

Sustainable Development and Energy- What is the least risk way forward?

12/6/10 for the SCALA/SCEME conference CAT

Brian Mark, Technical Director



DEFINITION OF ZERO CARBON IS PROMOTING W2E

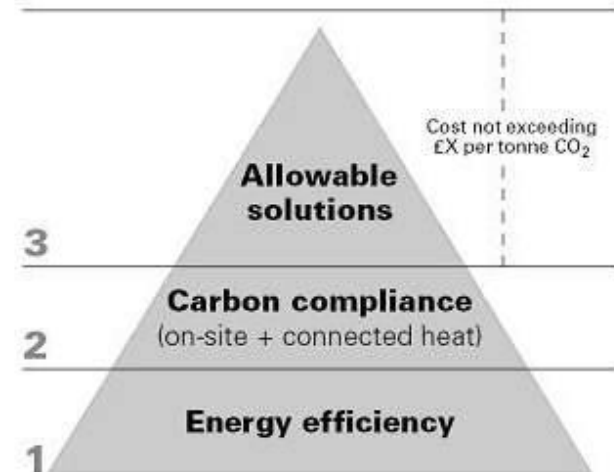
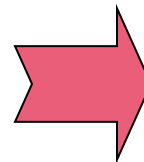
CURRENT REQUIREMENTS – too forward thinking?

Gave rise to negative land values in most regions !!

- Net carbon dioxide emissions resulting from **ALL** energy used in the dwelling are zero or better
- Requires **ALL** energy to be nett zero carbon generated on/near new buildings or delivered via Private Wire

▪ PROPOSED REQUIREMENTS

- Hierarchical approach requiring:
 - High-levels of energy efficiency
 - Mandatory level of on-site carbon mitigation (including district heating)
 - “Allowable solutions” for remaining emissions
- + Income for generation renewable energy i.e. The worlds first Renewable Heat Incentive Banded ROCs/Feed in Tariff





Proposed Allowable Solutions

- Carbon compliance beyond the minimum standard up to 100% of total energy
- Energy efficient appliances or advanced controls systems
- Exporting LZC heat/cooling to existing properties
- Section 106 Obligations
- Retrofitting EE measures to existing stock
- Investment in LZC energy infrastructure (within UK, 'benefits' to purchaser)
- Off-site renewable electricity via 'direct physical connection'
- Any other measures that Government might in future announce as being eligible
- Housing Ministers July 2009 statement that most popular was Carbon Fund
- Housing Ministers May 2010 statement that zero carbon compliance will be defined by this summer



Proposed Allowable Solutions – Why no firm announcement yet ??

- Fulcrum alone responsible for energy design of >80,000 post 2016 homes
- Land values depend on knowing compliance standards
- We cannot advise our strategic land clients
detailed energy masterplanning is presently impossible
- AS definition work has moved from DCLG to DECC

WHY ?- The heart of UK energy policy debate is the 'trilemma'
Security, Carbon, Cost

- Urgently need generation capacity, smart grids & meters
- The Renewable Energy Strategy requires >30% renewable generation in the grid (and that ignores electric vehicles and increased heat pump use)
- The Climate Change Act requires 80% CO2 reduction by 2050
- If this leads to a Nuclear/Renewables/CCS decarbonised grid with heat pumps, can the UK afford the additional cost to be heat efficient ?

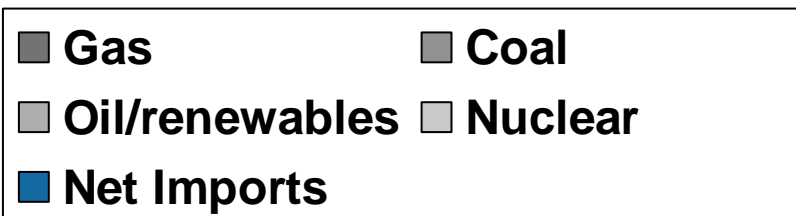
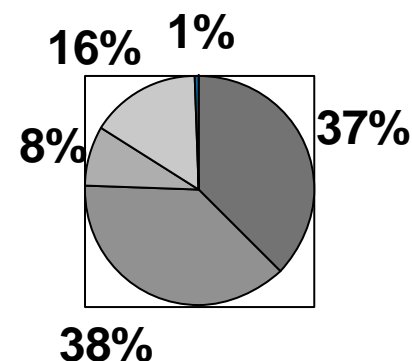




