greater adoption of more environmentally friendly technology is through the energy labelling of products.

As a result, it has prepared its Energy Labelling Directive (2010/30/EU) that will ultimately help consumers choose more energy efficient appliances.
Rising energy costs continue to be a major source of consumer dissatisfaction in Europe

Gas and electricity typically accounts for around 8.5% of a household’s disposable income\(^1\). So far, the 2014/15 fall in global oil prices from above $100 to below $50 a barrel has had only a small impact on energy bills, with gas bills only being reduced by single digit figures in some markets\(^2\).

**Micro-CHP can reduce fuel bills in many different types of homes and protect against rising energy costs.**

Micro-CHP can generate electricity and heat from the same fuel at very high efficiency and is one of a new suite of energy efficient solutions available today to the consumer and small businesses. It is also well-suited for deployment in large parts of the European building stock.

### How micro-CHP can reduce energy bills: an example of an average house in Germany or the Netherlands

*In a home of average energy use in Germany or the Netherlands, fuel bill savings of between 26% and 34% are achievable in 2015 and 2020 by using a micro-CHP.*

Savings could be higher in homes with higher energy use. There are over 8.5 million of these ‘above average’ houses in Germany and the Netherlands, and many more throughout the rest of Europe. They are typically single or multi-family homes.

<table>
<thead>
<tr>
<th>Base case</th>
<th>Micro-CHP example type 1</th>
<th>Micro-CHP example type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas boiler + electricity (grid)</td>
<td>Wall-hung engine micro-CHP</td>
<td>% reduction compared to base case</td>
</tr>
<tr>
<td>% reduction compared to base case</td>
<td>Floor standing fuel cell micro-CHP</td>
<td>% reduction compared to base case</td>
</tr>
<tr>
<td>2015 €2,154</td>
<td>€1,588</td>
<td>26%</td>
</tr>
<tr>
<td>2020 €2,405</td>
<td>€1,760</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>€1,419</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>€1,590</td>
<td>34%</td>
</tr>
</tbody>
</table>

Calculations assume 100% on-site use of electricity generated, or where generation exceeds use an export tariff of 9c€/kWh. Calculations assume a home which requires 17,500kWh of energy a year for heating and hot water, and 3,500kWh a year of electricity. Wall-hung engine micro-CHP and floor standing fuel all micro-CHP assured to have electrical efficiencies of 14% and 35% respectively.

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\(^1\) VaasaETT (2013). European Residential Energy Price Report
\(^2\) Financial Times (2015). British Gas follows Eon’s price cut
http://www.ft.com/cms/s/0/5602f446-9fd2-11e4-aab9-00144feab7de.html#axzz3RADHp84n, 15 January 2015
Balancing renewables

Micro-CHP can play an important role in supporting renewables and meeting the challenges of the modern electricity grid.

- Micro-CHP is able to support renewables at the system level in Europe
- Micro-CHP can realise multiple benefits as a form of demand response, enabling buildings to change their electricity production and demand to suit grid conditions

Micro-CHP is able to support renewables at the system level in Europe.

The journey towards renewable targets

The EU Renewable Energy Directive (RED) of 2009 mandates that 20% of the EU’s total energy needs should be derived from renewable energy by 2020.

Today’s share of renewable energy already exceeds 14% in Europe, a doubling since 2004, and is on course to meet the 20% target.

Some renewable energy sources are described by the European network operators group (ENTSO-E) as “inflexible and highly variable”.

Relevant policy documents:
Renewable Energy Directive (RED) - 2009/28/EC
As a flexible and controllable technology, micro-CHP can support the integration of variable renewable energies such as wind and solar power.

Because of the way micro-CHP uses natural gas and typically generates electricity at times of peak power demand or capacity shortages, it can 'step in' when the wind is not blowing or the sun not shining.

In addition, as part of a future 'smart grid', micro-CHP units can be aggregated together as a 'virtual power plant' which can be dispatched when the intermittent renewables are not generating. The start up speed for micro-CHP is high compared to much larger baseload power plants, offering additional advantages to flexibility.

The future smart grid
Case study: The synergy of micro-CHP with renewable energy

Vattenfall – ‘Virtual power plant’ (VPP) with a heat pump and micro-CHP

European utility Vattenfall is working on a project that will support an increasing level of grid integrated renewable energy technologies. The aim is to manage the fluctuating supply of electricity being generated by wind generators and help mitigate their impact on the grid. Overall, the trials find that, with different levels of wind output at different times, micro-CHP and heat pumps can help balance the grid.

