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Energy Economics Environment

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MicroCHP – The Magic Boiler

European Context on Developments & Changes

Contents

- Was ist Mikro-KWK?
- Vorteile
- Marktgröße
- Mikro-KWK - Wahrheiten
- Projekte
- Conclusion



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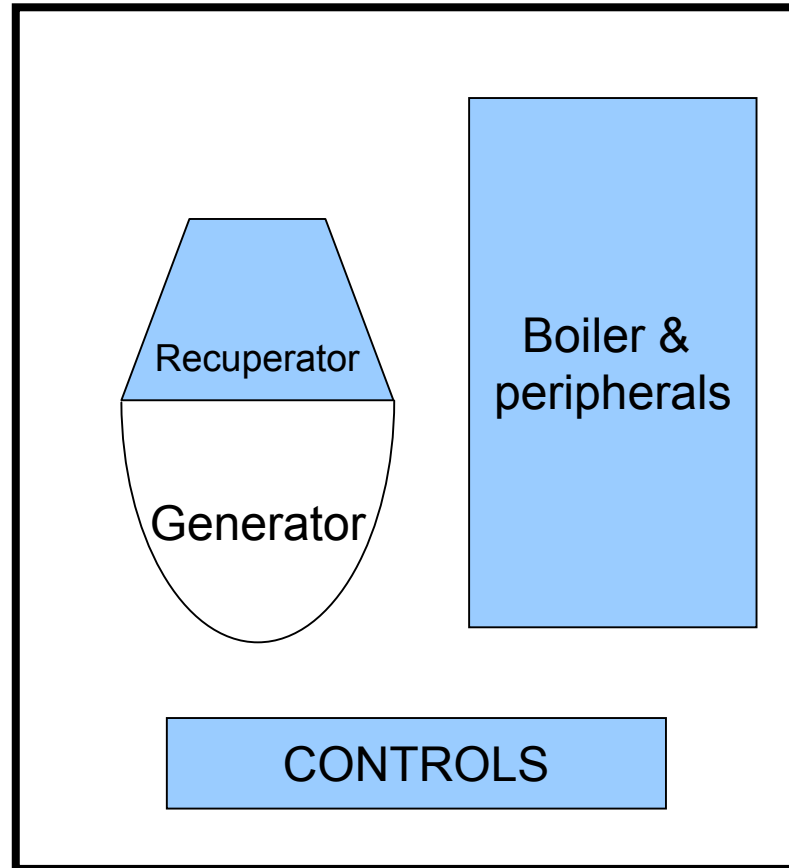
Micro-generation

- MicroCHP is the combined production of heat and power
 - It is no more than an electricity producing boiler
 - The electrical side requires attention
- Therefore, a **maximum 15 kWe** in the household environment is a useful definition for microCHP
 - Wires in the house do not need changing
 - Simple installation procedures
 - Heat Side modulates



Fundamentals:

MicroCHP – Three Basic Parts



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Fundamentals:

Micro-generation

- Even by distributed generation standards, each generator is very small
- The 'generator owners' are the public
- Generation at the point of use
- Market potential is high – particularly for micro-CHP



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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
 - At least 1 tonne of CO₂ emissions reduced per unit per year
- **Infrastructure**
 - Diversity of supply: better security & reliability
 - Helps defer investment costs



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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



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Benefits:

Energy Company

- **Customer Relationship**
 - Tie in customer with services contract
 - Offer, new, innovative product
- **Clean Energy Contribution**
 - Emissions reductions programme
 - Enhanced Security of Supply
- **Generating Capacity**
 - Long term build up of extra production
 - Helps ease Europe's 200 GW capacity deficit
 - Paid for by end-user



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The Opportunity:

Market Potential

- The central heating market is huge
 - Netherlands 400,000 per year
 - United Kingdom 1,300,000 per year
 - Germany 600,000 per year
 - Italy 500,000 per year
 - Rest of Europe >1,000,000 per year
- MicroCHP can directly replace the existing central heating appliance
 - At least 1 in 4 boilers can be replaced with a Magic Boiler
 - This implies a potential market of at least 500,000 Magic Boilers per year in the EU
 - Total potential is 40 million microCHP [EU 15]
- Winter period for microCHP to be economic
 - heating season 4-5 months or more