- **Installed capacity 75GW**
- **Peak demand 60GW**

Asset Type	Life (years)
Coal	40+
Gas	25+
Nuclear	40-60
Wind	25
Transmission	40+

Q1 2009 UK generation mix (source: DECC)



The energy security problem



- **11GW of coal/oil plant must close by 2015 or 20,000 hours from 2008(Large Combustion Plant Directive 2)**
- **6GW of old nuclear must close by 2020**
- **Remaining coal plant (21GW) will need significant capex to run past 2016**
- **Older CCGTs may have life issues by 2020**

Plant	Develop (years)	Plant Build (years)	10GW develop/build
Coal	4	4	10
Gas	2-3	2-3	6
Nuclear	5+	5+	15
Wind	2-3	2-3	8
Trans	2-10	2	6-14

DEFRA & DCLG have policies which recognise the need for efficient new decentralised and CHP local energy systems – is there a lack of integration with DECC ?



DEFRA

- The Dec 2008 EU Waste Directive (to become the 2010 UK Waste Strategy) – Possibly tough recovery targets, W2E only counting when efficient (60% for existing, 65% for new plant) this may need CHP when passed into the 2010 UK Waste Strategy .
- Environment Agency policy document GP3 classes heat or “coolth” as a possible pollutant of open or groundwater
Above 20Kw output, only ground source heatpumps in thermal balance i.e. with a heat/cooling network are licensable

DCLG

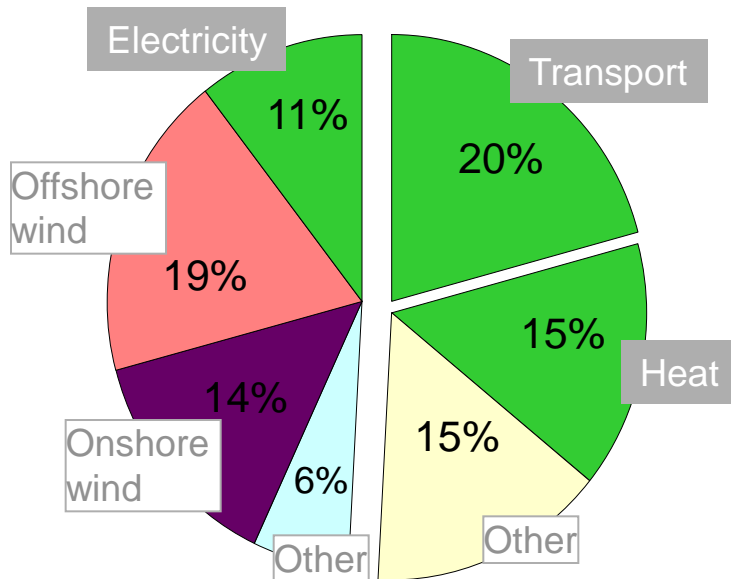
- Possibly funding CHP under AS in BRegs Issued the new consultation PPS on climate change to replace PPS22 (the Merton rule) & and the PPS1 Climate Change Supplement in Planning law- Allows only sustainable development reducing climate change (mitigation) surviving it when it happens (adaptation) ie don't reject heat into an Urban Heat Island ,store it for low CO² use instead.
Provide an evidence based local study to identify additional local renewable and decentralised energy sources, particularly W2E CHP, adapt Core Strategy to maximise uptake and facilitate it.

The Energy Carbon problem:- The immediate, necessary UK bioenergy contribution



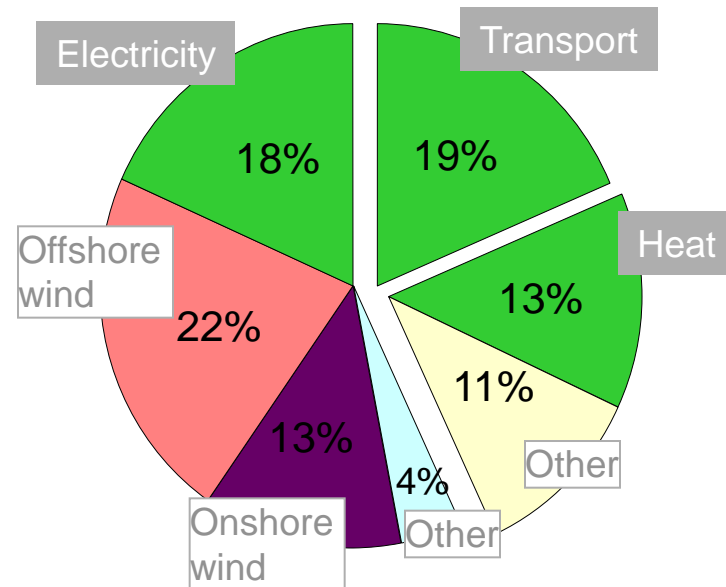
RE Strategy projection for 2020

- 238 TWh renewables
- 111 TWh bioenergy (46%)



