Fuel cell micro CHP:
A social housing solution?

Presented to

CHPA public sector workshop

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Overview

What is CHP?

Challenges facing public sector housing

Fuel cell mCHP

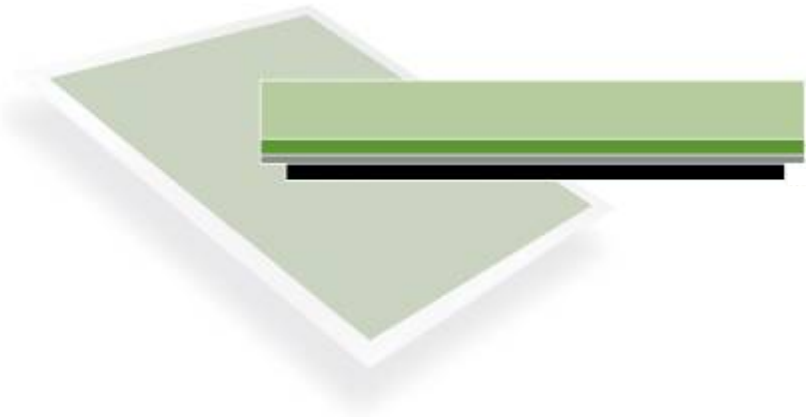
BlueGen

Is solar PV the only choice?

Public sector benefits

A core market for CFCL

Summary



We all know what CHP is now … or do we?

Combined Heat and Power

- Is it the generation of power as a by product of a heating system?

