Berliner Energietage

**MicroCHP – International Strategien in den Niederlanden und in Großbritannien**

Michael Colijn – EU Regulation and Public Affairs

17. Mai 2004
Overview

- Who is Microgen
- What is MicroCHP
- Cooperation
- Potential
- Changes needed
- Conclusion
- Who is Microgen? -
Microgen is a company that develops and markets combined heat and power systems for the domestic & light industrial market.

- Microgen’s HQ is in the UK
- Microgen is 100% subsidiary of BG Group
Microgen Team

Thames Valley Park
Reading

Microgen Technology Centre
Peterborough

Commercial Team
Building Business Models
Developing Int’l Partnerships
Contracts for Manufacturing

Engineering Team
Test Centre for 50 appliances
Development of engine & controls
Running field trials
Enabling Technology
Linear Free Piston Stirling Engine

- Simplicity
  - low cost
  - long, maintenance-free life
- High efficiency
- Low noise
- Single phase a.c. power
- Fixed frequency [50 Hz]
- Voltage 230 V
Microgen Home Energy Appliance
Suitable for the replacement market

- Dimensions (open vented):
  - Height 900mm
  - Width 450mm
  - Depth 420mm
- Combi / system variant 150mm wider.

<table>
<thead>
<tr>
<th>Type</th>
<th>Max Thermal Output</th>
<th>Electrical Output</th>
<th>Floor or wall mount</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>15kW</td>
<td>1.1kW</td>
<td>Wall mount</td>
<td>Natural gas or LPG</td>
</tr>
<tr>
<td></td>
<td>24kW</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>36kW</td>
<td></td>
<td></td>
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<tr>
<td>Combination</td>
<td>24kW</td>
<td></td>
<td></td>
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<td></td>
<td>36kW</td>
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</tbody>
</table>

Microgen prototype appliance © Microgen Energy
- What is microCHP? -
What is microCHP

- MicroCHP = small Combined Heat & Power
- CHP = the simultaneous production of electricity & heat for useful application
- This dual use gives a much higher overall efficiency
European Cogen Directive:

- Article 3(m):
  - "micro cogeneration unit" shall mean cogeneration unit with a maximum capacity below 50kWe”
  
[Ref: 2004/8/EC, 11 Feb 2004]

- For practical reasons, < 15 kWe in the household environment is a more useful definition for microCHP and micro-generation.
Micro-generation

Widely accepted definition:
- Up to 16A per phase (230/400V)
- Single phase  3.7kWe-5.5kWe
- Three Phase  11kW-15kWe
- [maximum size is country dependent]

Technologies:
- microCHP
- Solar PV
- micro-wind/micro-hydro
- fuel cells

Applications:
- Domestic and small commercial
What is microCHP

- Replaces the existing boiler
- Usually in household environment
- Also produces electricity
  - Mostly for direct consumption
- The home-owner becomes a producer
  - Tax implications?
  - What to do with extra kWh?
- Decentralised power production
What does microCHP consist of?

- A [condensing] boiler
- An integrated generator
  - Stirling engine, fuel cell, gas turbine, steamcell, etc
- Controls
- Peripherals
  - Wiring
  - Meter
  - [Flue]
Members of Dutch microCHP group - under Cogen Netherlands

BG-group
Delta
ECN
EnAtEc
Eneco
Essent
Gastec

Gasunie
MTT
NOVEM
NUON
Vaillant
Whispertech
Wonen Breburg
- Market Potential -
From 2007 there is an increasing shortage of electricity in the European Union
- This is due to increasing demand growth of electricity
The European Commission is looking to
- Build 200 GW of new generating capacity
- Renew 300 GW of existing capacity
But who is going to invest in a liberalised market?
Market Size [4] – the Netherlands

- The Netherlands has 6 mln homes
  - Up to $\frac{3}{4}$ are potential microCHP homes
- The boiler market is well established
  - Saturated market
  - 400,000 boilers sold per year
  - 90% of boilers sold are condensing
- MicroCHP could replace existing boilers directly
  - Installers already know condensing boiler technology
  - There is wide experience with solar PV electrical connections
How to get there?

- Compare to historical curve of similar technology
The condensing boiler in the Netherlands has highest penetration in the world at 60%, and is still growing rapidly.