RAB Projection for 2020

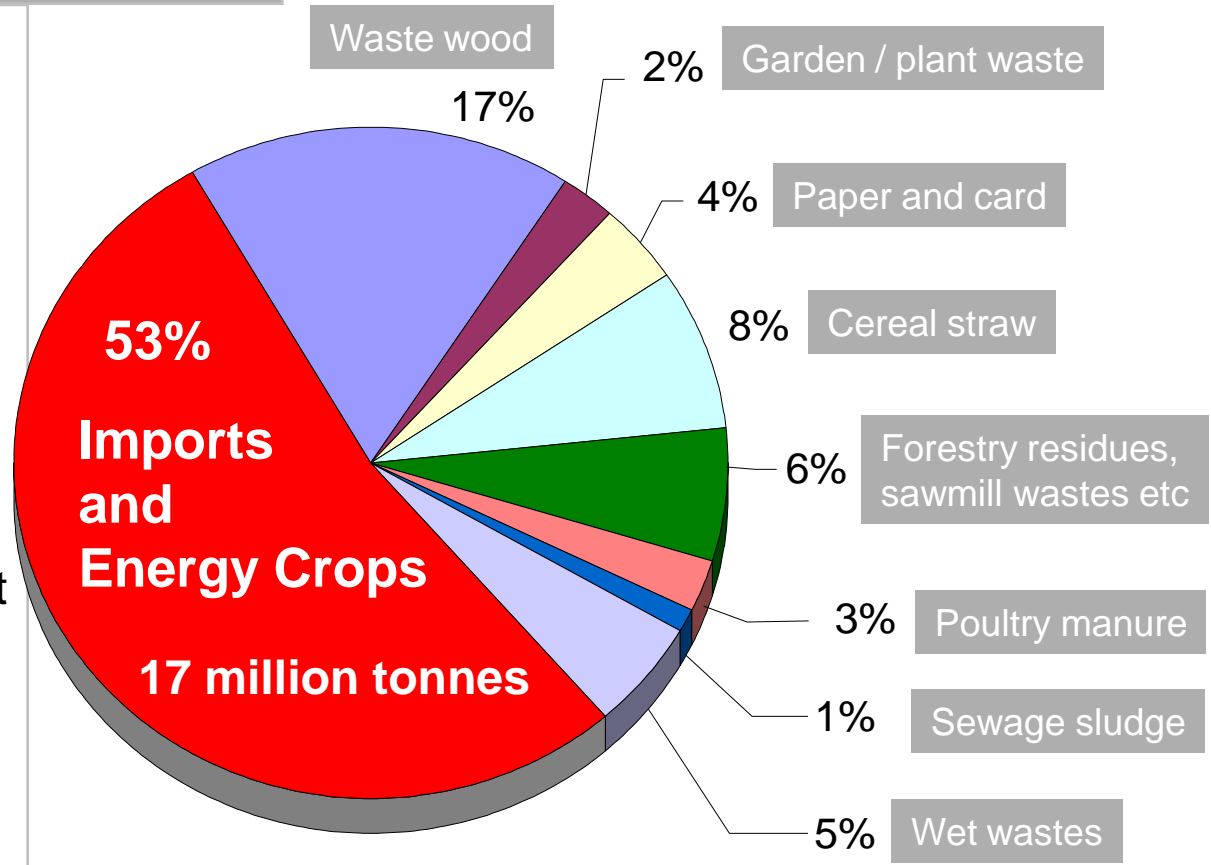
- 250 TWh renewables
- 126 TWh bioenergy (50%)