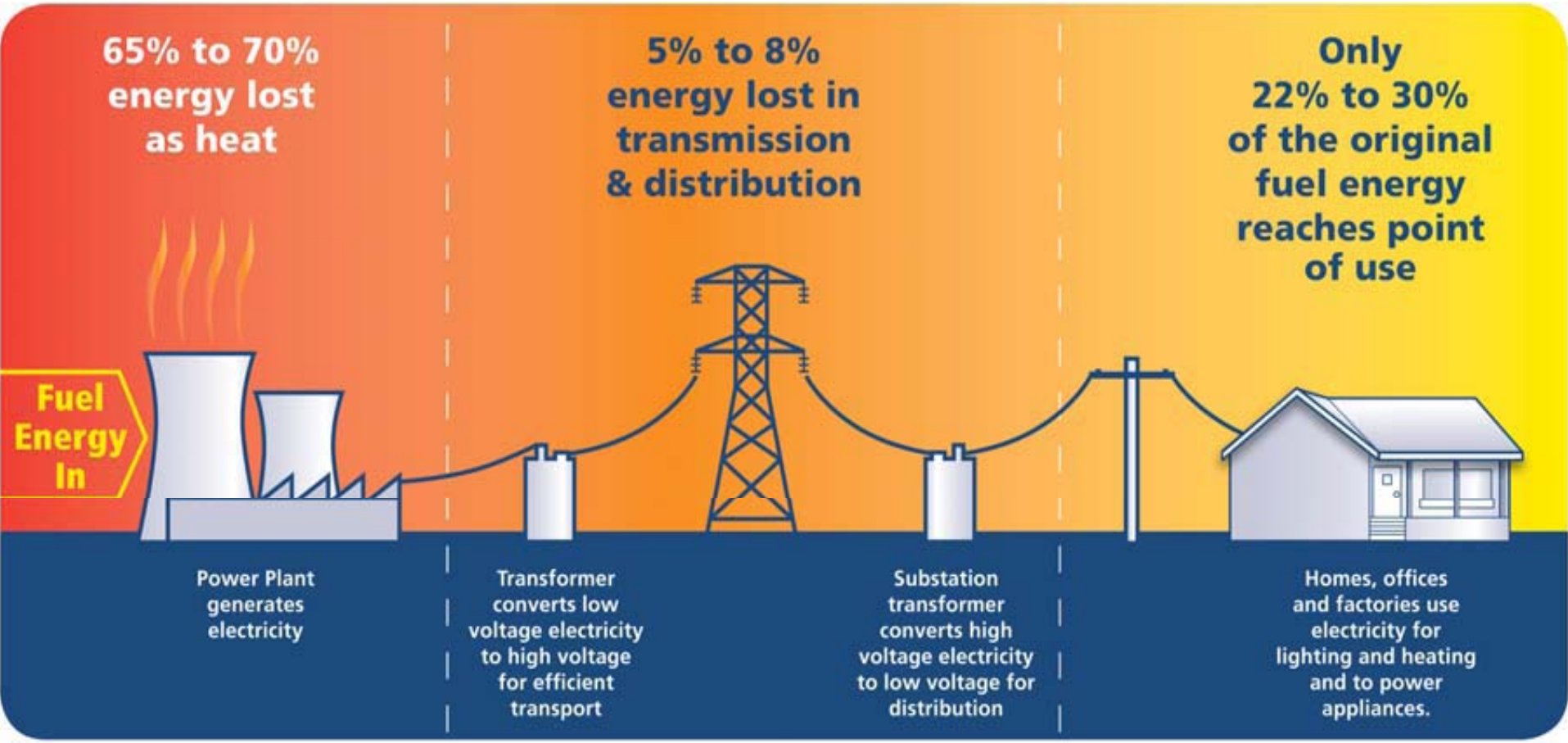
OR

- Is it the recovery of heat as the by product of a power generation system?

And at this point in the afternoon, does it matter?!