Scenario 1: when the wind isn’t blowing and there is a demand for power (e.g. a cold, still evening in December), the micro-CHPs operate and help provide the electricity to meet the load. If there is no demand for the heat generated from the cogeneration process, this is stored in hot water buffer tanks to be drawn as hot water when needed.

Scenario 2: when the wind is blowing and there is only a low demand for electricity (e.g. windy day at lunchtime in midweek), heat pumps will use the excess electricity to generate heat for the building or store it in a hot water buffer tank to be drawn when it is needed.

Micro-CHP can realise multiple benefits as a form of demand response, enabling buildings to change their electricity production and demand to suit grid conditions

‘Demand response’ refers to the integrated approach of influencing the amount – and timing – of electricity consumption and production.

By participating in demand response, consumers and businesses are able to adapt their energy consumption from times of high demand (low availability and higher price) to times of low demand (high availability and lower price).

Demand side participation is specified in the EU’s Electricity Directive (2009/72/EC) and the Energy Efficiency Directive (2012/27/EU). Both refer to its importance in balancing the energy market and in helping meet the EU’s environmental and renewable goals.

Micro-CHP can be used as a form of demand response

Micro-CHP can play a major role in demand response through its ability to flex and respond to electricity price signals. It can offer a number of options:

• Send electricity back to the grid when needed at a grid level but when it’s not needed on-site.
• Use the electricity it generates on-site when there is local demand.
• Can be enabled though energy storage (a heat buffer or even a hot water tank) for use later on-site when not needed at grid level.
Case study:
Greenlys - improving grid operation via demand response

Greenlys is a development project that aims to develop and test innovative solutions for the smart grid, located in Lyon and Grenoble in France. The project is driven primarily by ERDF, GDF Suez CEG, GINP and Schneider Electric.

Micro-CHP is one of a range of technologies that is being used to showcase how new technologies (including solar PV, electric vehicles, smart meters and micro-CHP) can work together to form an intelligent power grid. The project involves 1,000 residential customers and 40 commercial sites.

One part of the project is testing demand response with commercial electricity users, through tariff management and restricting consumption. Early results from one site show:

- Electricity usage restrictions did not impact comfort.
- A 16% reduction in electricity bills is possible from just moving demand to off-peak hours.
- A potential return on investment of less than 7 years.
Decarbonising heat

Micro-CHP is an effective way of decarbonising heat for Europe’s building stock now and in the future:

- Micro-CHP is a highly efficient way of using gas for heating millions of Europe’s homes and businesses.
- Able to cut carbon emissions now and into the future, micro-CHP supports Europe’s move towards the decarbonising of heat and electricity supply.
- Micro-CHP can use a range of renewable fuel sources, and so be a part of a future transition away from fossil fuels.

Relevant policy documents:
- Energy Efficiency Directive (EED)
- Renewable Energy Directive (RED)
Micro-CHP is a good fit with the European housing stock

There are around 100 million boilers installed in residential buildings across Europe. Micro-CHP is well-suited to serve a large proportion of them based on the fit between the amount of energy supplied and the demand profiles of the buildings.

In addition, micro-CHP can use the same fuel and the same connections (gas supply, electricity connection and water supply) as gas boilers. Similarly, they can be wall hung or floor mounted, they also use wet radiator systems to deliver the heat, and they are usually installed inside the building.

There are also different types of micro-CHP technology that suit different types of building:

- Fuel cell micro-CHP has a low 'heat-to-power ratio' (meaning it produces a relatively low amount of heat and a relatively high amount of electricity compared to other micro-CHP technologies) so is well suited to the evolving trend in buildings towards higher electricity use and low space heating demand;
- Engine micro-CHP has a high 'heat-to-power ratio', which can be better suited to existing buildings with higher heat demands;
- Residential micro-CHP is smaller and produces less electricity and heat—so is better suited to one- or two-family buildings.
- Commercial micro-CHP is larger and produces more electricity and heat—so is better suited to multi-family buildings and for business use.

Table: Comparison of the gas boiler with gas micro-CHP.

Micro-CHP and the gas boiler share many of the same features, making it a good fit with the European housing stock and more efficient way of using gas in many types of building.
Able to cut carbon emissions now and into the future, micro-CHP supports Europe’s move towards the decarbonising of heat and electricity supply

Supporting Europe’s move towards decarbonising heat and electricity

Carbon savings from micro-CHP depends on:

- The carbon content of the fuel it uses to generate heat and power (although this doesn’t vary much), and;
- The carbon content of the grid supplied electricity that micro-CHP displaces (this can vary a lot between countries).