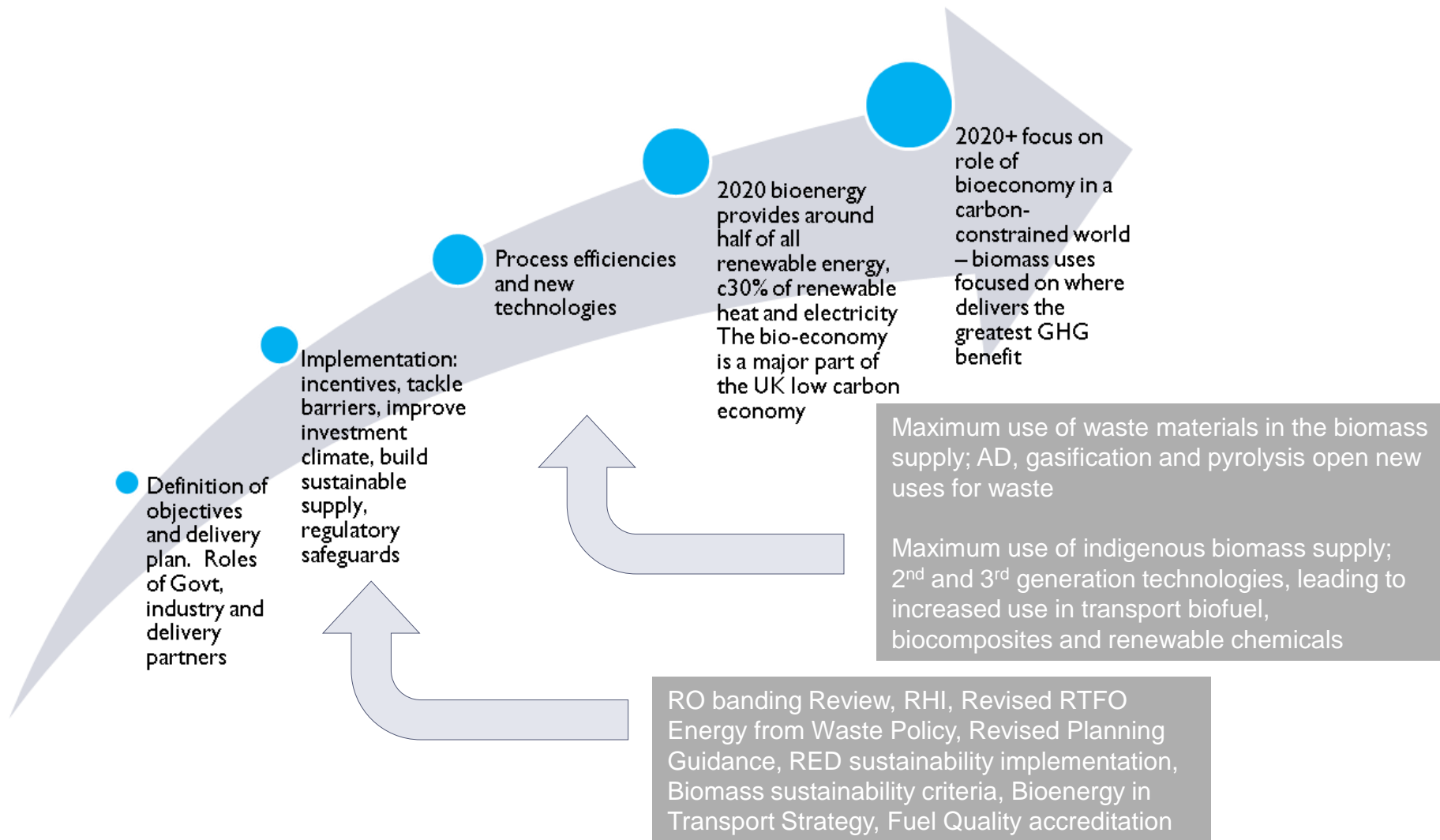
The Energy Carbon problem:- The immediate, necessary UK bioenergy contribution



- Requirement = 575 PJ
- UK arisings = ~270 PJ (32 million tonnes)
- EU biomass sustainability criteria first produced Feb.
- While considering a sustainable UK energy crop and import strategy, at least use waste which is the most sustainable source, irrespective of criteria