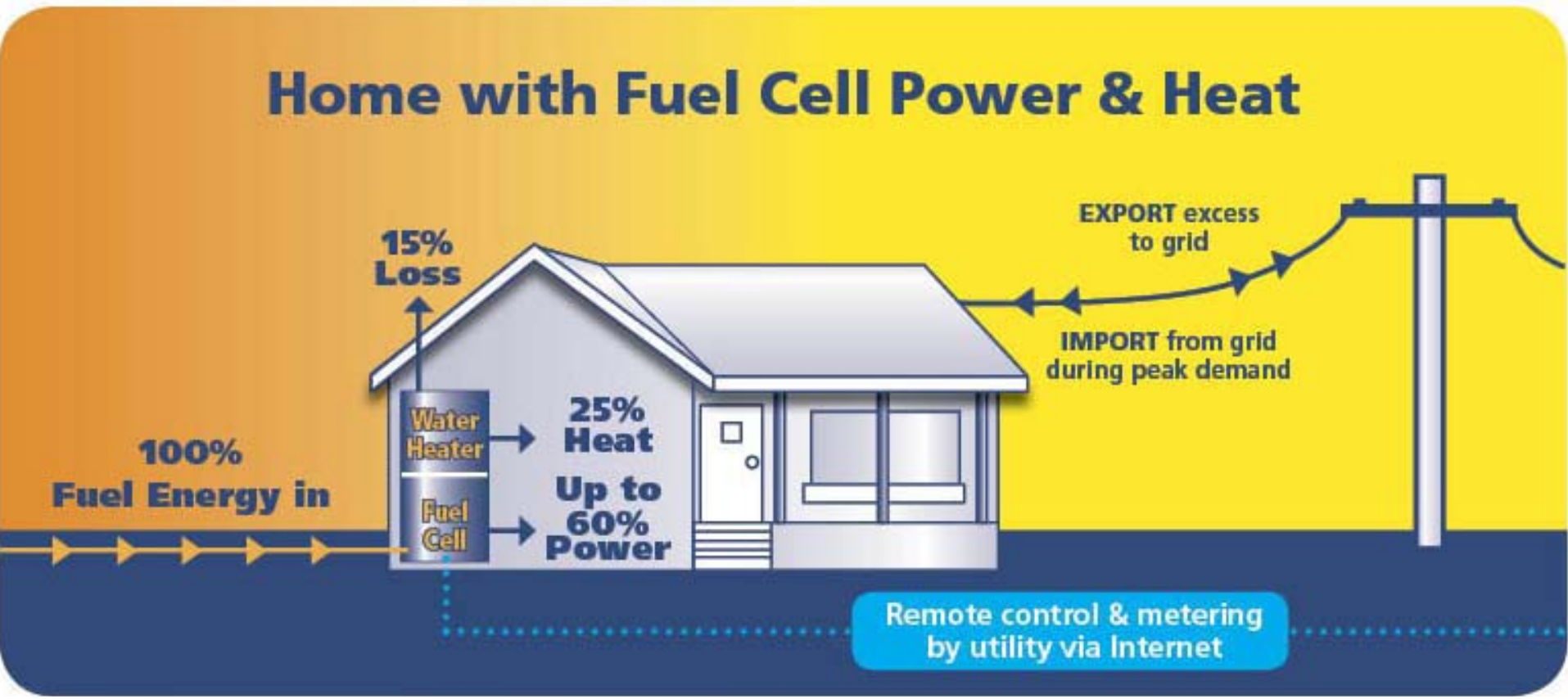
"Mainframe" power generation

Coal fired generation – up to 50% of UK Grid



Distributed power generation

Up to 85% of the primary energy usefully used in the home

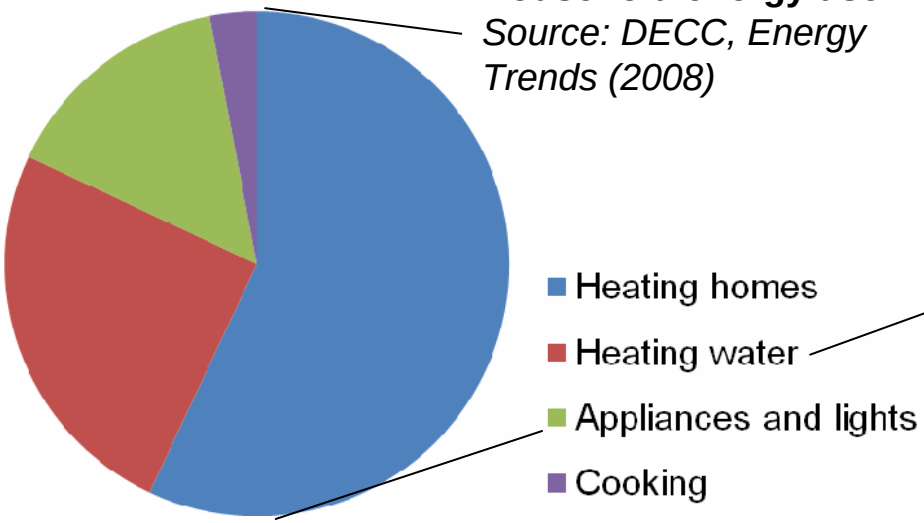


Challenges facing public sector housing

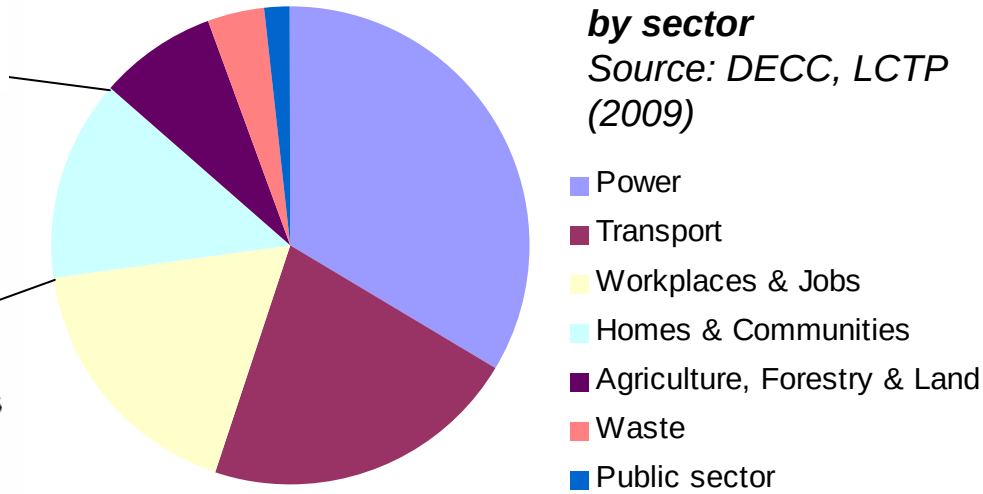
Carbon emissions

- Buildings are responsible for c. 33% of the UK's GHG emissions
- Public sector housing at the forefront of residential carbon emissions reductions
- Obligations on social housing first and private housing later
- The public sector has a leading role to show what is possible
- CRC is putting the emphasis on *absolute* carbon emission reductions

Household energy use
Source: DECC, Energy Trends (2008)



UK carbon emissions by sector
Source: DECC, LCTP (2009)



Challenges facing public sector housing

Code Compliance

- BREEAM code level 4 applies now to new build
- Need to plan for BREEAM code levels 5 and 6
- No clear definition yet as to what “zero carbon” means
- There is no clear path to achieving code compliance
- New solutions are required for new build
- Retrofit of existing stock is an even bigger challenge