Boiler market evolution in the Netherlands

Condensing boilers
VR boilers
Conventional boilers

[Share of total market]

Source: ECN, EnergieNed, Roland Berger analysis
The condensing boilers’ share of sales rapidly grew from <20% in 1990 to 80+% in 1990.

Condensing boiler uptake in the Netherlands

- new building regulations
- environmental regulations for utilities
- subsidisation

[Share of boiler sales]

condensing boiler sales

- new building regulations (EPS)¹

Reduced subsidisation

Temporarily put on hold

subsidised condensing boiler sales

0% 4% 17% 50% 81% 90%

1 Energie prestatie standaard
Source: ECN, EnergieNed, Roland Berger analysis
- Improvements for microCHP -
Home-Owner’s Needs

- Grid Connection
- Meter Installation & Metering
- Upfront Support
- kWh feed-in fee
Grid Connection:

Case Situation

- 31st December, evening
- Boiler Breaks Down
- Replacement is needed within 24 hrs

What happens here if the customer wants to buy a microCHP to replace the boiler?
Grid Connection: Solution

Home Owner cannot replace boiler with a microCHP within 24 hrs = unfair disadvantage
Goes against European policy goals to rapidly develop microCHP market
Root cause is in regulatory framework

Needed change is:
[1] “Fit & Inform” system
[2] Type approval of microCHP’s
[3] Harmonised acceptance by network co’s
When fitting the microCHP, costs need to be kept as close to boiler costs as possible to be competitive.

This means all installation work to be done in one day - No separate call-out for meter installation and final OK for appliance activation.

This improves convenience for home-owner.

However, current meter regulations generally don’t allow easy installation.
Meter Installation:

Current situation

- Meter installed on separate day
- By separate team
- Timelines unclear
- Costly situation

Need further opening of the meter market:
- [1] Certify and use meter of choice [cheaper]
- [2] “Fit & Inform” rule with network company
- [3] Delegated authority to accredited installers
Upfront Support

- Early Adopter market, no price issue
- Mass Market requires a kick-start and reduction of price differential with boiler market
- Current policy goals send conflicting messages

Change needed:
- [1] End users need certainty of structural support for energy efficient technology
- [2] A level playing field for all energy
Upfront Support:
The Tax System

CORRECTIVE MEASURE:
Lower VAT for microCHP

19% VAT

Lower % VAT

CO2

Energy Efficiency

Unfair Competition

microgen
kWh pricing

- Structural arrangement for buy-back of kWh generally not arranged
- Government registration fee out of proportion
- Home-owner does not want hassle of negotiations with energy company; Home-owner does not know where to begin

Needs:
- [1] A simple, automatic kWh buy-back system
- [2] Low cost / No cost registration system
QUESTION TIME!

Further information:
www.microgen.com
www.BG-Group.com

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11th May 2004
Benefits:

Government

- Primary Energy Saving
  - Lower primary energy consumption
  - Lower transmission losses

- Emissions Reductions
  - Gas consumption has low carbon value
  - Waste heat used more efficiently
  - Around 1.5 Ton CO₂ avoided per system/year

- Infrastructure
  - Diversity of supply: better security & reliability
  - Helps defer investment costs
Benefits:

Lower Transmission Losses [1]

- Electricity cannot be stored
  - It has to be used as soon as it is produced
  - Unless you convert it –costs energy [2x]
- Transporting electricity costs energy
  - About 3% of electricity is lost in transport
  - Up to another 5% is lost in transformers
- These losses have to be accounted for:
  - Makes central production less attractive
  - Costs due to losses in The Netherlands are some Euro 18 mln /year
Benefits: Lower Transmission Losses [2]

- The Netherlands loses some Euro 18 mln /year
- However, already >50% of electricity is produced by large CHP /decentral power
  - This has reduced losses by 1/3 [i.e. actual losses would have been Euro 27 mln /year]
- One reason for benefit is that electricity is produced at *Point of Use*
  - Close to where you need it, no transport
- Second reason is that CHP is *Predictable*
  - You produce power when you also need heat
Benefits:

Home-Owner

- Own Power Station
  - Sense of independence
  - Potential to run even during power cut
- Reduced Energy Bill
  - Annual reduction about €225
  - Mostly through avoided kWh-purchase
- Environment
  - Contributes to efficient energy use
  - Without reduction in quality of life
  - Sensible, economic investment
Reduced Energy Bill [1]