The carbon content of grid supplied electricity depends on the power generation mix—the different types of power stations and fuels they use that contribute to that electricity.

A generation mix that has a high proportion of coal power stations will have a higher carbon content than one that has a high proportion of renewable power or gas generation.

Compared with a conventional gas boiler and grid supplied electricity, micro-CHP can significantly reduce carbon dioxide emissions from homes, now and in 2020 (see the case study below).

Any further increase in the electrical and overall efficiency of micro-CHP, coupled with decarbonising gas supply (through biogas injection), will result in even more carbon dioxide savings.

**CASE STUDY 1:**

Carbon dioxide emissions associated with heating and powering a family home in Europe, in 2015 and 2020, using a micro-CHP unit, or a condensing gas boiler plus mains electricity.

- **Gas boiler & Electricity (Grid)**
- **Micro-CHP lower emissions level**
- **Micro-CHP upper emissions level**
- **Micro-CHP technologies**

Based on an average European house requiring 17,500kWh of energy per year for space heating and hot water, and 3,500kWh of electricity per year.
Micro-CHP units are being developed that make use of renewable or low carbon energy sources:

- The majority of micro-CHP products sold or in development are designed to use natural gas as a fuel.
- However, micro-CHP can be ‘fuel flexible’: so it can be designed to run on renewable or low carbon fuels, including hydrogen, biomass, biogas, waste heat, and even solar energy.
- It can therefore support Europe’s move towards renewable energy in the long term, while reducing carbon dioxide emissions in the short term by making more efficient use of natural gas.
- A number of companies have developed – or are developing – micro-CHP units, which can use renewable fuels:

### Case studies:

#### Biodiesel/biogas:

The SenerTec ‘Dachs’ was launched in 1996 and has sold over 33,000 units since then. It introduced models 15 years ago that could run on biodiesel made from canola oil and also biogas from agricultural waste. Status: commercialised

#### Hydrogen:

Hydrogen can be used as a 100% fuel source in fuel cells – or as part of a low carbon blend when added to natural gas in the gas network. While over 100,000 fuel cell micro-CHP have been sold in Japan, the fuel cell micro-CHP market in Europe is still at a very early stage. Several dozen other companies involved in trying to bring gas-fired fuel cell micro-CHP to market. However, one Danish company is hoping to do it using pure hydrogen fuel - IRD Fuel Cell – with a 1.5kW wall hung micro-CHP. Status: pre-commercial

#### Waste heat:

Viking Heat Engines are a technology developer with roots in the oil industry. They developed a product that can use low grade heat – either from geothermal sources, solar sources, or even waste heat from industrial processes. Status: Pre-commercial/Field trials

#### Biomass:

ÖkoFEN are a major Austrian biomass boiler manufacturer and one of several looking to launch a biomass fired micro-CHP. A pioneer of the pellet boiler, they are integrating a Stirling engine (found in some commercialised gas-fired micro-CHP) into a biomass pellet system. It is currently testing micro-CHP and is looking at different versions for dwellings and businesses. Status: Pre-commercial/Field trials

#### Solar:

Innova are a solar technology developer established in 2005 in Italy. Using a Stirling engine from the gas-fired micro-CHP industry, they commercialised a parabolic collector system and is targeting both residential and small commercial applications such as schools. Status: Commercial.
Providing energy security

High efficiency distributed energy solutions like micro-CHP can improve security of energy supply by improving power grid stability and saving primary energy

• By generating heat and power at times of peak demand, micro-CHP can significantly improve the stability of the electricity grid.
• As an enabler of other low carbon technologies, micro-CHP can support the deployment of electric heat pumps and electric vehicles.
• Micro-CHP can also boost security of energy supply through its Primary Energy Savings

By generating heat and power at times of peak demand, micro-CHP can significantly improve the stability of the electricity grid.

Micro-CHP can play an important role in balancing supply & demand.

Balancing electricity supply and demand is a fundamental challenge facing all electric grid operators. A feature of micro-CHP is that it can generate heat and power at times of peak demand and so strengthen grid resilience.

In order to balance the fluctuations in demand and supply on an electricity transmission system, transmission system operators (TSOs) need to ensure that they can access a sufficient amount of electricity when they need it.

If insufficient power is available, the capacity to harness multiple micro-CHP systems to help ensure demand peaks can be met contributes to protection against unexpected power station failures or weather events.

Why distributed energy solutions, including micro-CHP, can help

Many micro-CHP systems, when connected together, can work as a ‘virtual power plant’ (VPP), providing back up power and helping TSOs better balance demand and supply.