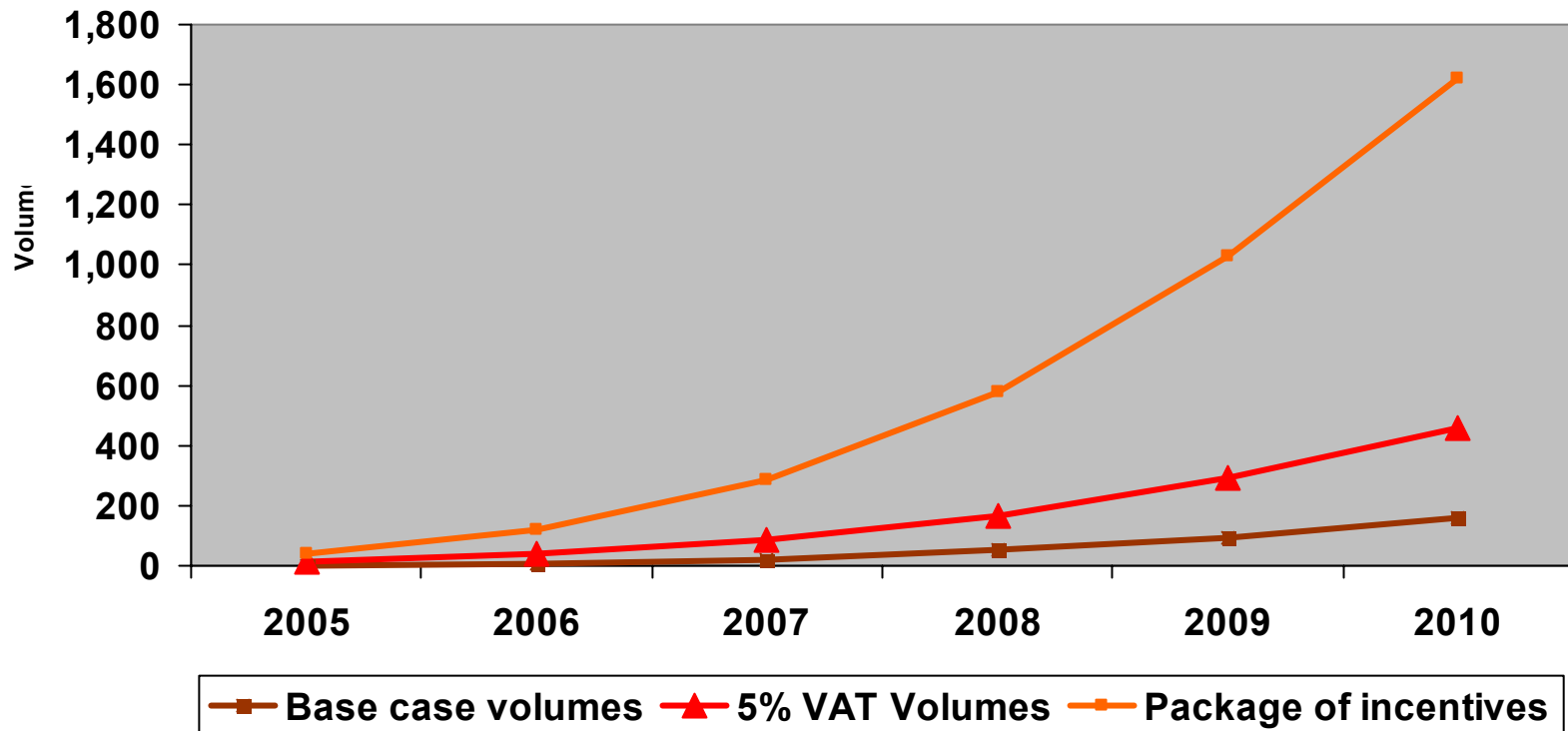


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The Opportunity: Market Framework

Cumulative microCHP Market Volumes



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The Opportunity:

Stimuli for Growth

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



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Case Situation

- Central Heating System breaks down
 - A replacement is required in 24 hours
 - MicroCHP is placed in the home
- Before it is connected it needs:
 - ENS
 - Permission Network Company
 - Annualized Efficiency Calculation
- Can be improved with:
 - Standard connection requirements
 - Type approval of microCHP
 - Installer check & OK for switching on [“Inform & Fit”]