BRE Innovation Park, Watford

Challenges facing public sector housing

Cost

- Cavity wall and roof insulation is a given
- Solid wall insulation is more expensive but necessary
- Then what?
  - Solar PV?
    - *Orientation, Cost, Run Hours, Carbon Abatement Impact*
  - Solar thermal?
    - *Orientation, Measurement, Carbon Abatement Impact*
  - mCHP?
    - *Engine based mCHP or fuel cell based mCHP?*

Key benefits of fuel cell mCHP

Addresses key social housing challenges

- High electrical efficiency significantly reduces carbon emissions
- Carbon abatement allows compliance with future BREEAM code levels
- Eligible for mCHP feed in tariff so reduces costs
- High electrical efficiency means low cost of electricity, even before feed in tariff payments

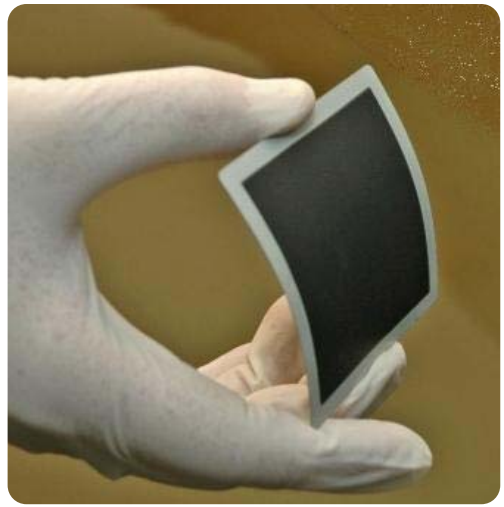
Fuel cell mCHP is the generation of power

with heat recovery as a useful by product

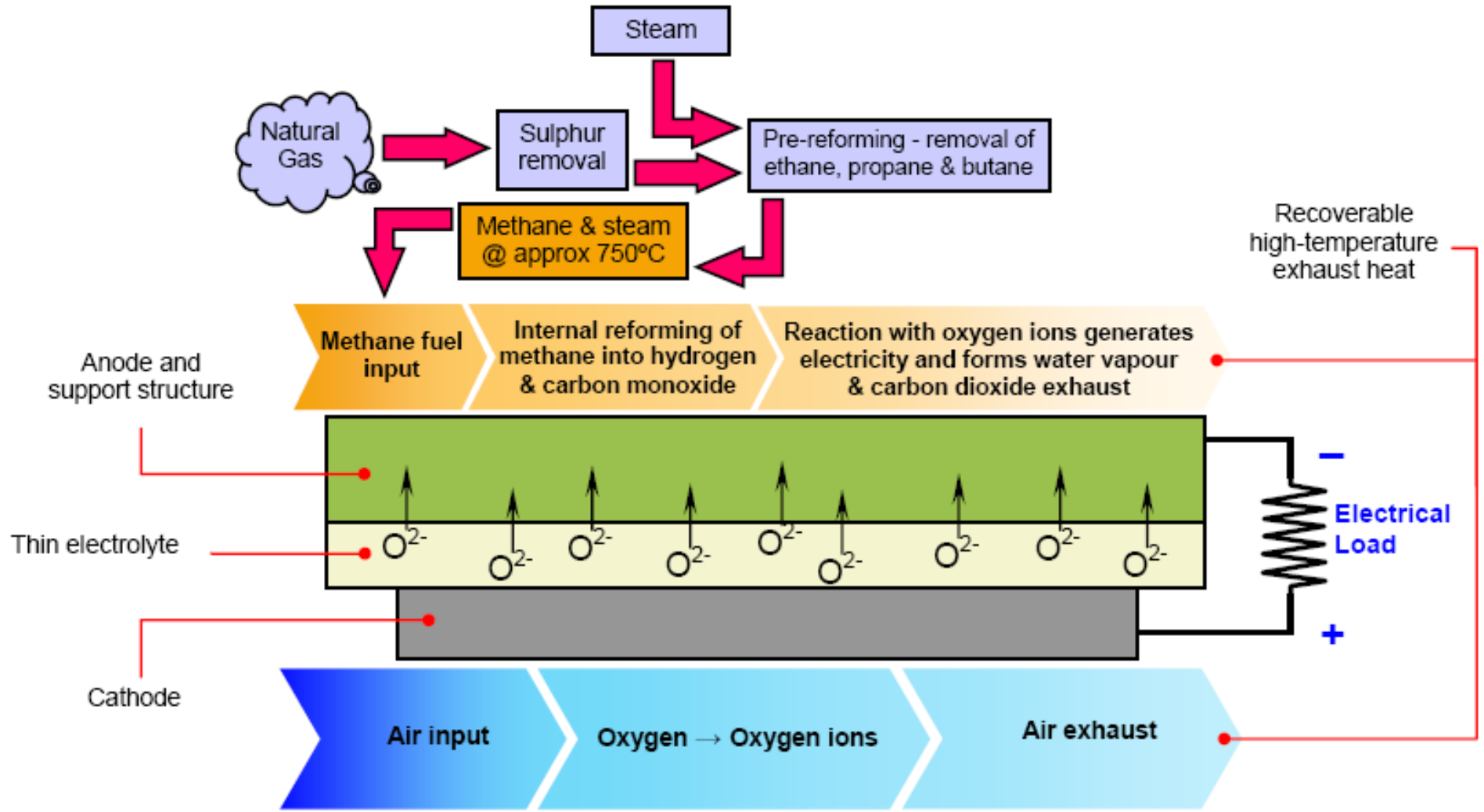
What is a fuel cell?