Micro-CHP has already been used in numerous VPP field trials and demonstrations across Europe.

Relevant policy documents:
Directive 2005/89/EC (Security of Supply)
Energy Efficiency Directive (EED)
Case study: ‘Smart Power City’, Apeldoorn - Demonstrating how micro-CHP can contribute to grid stability

Sponsored by the Dutch Ministry of Economic Affairs, in 2011 “Smart Power City” in Apeldoorn monitored the impact of 170 micro-CHP units on the local electricity network.

The project aim was to gain experience with a large-scale and concentrated application of micro-CHP in one district.

The micro-CHPs were installed in homes that meant they were connected to one transformer station so the impact on the electricity network would be directly visible.

Showing that micro-CHP could contribute to grid stability was just one of the conclusions from the project. It also showed how more efficient heating technologies could contribute to the region’s climate change and sustainability objectives, and gave insights into the user experience of distributed generation resources.

As an enabler of other low carbon technologies, micro-CHP can support the deployment of electric heat pumps and electric vehicles.

Electricity consuming low carbon technologies can lead to growing congestion on the grid; micro-CHP can help to relieve this

Increasing penetration of electric heat pumps and electric vehicles will lead to growing congestion on local electricity distribution networks.

Various projects and trials have shown that micro-CHP, when deployed alongside electricity consuming technologies such as electric heat pumps and electric vehicles, can help relieve the stresses on distribution networks that can be created when these technologies are widely deployed.

The importance of security of supply
- In order to balance the fluctuating differences in demand and supply on an electricity transmission system, transmission system operators (TSOs) need to ensure that they can access a sufficient amount of electricity when they need it.
- According to ENTSO-e, if the required back up power is not available and a relatively minor issue such as an unexpected power station failure or weather event occurs, it could have serious Europe-wide consequences for system security.
- The directive stipulates that “when promoting electricity from renewable energy sources, it is necessary to ensure the availability of associated back-up capacity...in order to maintain the reliability and security of the network”

Why distributed energy solutions like micro-CHP can help
- Micro-CHP is one technology that can potentially work as a virtual power plant, providing back up power and helping operators’ better balance demand and supply.
- Micro-CHP has been tested in numerous virtual power plant field trials and demonstrations across Europe.
Case Study: ‘Powermatching City’ - Micro-CHP and other low carbon technologies working together with benefits for the electricity network

Powermatching City was a Dutch smart grid demonstration project that involved 25 households and a range of new, low carbon technologies. It was sponsored by the Dutch government.

The smart grid concept, involving numerous technologies, was successfully demonstrated along with its potential to work as a VPP - with benefits for consumers, the electricity network, and the operators. The study's second phase ran until September 2014.

The technologies used in the demonstration included:

- Micro-CHP
- Electric vehicles
- Smart meters
- Wind Energy
- Solar PV
- Hybrid heat pumps
- Smart appliances

Case Study: Kiwigrid - Connecting a diverse range of distributed energy generators together to optimise their various benefits

Kiwigrid is a start-up company from Germany. It has developed a smart grid platform for helping connect a range of distributed energy technologies together, with the aim of improving their flexibility and allowing them to work together to make the most out their different benefits.

Kiwigrid's solution allows the management of:

- Distributed and sustainable energy generators (such as micro-CHP, solar power, and wind power)
- Local energy storage systems
- Flexible energy systems (such as heat pumps, district heating, climate control systems, and electric vehicles).
- Intelligent, flexible energy consuming devices.

Some of its early projects are aiming to realise a series of potential benefits, including charging electric vehicles when the sun is not shining, and helping to bring greater energy independence by optimising the operation of distributed energy resources.
Micro-CHP can boost security of energy supply through its Primary Energy Savings

Primary energy savings are a key European policy goal

The EU’s total demand for heat is equivalent to around 46% of its final energy use, and it accounts for 60% of its primary energy use – the amount of energy entering the European energy system before any conversion takes place (for example in power stations and boilers). The EU Energy Efficiency Directive (EED) defines how primary energy savings can reduce reliance on energy imports and help cut carbon emissions.

Modern micro-CHP systems can achieve primary energy savings of more than 25%

Combining the production of on-site local heat with local electricity generation to meet on-site energy needs for both saves around 25% of the primary energy needed.

Schematic representation of how CHP saves upwards of 25% primary energy compared to separate production of heat and power

For the same 260 units of delivered energy, CHP only needs 325 units of fuel input while conventional methods requires 465 units of fuel inputs.
Fostering economic growth

Micro-CHP market development will support innovative European industries, create new jobs and build economic value across the EU

- An EU success story: the European heating industry, and the jobs it supports.
- Micro-CHP is one of the heating industry’s next-generation products, crucial to its continuing evolution and success.
- Nurturing a European industry of high-tech, innovative products like micro-CHP leads to new and high-value jobs, and helps drive economic growth.