- Normal buy-in price / kWh = ~Euro 0.13
- Transport costs / kWh = ~Euro 0.03

Let’s assume Euro 0.16 / kWh

Of 2200 kWh per year produced,
- 440 exported
- 1760 used [and not bought from Grid]

1760 kWh x Euro 0.16 = Euro 282
440 kWh x Euro 0.04 = Euro 17.60

[wholesale price refunded to home-owner]

Electrical saving: Euro 300 /year
Reduced Energy Bill [2]

- But, slight increase in gas use [~ 10%]
- Average house uses 3000 m³ / yr
- So now, 3300 m³ / yr
- Price / m³ = ~Euro 0.25
- Additional gas costs
  - 300 m³ x Euro 0.25 = **Euro 75** / yr
  - This has to be subtracted from the electricity gain
- Gain Euro 300
- Cost Euro -75
- **Saving** Euro 225 / year
Within the EU [15] the total market for microCHP is estimated at some 50 million appliances.
- Main markets are Germany, Netherlands, UK and [northern] Italy. These account for >50% of total
- Other countries include Belgium, Austria, Switzerland, Denmark and France

Countries need a significant winter period with cool winter days for microCHP to be economic
- >5 months per year heating season
If the full potential of microCHP were installed in the EU,
- Each the smallest generator of 1.1 kWe
- That makes 55 GW of production capacity
- That is >25% of the 200 GW EC target
  • [but what do you do with the heat in summer?]

If each generator saved 1.5 ton CO₂ / year
- Equals 75 mln ton CO₂ / year
- Significant addition towards achieving Kyoto

Investment made by home-owner
Rapid growth in the 90’s was realised on basis of strong installer support & incentives, regulations and subsidisation (1/2)

Regulatory key success factors

<table>
<thead>
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<th>Key success factor</th>
<th>Explanation</th>
<th>Period</th>
<th>Impact</th>
</tr>
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<tbody>
<tr>
<td><strong>Building regulations</strong></td>
<td>Regulations to decrease energy consumption in new construction increased uptake of condensing boiler (cheaper alternative to installing additional wall/ceiling/floor insulation)</td>
<td>Begin 1990’s</td>
<td>Fast adoption of condensing boilers by architects and project developers</td>
</tr>
</tbody>
</table>
| **Environmental regulations** | Introduction of MAP\(^1\) agreement: Utility companies committed to efficiency improvements and CO\(_2\) reductions: push effect for condensing boiler by utilities to meet targets  
High involvement and support from Novem and GasUnie | 1991 - ongoing | Energy distributors stimulated to promote condensing boilers                                                                                                                                                                                                 |
| **Subsidisation**          | Utility companies offered consumer subsidies (financed for 50% by government and through 2% levy on end-user electricity and gas prices)                                                               | 1991-1996         | Sales push from utilities led to increasing sales (yet only 38% of boiler sales subsidised)                                                                                                                                 |

1: Environmental Action Plan  
Source: ECN 2002; Roland Berger analysis
Rapid growth in the 90’s was realised on basis of strong installer support & incentives, regulations and subsidisation (2/2)

**Distribution key success factors**

<table>
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<th>Period</th>
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</tr>
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<tr>
<td><strong>Installer support</strong></td>
<td>Utility companies invested heavily in product promotion and training among installers and consumers</td>
<td>1990 +</td>
<td>Installers felt comfortable to install condensing boilers</td>
</tr>
<tr>
<td></td>
<td>Manufacturers investing in new product lines strongly promoted and advertised product and offered incentives to installers</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Installer incentives</strong></td>
<td>Installers received higher compensation for condensing boilers (estimation EUR 50-100)</td>
<td>1990-1996</td>
<td>Installers promoted condensing boilers strongly</td>
</tr>
<tr>
<td></td>
<td>Secondary benefits for installers from manufacturers e.g. trips</td>
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</tr>
<tr>
<td><strong>Product standardisation</strong></td>
<td>Manufacturers standardised products and installation requirements</td>
<td>1990 -</td>
<td>Condensing boilers high level of standardisation – simplified installation</td>
</tr>
<tr>
<td></td>
<td>The GasUnie was responsible for ensuring constant high national gas quality (prerequisite)</td>
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<td></td>
<td>High level of Gastec certification for boiler producers (Gastec: independent international organisation for testing and certifying gas related products for manufacturers and distributors)</td>
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Source: ECN 2002; Gastec; Roland Berger analysis