The Energy Carbon problem:- A UK STRATEGY FOR BIOMASS-



The energy cost problem:- An answer maximising community gain and engagement



The present business case for waste to energy or biomass/CHP

Total income stream per Kwhr

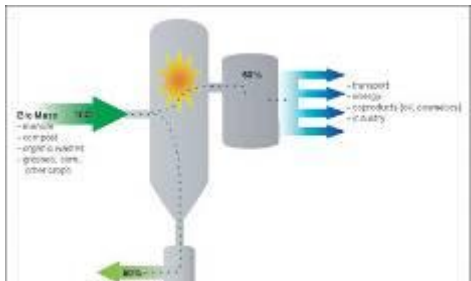
- For zero carbon electricity sold to new development to help control future land value reduction
- For heat sold to existing stock or industry
- From this April banded ROC incentivisation for renewable electricity produced, more if you also use the waste heat in CHP
- Redirected Landfill income for treating waste + future waste recycling credits?
- Feed in Tariff (2010) if better than ROCs + Renewable Heat Incentive (2011) income

Total income stream per Kwhr

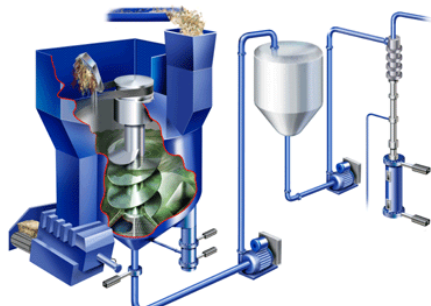
- Total over 30p/Kwhr (its 4p to the Grid! when you compare against the business plan for a new coal fired power station)
- So 4p pays for the power station leaving the rest to pay for the new community supply networks returning any profit back to the community itself, after all the waste belongs to them and they have a right to this “planning gain” under PPS1!!!



Steam Turbine



Pyrolysis



Anaerobic Digestion

Considerations

Waste to Energy with a chimney

- Steam Turbine

Waste to Energy without a chimney

- Anaerobic Digestion to methane

- Gasification to singas

- Pyrolysis to singas or liquid biofuel

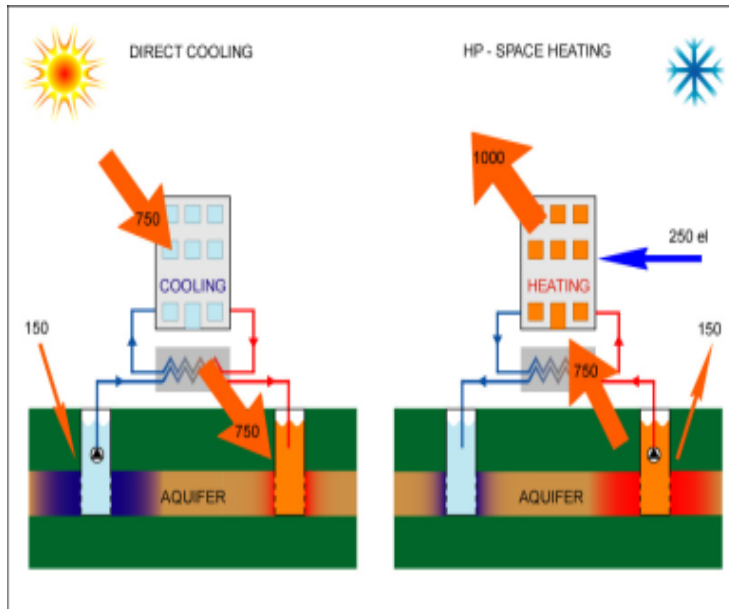
- Lignocellulosic Hydrolysis (1 tonne waste fibre to 300 L bioethanol a renewable transport fuel)



Related heat distribution technologies:- Not simply District Heating using waste heat but...



Interseasonal Thermal Storage



- Cooling needed for commercial/retail/ leisure buildings
- Heating needed for buildings and other process needs, not much needed for space heating in new build
- Store heat from the summer till winter and “coolth” from the winter till summer
- This can be achieved most efficiently in aquifers but can also be stored in the ground
- Alone can achieve 20% reduction in CO2 emissions and help renewable energy provision for BRegs compliance
- Facilitates climate change adaptation and mitigation by storing summer heat till winter

Why be heat efficient 1: CHP in Copenhagen- Denmark



Copenhagen and virtually everywhere else in developed N.Europe/Scandinavia with modern exemplary sustainable communities (Hammersby, Freiburg etc) embraced energy supply efficiency as their reaction to the 1970's oil crisis – we found N. Sea oil!



- One of the largest communal energy systems in the World
- Servicing 50 million square metres
- Connects 4 CHP plants, 4 waste incinerators, more than 50 peak load boiler plants to more than 20 distribution companies in one pool-operated system
- Total heat production of 30,000 TJ.