An EU success story: the European heating industry, and the jobs it supports

The European heating industry employs around 120,000 people and is worth around €20 billion in revenues annually.

The sector also supports many other indirect jobs and industries, many of which are small and medium sized enterprises (SMEs).

While some of the companies that make up the heating industry are well over 100 years old, new companies continue to appear, developing new and innovative products for homes and businesses.

Micro-CHP market success is key to the heating industry - it represents its next generation of low carbon, energy efficient heating products.

Relevant policy documents:
Research and Innovation as sources of renewed growth - COM(2014) 339 final
Energy Efficiency Directive (EED)
Micro-CHP is one of the heating industry’s next-generation products, crucial to its continuing evolution and success.

The European heating industry needs to evolve and innovate in order to continue to succeed

The gas boiler has been extremely successful in Europe - 8 million are sold each year to the residential sector alone.

The European heating industry is committed to innovation and the development of new, lower carbon and more efficient offerings for consumers. At the same time, there are many new market entrants looking to bring their advanced products to the market.

Innovation is crucial for these companies to be successful, to stay competitive and to stimulate growth.

“We are genuinely very excited about what Viessmann has to bring to heating innovation at what feels like a key time for our industry. Over the next 25 years, Viessmann will continue to be at the forefront of the transition from boilers, to hybrids, to heat pumps, to micro-CHP and to fuel cells.”

Graham Russell, MD of Viessmann UK

“Through developing a portfolio of next-generation low carbon products, BDR Thermea is proud to be helping our customers lower their energy bills and reduce their carbon emissions. Innovation and sustainability are key values for us as a business and that’s why we will continue to invest and develop products like micro-CHP.”

Rob van Banning, CEO, BDR Thermea
Micro-CHP is a next-generation heating product

Micro-CHP supports current market channels and supply chains because it represents a natural evolution of existing boiler technology. Many of the components in a micro-CHP unit are the same as - or based on - those found in a traditional gas boiler. The similarity of micro-CHP to the gas boiler means consumers and businesses also have a familiarity with them. This is one reason why the appeal of micro-CHP to consumers is high.

In the same way solar panels can be added to a building to generate electricity, micro-CHP can also be designed to be fitted alongside an existing heating system. This can create extra opportunities for business outside the heating system replacement market. This means extra value for the economy and extra opportunities for employment.

The evolution of the gas boiler

In the second half of the 20th century, central heating became a standard feature of the modern home and business.

Today, there are more choices - gas boilers continue to evolve and there are also a growing number of low carbon, efficient energy products that consumers and businesses can choose from.

The development of new markets for micro-CHP is an important source of innovation within the heating industry.

Micro-CHP market development will enable the workforce to develop new and high value skills, while building on the existing expertise of employees in Europe's heating industry.

With innovation and manufacturing centres located throughout the EU-28, Europe is already a global leader in micro-CHP engine and product technology.

Encouraging innovation in Europe's heating industry supports jobs and economic growth.

The European Commission's Innovation Union states that innovation in Europe is a crucial investment for its future. Its target of investing 3% of EU GDP in R&D by 2020 could create 3.7 million new jobs and increase annual GDP by €795 billion by 2025.

Nurturing a European industry of high-tech, innovative products like micro-CHP leads to new and high-value jobs, and helps drive economic growth.
Case study: Innovation in Europe - micro-CHP

**GDF Suez’s CRIGEN research centre near Paris** focuses on new energy sources and emerging technologies (including micro-CHP). It employs 366 people and generates revenues of €77 million/year from research, development, and consultancy.

**Viessmann** is one of Europe’s leading heating equipment manufacturers. It is investing €50 million in a new research and development centre in Allendorf, Germany.

**Solid Power** – an Italian/Swiss technology developer - has been working since 2006 to develop its micro-CHP technology. In 2014 it opened a new production plant in Mezzolombardo, Italy.

**BDR Therma** employs 6500 people in its business as a manufacturer and distributor of sustainable, smart climate and sanitary hot water solutions. The company’s Micro-CHP R&D competence centres are located in Germany (Schweinfurt and Hamburg) and UK.

New technologies like micro-CHP will also support and create jobs in energy services companies, retrofit companies, investment funds, sales and distribution, as well as those in R&D, manufacturing and with the energy utilities.