An electrochemical power generator

- No combustion – NOT a boiler
  - No NO_x
  - No SO_x
  - Low overall emissions
- Solid state
  - Few moving parts
  - Long life
  - Low maintenance
- Continuous power generation
  - Prefers not to cycle on and off
  - Longest run times available
  - High levels of annual power generation



How does a fuel cell work?



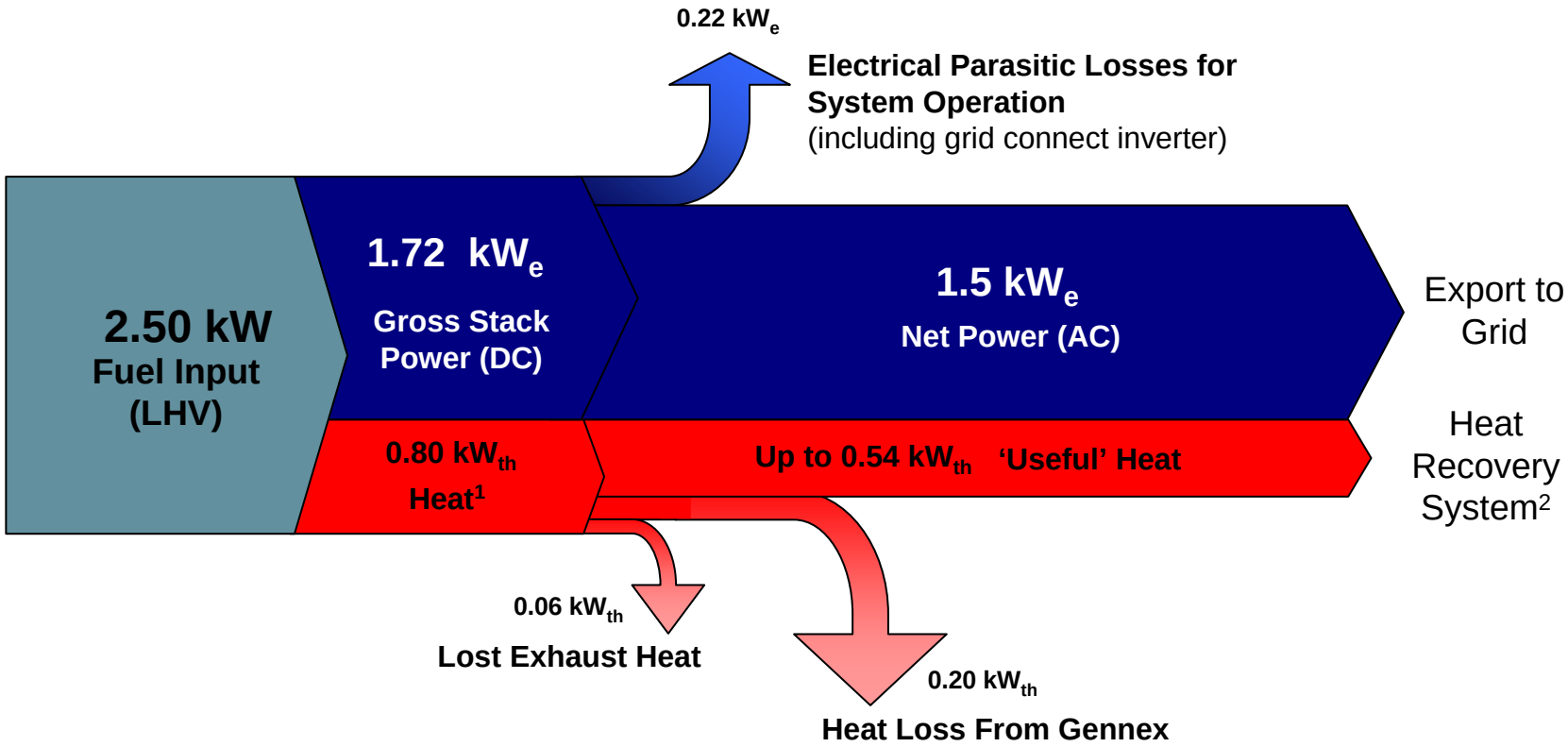
BlueGEN

A fuel cell generating power and providing hot water

2010 summary specifications:

- Voltage / frequency 230V / 50 Hz
- Electrical power: Up to 2 kW
- Peak electrical efficiency: 60% at 1.5kW
- Overall efficiency: Up to 85%
- System design life: 80,000 hrs
- Compliance: CE & European codes
- Grid connection: Parallel
- Gas desulphurisation: Integrated
- Water treatment system: Internal
- Waste heat recovery: Integrated (requires HWC)

BlueGEN Energy Balance



1. Incorporates some HHV (latent heat) recovered from the fuel input.

2. Based on exhaust gas cooled to 30° C;
   90% WHR efficiency

Key features of BlueGEN

Carbon emissions

- High electrical efficiency, up to 60%
  - *Much better than grid electricity at c. 35%*
  - *Reduces carbon by displacing grid electricity*
- Combined Heat and Power
  - *Reduces primary energy use ("free" hot water)*
  - *Further reduces carbon*
  - *Annual carbon emissions displaced between 4 and 6 tonnes CO_2 depending on power output setting*

Key features of BlueGEN

Compliance

- Low thermal output
  - *Suitable for modern homes with low thermal demand*
  - *Allowable solution for BREEAM code levels 4, 5 and 6*
  - *Complements LZC heating systems (heat pumps, solar thermal)*
  - *Maximises annual run hours (8,760 per year)*
- 2kW max output
  - *Complies with max permitted rating under feed in tariff*
  - *Maximises power generation (up to 17,520 kWh per year)*
  - *Maximises feed in tariff receipts*