Grid Connection: Overview

Country	Fit & Inform	Obligation to Connect	Right to feed in	Permission Needed	Easy In Practice
Germany	Yes*	Yes	Yes	Yes	No*
Italia	Yes*	Yes	No	Yes	No
Nederland	Yes*	No	No	Yes	Yes
UK	Yes	Yes	Yes	Yes	Yes

* Pending European connection Standard PrEN 50438



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Meter Installation: Overview

Country	Own Meter	MicroCHP Team Install	Same day	Network Permission Needed	Current Meter suitable
Germany	Yes	No	No	Yes	Yes*
Italia	No	No	No	Yes	Yes*
Nederland	Yes	No	No	Yes	Yes*
UK	Yes	No	Yes	Yes	Yes*

* Feraris meter runs backwards / digital meter is an alternative



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Upfront Support: Overview

Country	Level Playing Field	Lower VAT	Structural Support	Project support [municipal]
Germany	No	No	Yes	Yes
Italia	No	No	No	Yes
Nederland	No	No	No	Yes
UK	Yes	Yes	Yes	Yes



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kWh Pricing:

Overview

Country	Registration Fee	Minimum price Guarantee	kWh Support	Network kWh buy-back
Germany	Yes	Yes	Yes	Yes
Italia	No	No	No	No
Nederland	Yes	No	No	No
UK	Yes	No	Yes	Yes



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Changes Required:

Why is Change so Slow?

- **Government Decision Making**
 - Not yet enough evidence / information
- **Lobby from Energy Companies**
 - Afraid of decentralized power
- **Where are the MicroCHP's?**
 - "Launching next Year" Syndrome



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Changes Required:

Governments

- Decisions are made slowly
 - Industry partners giving conflicting statements
 - Need evidence of industry existence
 - Need evidence of benefits

- So what are the issues for the Energy companies?



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Changes Required:

Energy Companies

➤ False fears:

- MicroCHP is unpredictable
- The network can't handle the large quantities of electricity from "the bottom up"
- The technology is unproven

➤ True fear:

- Network income will decrease over time

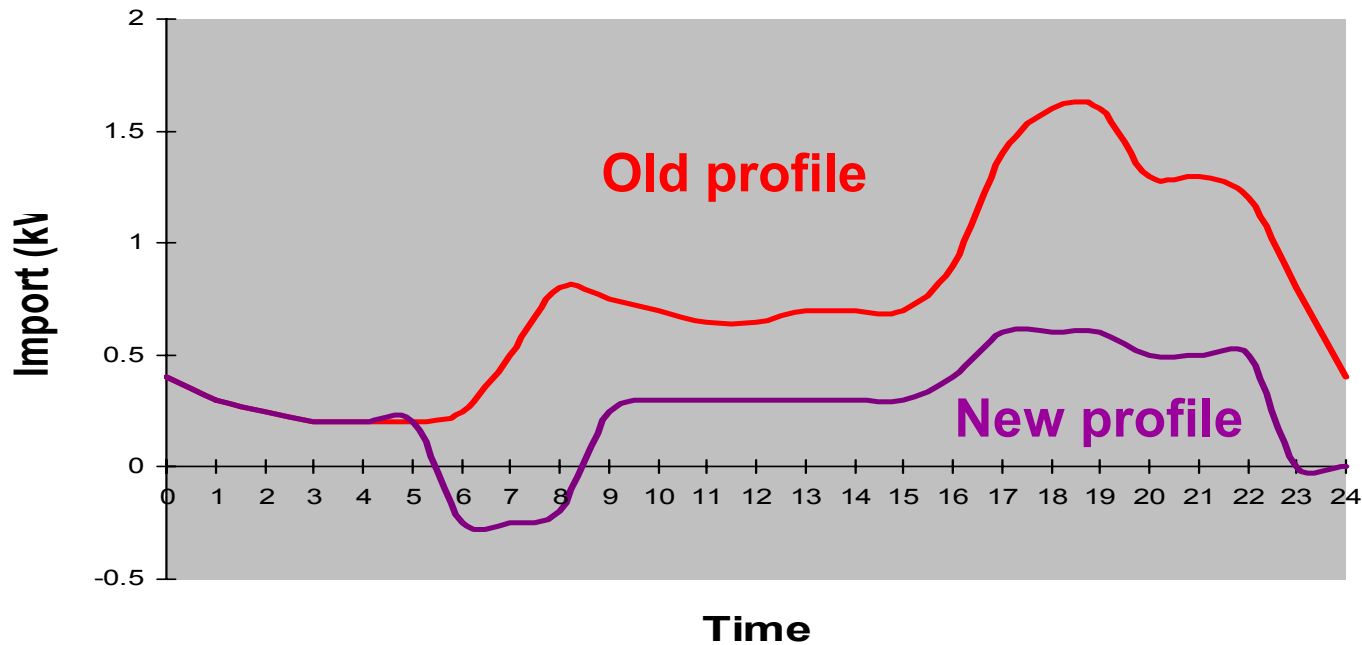


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MicroCHP is Predictable

Effect of a microCHP unit on average domestic electricity demand – winter weekday

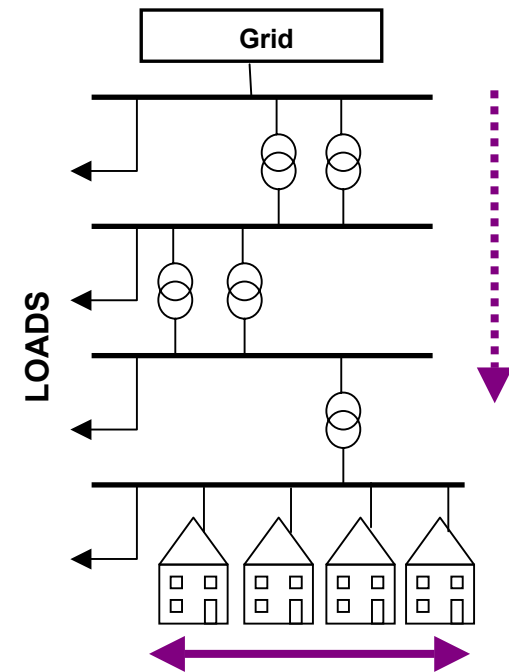


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MicroCHP Power Goes Next Door

- **A 1 kWe electric microCHP**
 - Generates 2500 kWh of electricity per year
 - 80% is used in the home
 - So only 500 kWh are exported per year
 - This is LESS than 2 kWh per day
- **Even with 20% growth year-on-year**
 - No threat of burdening the electricity grid
- **Intelligent Technology available**
 - As network is updated, intelligent transformers installed
 - Upgrade electricity from low voltage, at no extra cost



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MicroCHP has proven itself

- **36 developers of microCHP globally**
 - Stirling, Steamcells, Gas engines, Gas turbines, fuel cells
- **5 have been selling for years**
 - Gas engines [Ecopower, Senertech, Honda]
 - Stirling [Whisper Tech]
 - Steamcell [Otag]
- **More are very promising**
 - Stirling [Enatec, Microgen, Stirling Systems, etc]
 - Steamcell [Enginion]
 - Gas turbines [Azimuth]
 - Fuel Cells [Nedstack]



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Network Company Income

- One real fear is reduced network income
 - Over time income for network companies will reduce
 - Unless current model of income generation is changed
- Current business model invoices per delivered kWh
 - MicroCHP industry needs to work with network industry
 - Develop model to fixed cost per connection
 - Gradual change required to allow microCHP smooth market entry



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Network Company Income

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
MicroCHP units cumulative [1kWe]	1,000	2,000	4,000	8,000	16,000	32,000	64,000	128,000	256,000
Electricity generated [MWh]	2,500	5,000	10,000	20,000	40,000	80,000	160,000	320,000	640,000
Value of transport fee [EU 0.04 / kWh]	€ 100,000	€ 200,000	€ 400,000	€ 800,000	€ 1,600,000	€ 3,200,000	€ 6,400,000	€ 12,800,000	€ 25,600,000