Malmö, Sweden

The following slides are shamelessly copied from presentations given during a study tour of Malmö May 2010 for which I thank Anders Rubin- Vice Mayor of Malmö, Hakan Rylander- Sysav, Karin-Jarl Mansson- Eon.

- Sweden's 3rd City
- 300,000 people
- 30 minutes from Copenhagen
- Similar latitude & climate to Edinburgh
- 4th Greenest City in World according to www.grist.org



The Western Harbour 1990s



RÖR INTE KOCKUMS



The Western Harbour now



Waste CHP – 550,000 tonnes per year





Waste to energy

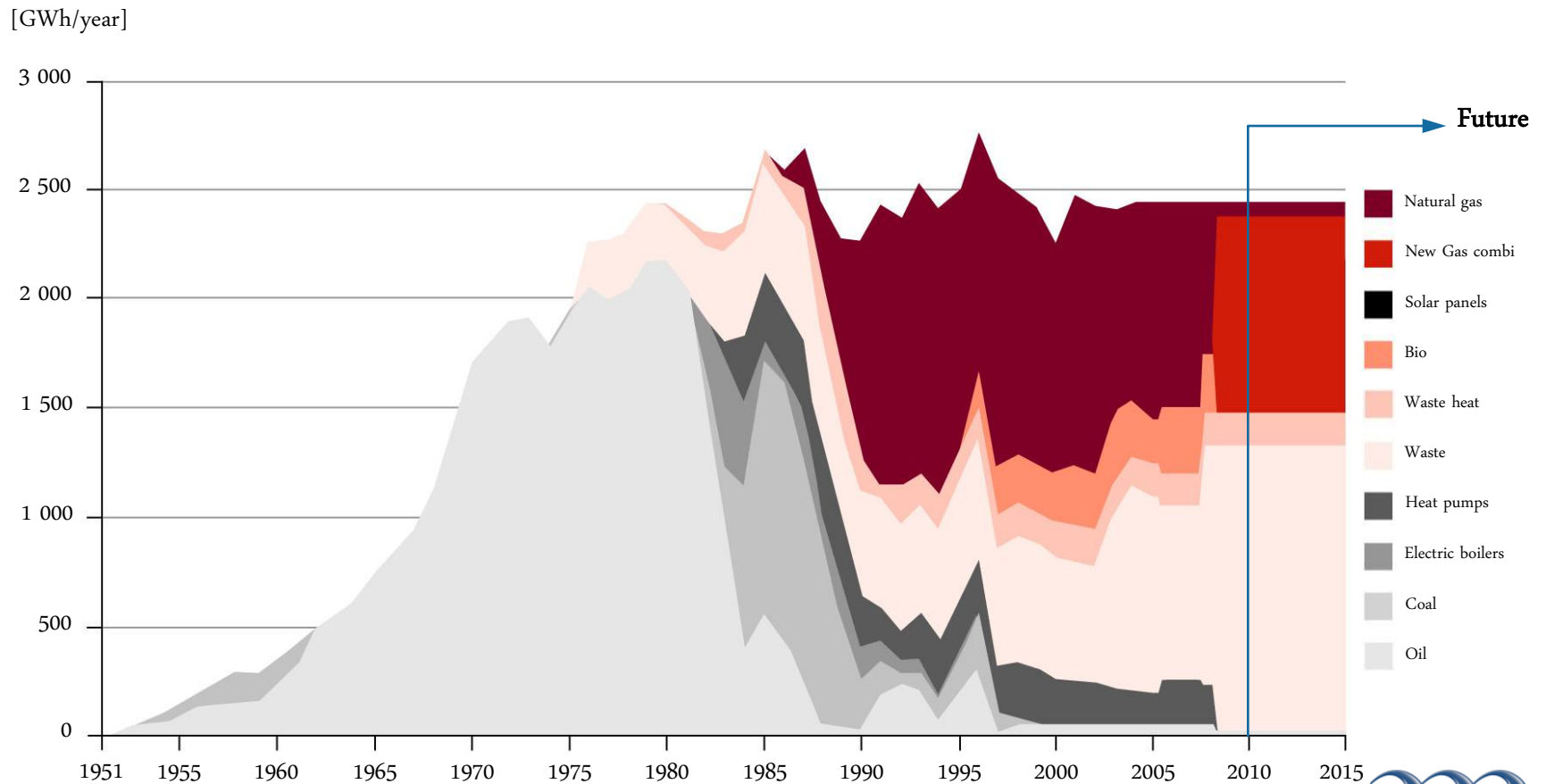
- 1,4 TWh of heat
- 250 GWh of electricity
(~ 50,000 homes)

25% of public transport fueled by biogas from anaerobic digesters (soon to be 100%)

Corresponds to 60 percent of the district heating demand of the municipalities of Malmö and Burlöv.