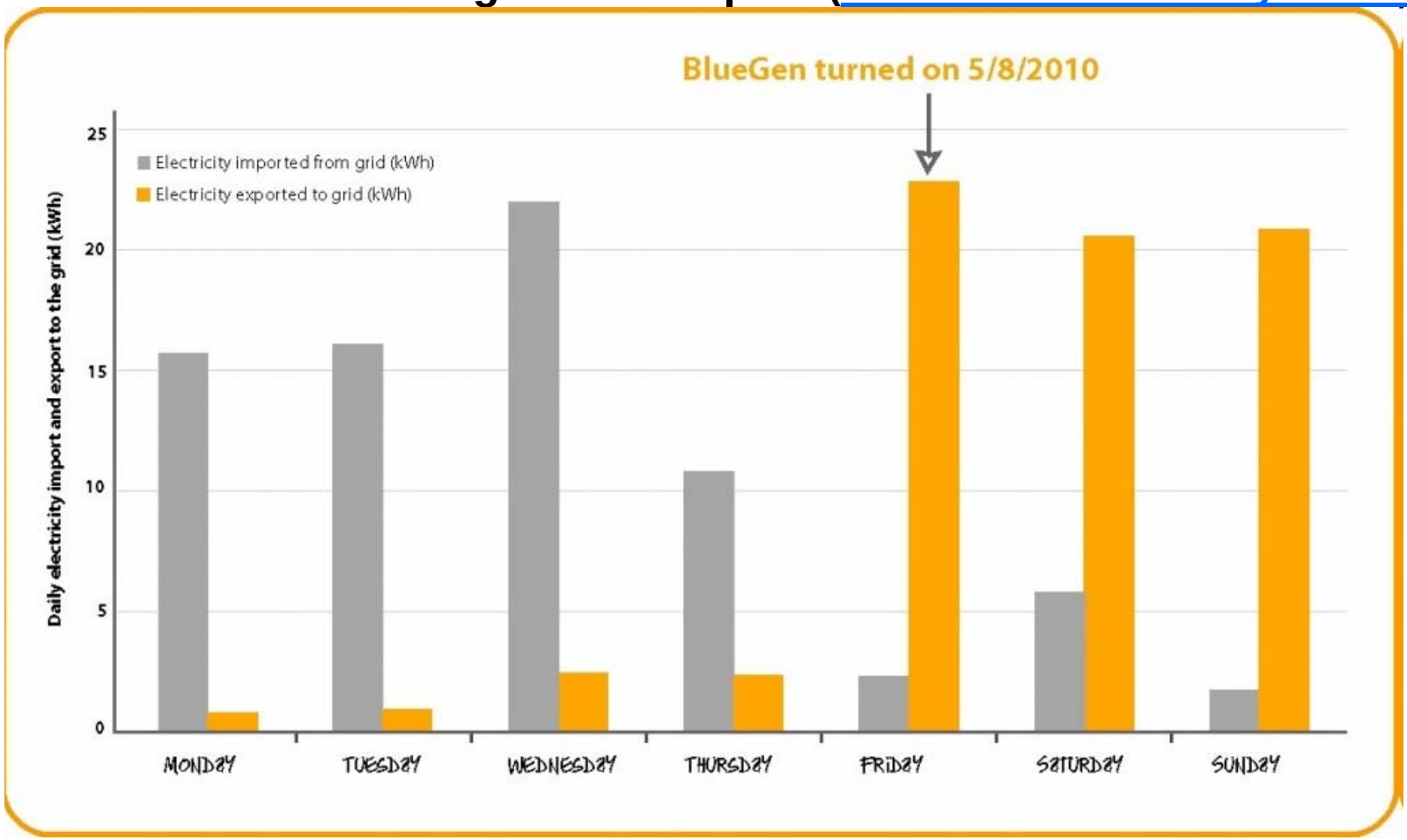
Key features of BlueGEN

Cost

- Reduces the marginal cost of generation
  - *5p-6p per kWh electricity vs 10p-12p retail price*
  - *Also eligible for the mCHP feed in tariff at 10p per kWh*
  - *Provides a net income after the costs of gas and maintenance and capital amortisation*
- No specialist connections
- Annual maintenance intervals
- No planning issues

Challenging the solar PV assumption

Fuel Cell mCHP makes a significant impact (www.smarthomefamily.com.au)



Carbon Impact Comparison

	2kW Solar PV	2kW BlueGen
Annual UK run hours (equivalent at full power)	**c. 850**	**c. 8,760**
Annual power generation	**c. 1,700 kWh**	**c. 17,520 kWh**
Carbon intensity of grid electricity displaced ($g\ CO_2/kWh$) (source: DECC)	**568 g CO_2/kWh**	**568 g CO_2/kWh**
Carbon emissions displaced each year	**c. 960 kg CO_2**	**c. 4,200 – 5,800 kg CO_2**

Around FIVE 2kW PV systems are required to abate as much carbon as ONE BlueGen unit in any one year

Benefits of fuel cell mCHP for the public sector

- Carbon reduction compliance
- BREEAM compliance
- Improve local power grid?
- Facilitate EV recharging
- Facilitate heat pumps
- ESCO opportunity
- Power sales?
- Alleviate fuel poverty?
- Create jobs?
- Complements insulation initiatives, e.g. Green Deal
- Compliance with clean air policies
- Compliance with planning regs
- Local solution to global issue
- Catalyst for driving change in private sector housing
- Remote control of power generation

Social housing: a core market for CFCL

Our interest in social housing

- Forward looking
  - *Long term time horizon*
  - *Used to planning ahead*
  - *Political and regulatory imperatives to reduce carbon*
- Social imperatives
  - *Address fuel poverty*
  - *Expand employment opportunities where possible*
- Volume installations
  - *Over 2 million dwellings owned by RSL's in the UK*
  - *Over 400 RSL's making an average of 5,000 dwellings per RSL*
  - *140 RSL's with 5,000 or more dwellings*
  - *Potential for high volumes of installations*
  - *Tight geographic clusters*

Summary

Fuel cell mCHP is an important social housing solution

- Helps address RSL's key challenges of carbon, compliance and cost
- Compatible with different property types and other LZC technologies
- Offers important early carbon savings and ongoing cost savings

Talk to us to find out more

Thank You For Your Time

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