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Small-scale cogeneration in Europe: Technology status and market development

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Barcelona – 3 November 2009

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Agenda

- Small-scale cogeneration
- Micro-cogeneration

Small-scale cogeneration – technology range

- **Internal combustion engines (ICEs)** – default technology
- **Long-life ICEs** – developed for residential and small commercial applications
- **Micro-turbines** – attractive in some applications because of lower servicing requirement and compact design, high temperature exhaust can drive double effect absorption chiller
- **Fuel cells** – attractive for demonstration projects, but not yet economic

Application	Long-life ICE	ICE	Micro-turbine	Fuel Cell
Apartment Buildings	✓	✓	✓	✓
Commercial Buildings	✓	✓	✓	✓
Municipal Schemes		✓	✓	✓
Small Industries		✓		✓

Small-scale cogeneration – several applications

Application	Typical Capacity	Description	Global Market Status
Apartment Buildings	5 – 100 kW	Working alongside boilers providing communal heating.	Proven and widespread in Continental Europe
Commercial Buildings	20 kW – 1 MW	Provide space heating / hot water supply and chilled water for cooling.	Proven and common worldwide
Municipal Schemes	20 kW – 1 MW	In municipal buildings and to serve existing or new district energy schemes.	Proven and widespread in Northern and Eastern Europe
Small Industries	1 + MW	Providing process steam and hot air for drying. The carbon dioxide can be used in greenhouses.	Proven and common worldwide

Small-scale cogeneration - technology summary

Technology	Capacity Range	Electrical Efficiency	Market Status	Selected Suppliers
ICE	10 kW +	25% - >40%	Mature and default technology	Tedom GE Jenbacher Waukesha
Long-life ICE	1 – 25 kW	~25%	Commercial (natural gas)	Baxi Senertec EC Power Yanmar
Micro-turbine	30 – 250 kW	25 – 30%	Commercial	Capstone Ingersoll Rand
Fuel Cell	200 kW – 1 MW	40 – 45%	Early commercial	FuelCell Energy UTC

How is the market developing: 2008/09?

Country	Market size (installations/yr) 5-100 kW		Future outlook for 5 – 100 kW market
	Natural Gas	Biogas	
Germany	2500 – 3500	<250	Promising growth after a small decline in 2008
Italy	<100	<10	Slow growth if administrative barriers are removed
Netherlands	100 - 200	<25	Steady growth
UK	100 - 200	Negligible	Steady growth, which will increase when feed-in tariffs are introduced

Agenda

- Small-scale cogeneration
- Micro-cogeneration

Many micro-cogeneration products ...