➤ Need to adjust Network Income over time

➤ Start changing the transport part for fixed income



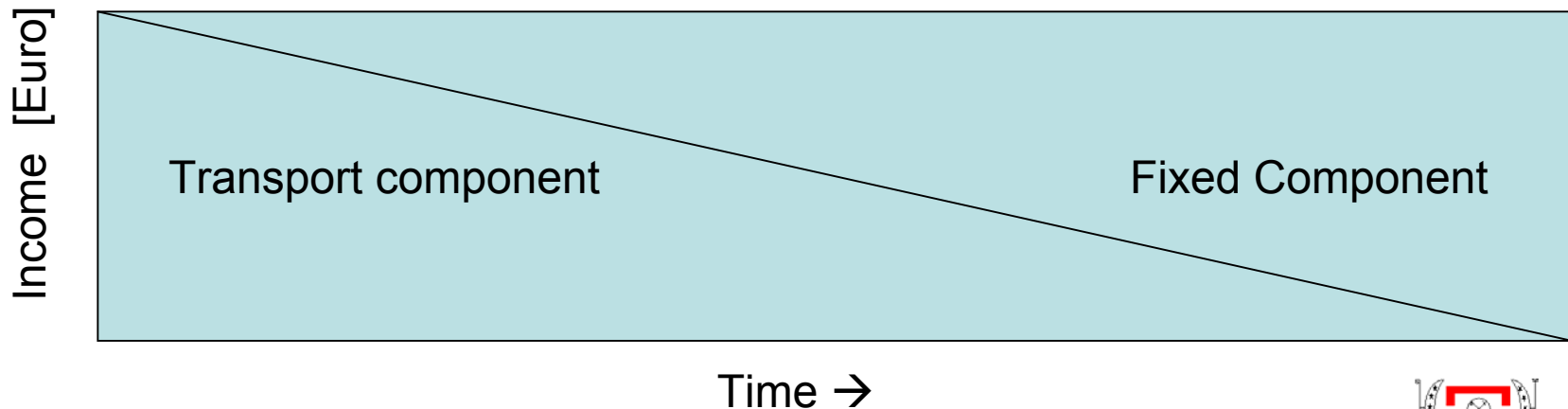
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Network Company Income

➤ Discussion to start now

- Prevents aversion to decentralised power with big Energy Companies
- Example model to form the basis of discussion
- Use benefits of microCHP as the basis, i.e. deferred network investment, to postpone fixed income model



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Real World Projects

- High Number of High Profile Projects now in place – Big & Small together
 - Honda in Japan >20,000 units placed
 - Senertech in Germany > 10,000 units placed
 - Whispergen started installing 80,000 project
 - Microgen – 1st unit placed in Dutch home
 - Otag – sold out 1st year production
 - Enatec – delivered 1st Stirling to Dutch Economics Minster



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Real World Projects:

Gasunie Netherlands [50 units]

- Electricity consumption in the house 50% - 80% [$\sim 70\%$]
 - Production just over 2000 kWh
 - Demand curves coincide
- For 1 location gas consumption did NOT increase

Tolbert

➤ Long, two hour cycles through a 150 liter buffer

- 2 locations 7 kWth sufficient at 20° C

- Floor heating systems
- WhisperGen ran continuously
- No stops / starts



Technical Findings

➤ Controller

- Standard = better;
- wireless – potential extra work

➤ Burner

- Adjust to local gas pressures & type

➤ Buffer

- Better larger
- Than too small [i.e. >100 l]

➤ Floor Heating

- Very good for the performance of the microCHP

➤ Corrosion

- Clean existing radiator systems



Management

➤ Customer Expectations

- Clear definition of activities BEFOREHAND
- Excellent service organisation to step in when needed

➤ Training of Installation Staff

- Gas and electricity certificates needed
- Assure correct equipment & procedures in place
- Double check after work done

➤ Suitable Properties only

- Heat demand to fit heat capacity of unit
- Assess carefully accessibility of location & space



Conclusion

- **MicroCHP is finally coming to market**
 - First projects to be managed carefully
 - MicroCHP will contribute significantly to production potential and emissions reductions in the EU
- **Industry now coming together for manufacturing**
 - Next two years will see big investments and big production volumes starting
 - Government to wake up to call for simplification of regulations and installation practices



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