District heating in Malmö – development from oil and coal to a more diverse and climate efficient fuel mix





The eco-cycle model

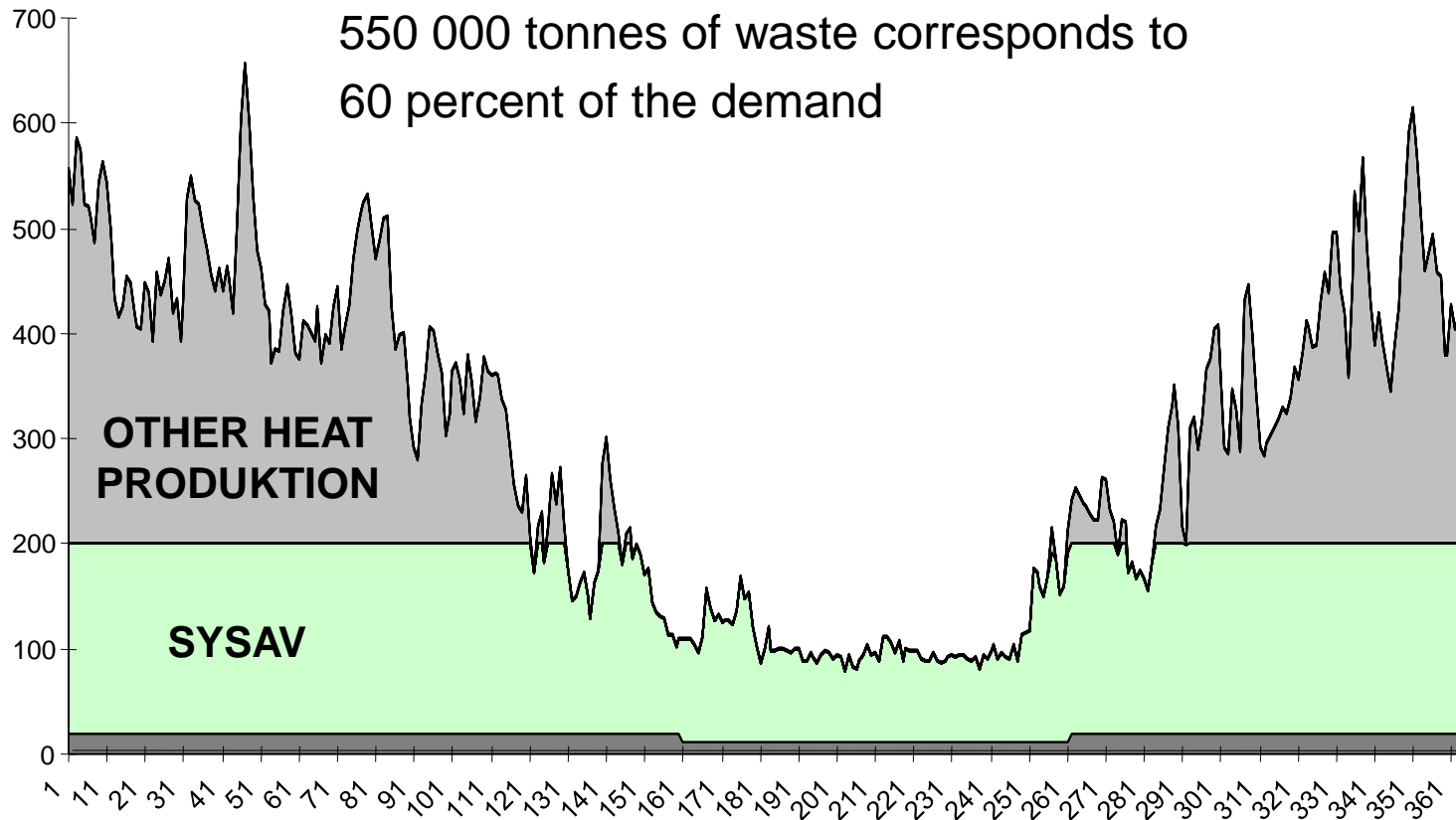




Delivery of district heating to the city of Malmö and Burlöv

MW

550 000 tonnes of waste corresponds to
60 percent of the demand





Advanced fluegas cleaning

- Electrostatic precipitator
- 3 scrubbers including a condensing scrubber
- Electroventuri filter
- Catalyst
- Water cleaning



