## Living with domestic CHP

Jeremy Harrison EA Technology



## EA Technology field trials

- 1990 feasibility study
- 1999 laboratory trials & evaluation
- 2000 sheltered trials (5 units)
- 2001 alpha trials (20 units)
- 2002 beta trials (30 units)
- 2003 "commercial" trials?



## 2002-2003 TRIALS

- 30 installations
- 15 Ipswich area
- 15 Chester area
  - 10 existing
  - 5 new
- Mix of sizes, ages, constructions and occupancy

























## Example trial house

- 138m² total floor area
- three storey living on mid floor
- built 1998
- insulation to Building Regulations
- usage pattern
  - continuous occupancy
  - copious showers





# Original heating system (1)

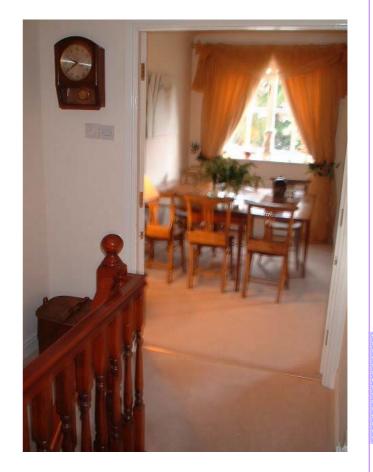
- Wall-hung, noncondensing boiler in kitchen (mid-floor)
- Y-plan (3-port valve)
- fully pumped system
- 7-day programmer
- strap-on cylinder thermostat





# Original heating system (2)

- Single zone micro-bore
- TRV to all except midlanding dump radiator
- thermostat on midlanding
- separate DHW and space heating programmes
- questionable radiator sizing/commissioning





## Changes since last year

### 2002

- Technical specification
  - 800We/7kWt
- Configuration
  - boiler in series
- Monitoring
  - integrated into controller
- Characteristics
  - noise/appearance
- Control (optimised)

#### 2003

- Technical specification
  - 1.2kWe/9kWt
- Configuration
  - no supplementary
- Monitoring
  - detailed (not all homes)
- Characteristics
  - noise/appearance
- Control (conventional)



# Micro CHP system (1)

- MK III WhisperGen
- Directly below boiler in kitchen
- Integral G83 LOM protection
- Controlled from existing programmer (run signal)
- Remote data logging and on-line diagnostics





# Micro CHP system (2)



- Differences from boiler system
  - smaller peak thermal output
  - overrun (pump fed from engine)
- Location
  - floor mounted
- Connection
  - G83
  - normal flow temperature



## How does it compare?

#### **GAS BOILER**

- thermal response
  - TRV coarse control
  - thermal inertia
- stratification
- DHW recovery time
- noise
  - annoying but accepted
- appearance
  - compact
  - location compromise

#### MICRO CHP

- thermal response
  - needs thermal buffer
- stratification
- DHW recovery time
  - thermal store solution
- noise
  - OK for location
- appearance
  - large but acceptable



## **Economics** (nominal)

Annual gas bill
£ 550

Annual electricity bill
£ 450

Annual gas consumption kWh 35 000

Annual space heat kWht 18 000

Annual DHW kWht 6 000

Annual electric consumption kWh 6 000

Generation kWhe 3 400

Projected savings
£ 150-200



## Performance

### **Problems I feared**

- noise
  - no problem
- vibration
  - no problem
- failures
  - on-line diagnostics
- inadequate heating
  - no problem

### **Benefits I hoped for**

- savings
  - gas
  - electric
- comfort
  - MIT
  - Hot water
- green credentials











## The ideal customer?

- High demands for comfort
- High demands for hot water
- Consequently high energy use offers potential for big savings
- Prefer to pay for energy service rather than product
- Micro CHP offers improved energy efficiency without compromising comfort



## **Environmental comments**

- will target CO<sub>2</sub> savings be achieved?
  - higher mean internal temperature (MIT)
  - more likely to mitigate increase in energy demand than actually reduce it?
- target market (not fuel poor)
  - % savings
  - comfort factor





## Subjective reactions

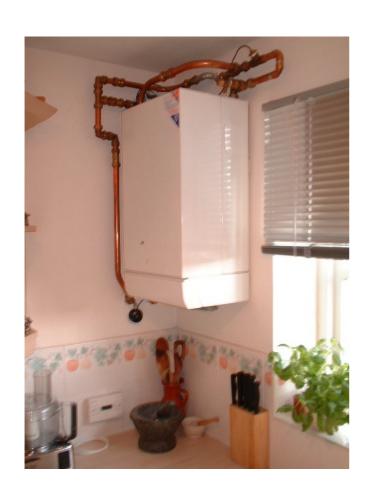


## **Consumer panel**

- Adult male
- Adult female
- Teenage female
- Teenage males (2)



# Consumer experience (1)



### **ADULT 1**

hot water

• heat (24°C)



control



pipes





# Consumer experience (2)



### **ADULT 2**

hot water



• heat (24°C)



control



pipes



garage



gas bill



electricity bill





# Consumer experience (3)



### **TEENAGER 1**

hot water



### **TEENAGER 2**

"when are we getting one?"

### **TEENAGER 3**

"I'm on level 4"



## The other experiences

- 80% of respondents want to keep the system
  - impossible for some
- All have demonstrated significant energy savings
- Systems have performed well
  - excellent service support
- Some supplementary heat requirement for larger houses



## Conclusions

- Raises awareness of pre-existing shortcomings
- Anticipated energy savings may lead to higher comfort demands and consequently lower savings
- Need to target customers carefully and give clear message about what micro CHP will or will not do for them
- Excellent service support essential



## What happens next?

- Live market test
  - partnership with housebuilder
- 400 systems to be sold winter 2003/04
- Majority will be new-build with thermal store
  - improves performance
  - simplifies installation
- Need for ongoing monitoring
  - profile settlement (economic)
  - SEDBUK, EEC etc (environmental)