Baxi - MEC



Stirling
Engine



WhisperGen /
EHE



OTAG

Rankine
Cycle



Energetix



Ariston & Bosch -
Enatec



Remeha - MEC



Vaillant Ecopower



Yanmar Genlight

Baxi SenerTec



ICE



Honda ECOWILL

... more products



ClearEdge Power



Plug Power



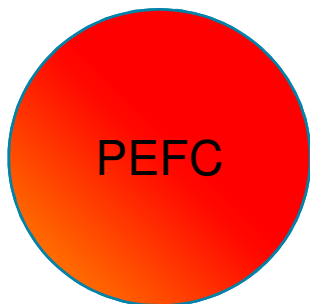
Baxi Innotech



Ceres Power



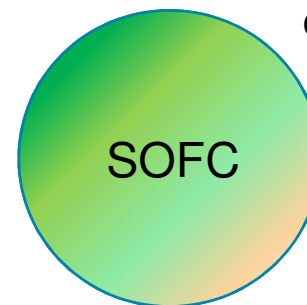
Ceramic Fuel Cells



PEFC



Toshiba Ene-Farm



SOFC



GS FuelCell



Tokyo Gas & Panasonic
Ene-Farm

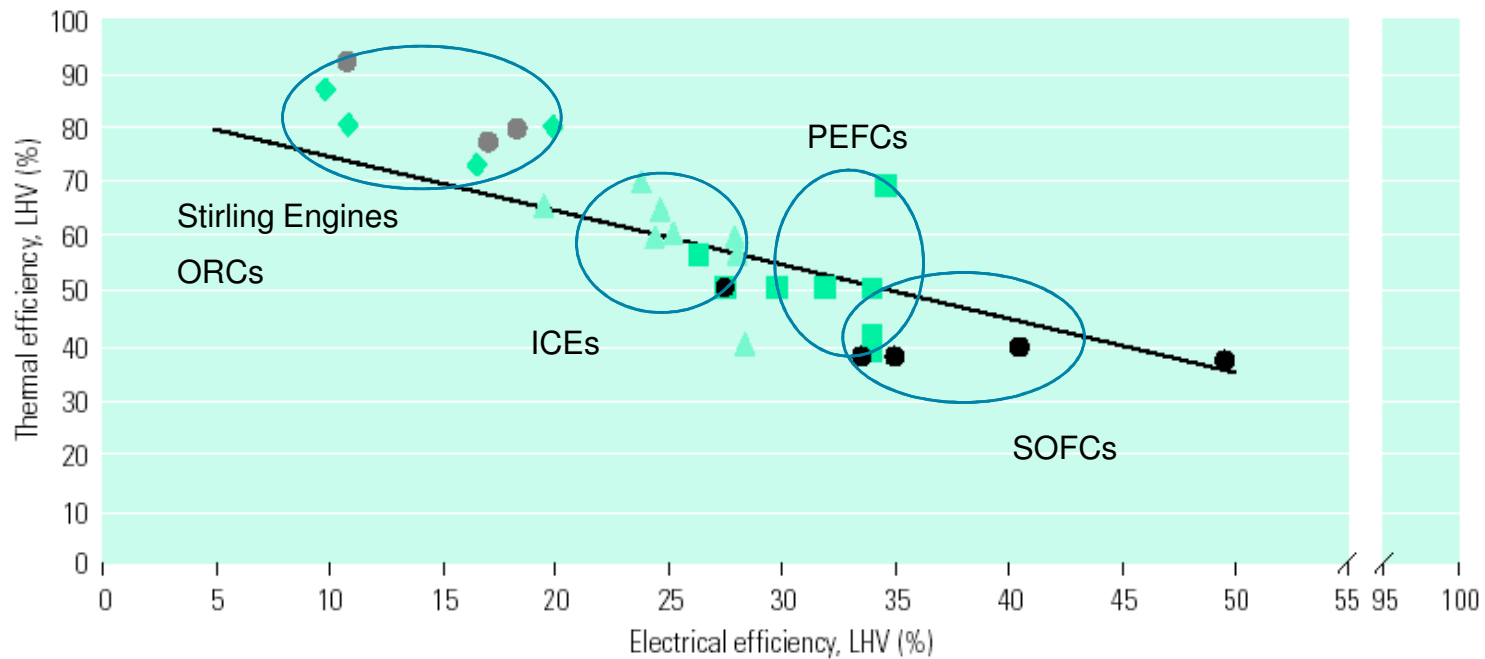
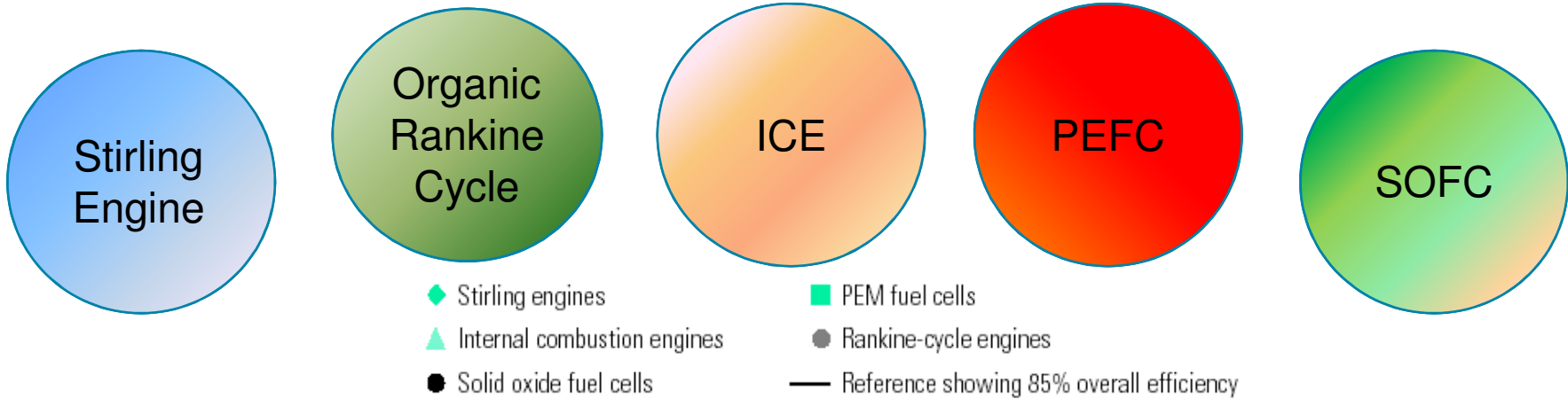


Hexis



Osaka Gas & Kyocera

A wide range of technologies with different performance



Flavours of Micro-cogeneration – Single-family house ...



Annual energy demand ~18,500 kWh

Heat 60% - 85%

Electricity 15% - 40%

Baxi - MEC



Stirling Engine



Whisper Tech / EHE



Ariston - ENATEC

Organic Rankine Cycle



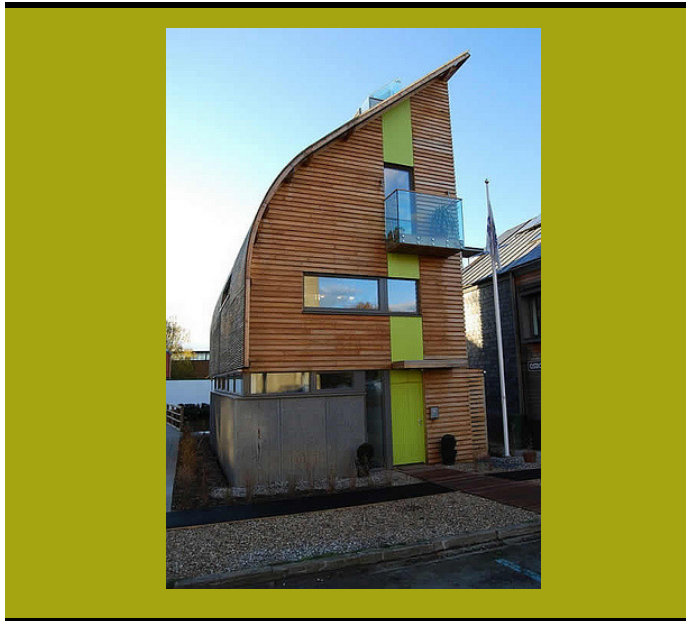
Energetix

ICE



Honda ECOWILL

... And a low-carbon house highlighting relevance for Spain



Annual energy demand <10,200 kWh

Heat demand ~12%

Electricity demand ~88%



Tokyo Gas & Panasonic



Ebara Ballard

PEFC



Ceramic Fuel Cells



Galileo

SOFC



Hexis



Osaka Gas & Kyocera