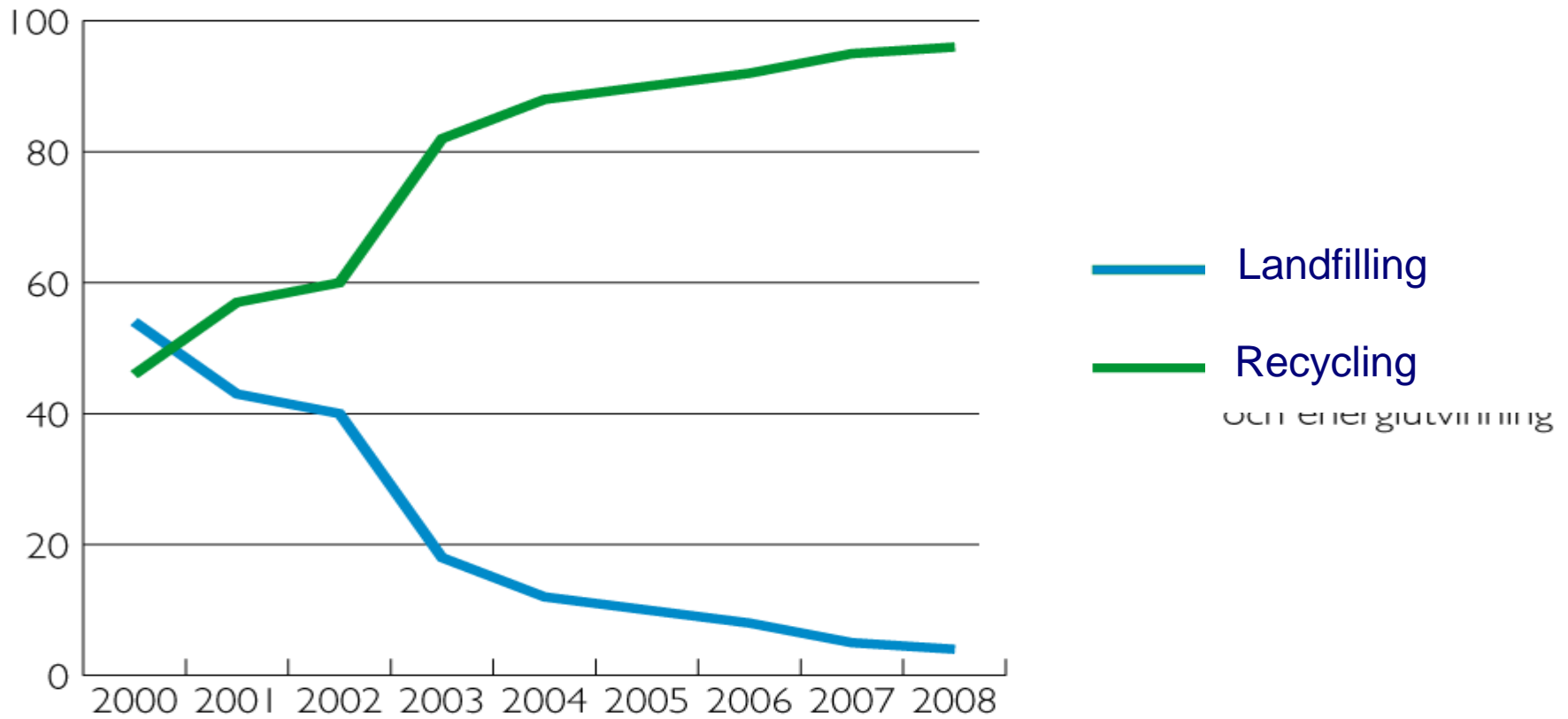
Emission

Parameters	Result	Permit	Unit
CO	6	50	mg/m ³
Dust	1,9	10	mg/m ³
NO _x	18	150	mg/m ³
SO ₂	1,3	50	mg/m ³

Resultat from Line 3, 2008



Recycling versus landfilling 2000-2008



Malmö residents now 20% happier than the rest of Sweden





Thank You

Brian Mark, Technical Director
Mott MacDonald Fulcrum