Small-scale EfW strategy for Warwickshire

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Overview

- The academic context
- The current UK EfW policy background
- The UK EfW situation (large and small scale)
- Discuss the advantages and disadvantages of small-scale EfW
- Present small and medium-scale EfW strategies for Warwickshire
- Questions about small-scale EfW and project examples

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Academic context

- Aims:
  - develop a strategic decision making approach to planning energy generation from biomass and waste at county level
  - test and evaluate this approach on two county areas
  - evaluate the benefits of using large or small-scale plant
- Background:
  - PhD
  - funded by the EPSRC (CASE), additional support from Compact Power Ltd.
- Partners and contributors:
  - Warwickshire and Cornwall County Councils
  - Central Networks, Western Power Distribution
- Results
  - Peer reviewed in 2 journal and 3 conference papers

Policy context

- Government Energy White paper (2003)
  - *"There will be much more **local** generation, in part from medium to small **community** power plant, fuelled by **locally grown biomass, generated waste**, local wind sources and possibly from wave and tidal generators".*
  - *a new approach to energy planning…* but how?
- Renewables Obligation and Climate change
  - 10% of UK electricity by 2010
  - Renewables Obligation Certificates (ROCs)
- Landfill Directive
  - Landfill Allowance Trading Scheme (LATS)
    - reduce landfill of BMW to 75% of its 1995 level by 2010

What is local?

- The term “local” is defined by its reference in the Oxford dictionary
- Relating or restricted to a particular area or one's neighbourhood
- Neighbourhood is defined as a *district or community* within a town or city
- This meaning has been literally assumed as the *district* level of local government

UK EfW situation

- 19 EfW plants
- 4 of which produce heat and electricity (CHP)
- 1 EfW plant generates heat only (30 ktpa)
- 2 are 30 and 60 ktpa respectively
- 8 are larger than 180 ktpa
- 60% of plants built on former incinerator sites in industrial/urban areas
- Difficulties in gaining planning permission

Source: ILEX Energy, 2005

Advantages to a large-scale, combustion approach to EfW

- Some plant economies of scale

Fichtner, 2005

- Greater electricity generation efficiencies

Consonni et al, 2005

- One-stop shop to planning and permissions
  - all efforts on one location
- Market maturity
  - well established in Europe and UK

Porteous, 2005

Defra Waste Consultation - 2006

- View
  - EfW options should arise from LA waste strategies
  - EfW should be CHP
  - EfW to expand in UK waste management
- Concerns
  - Capital intensive nature of plant
  - Risk that EfW could divert material from opportunities higher up the waste hierarchy
  - Consideration for local impact
- Solutions?
  - Are there an EfW policies that can address these concerns…?

Advantages to a local-scale approach to EfW

- Plant can be more easily sized to the needs and *resources* of the local area:
  - minimising transport impact — *Bergsdal et al, 2005*
  - lower visual impact — *Kristiansen, 2006*
- Heat generated from smaller plant can be more easily used in local CHP applications:
  - industry/local district heating — *Kristiansen, 2006*
  - meet climate change targets — *Boyle et al, 2005 & Beggs, 2002*
- Flexibility:
  - if one plant cannot operate, the others remain open
  - financial decisions can be made over a longer period
  - adjust to feedstock availability – greater recycling etc. *Dawber, 2006*

EfW strategies for Warwickshire

This approach uses...

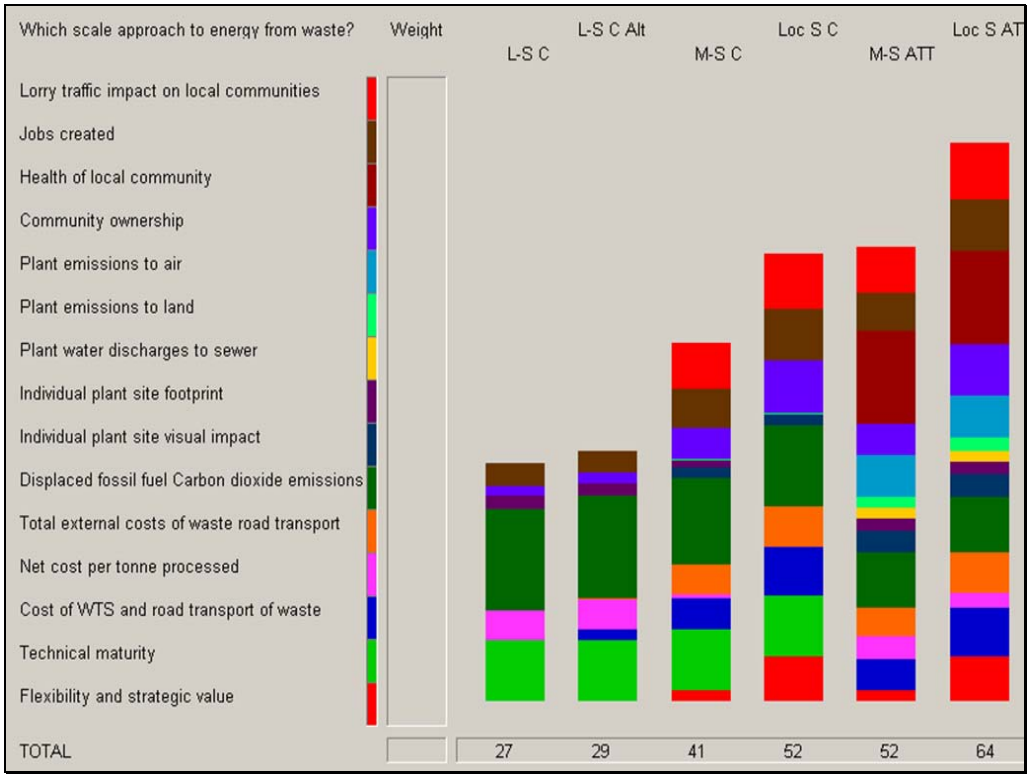
- A geographical information system (GIS) to:
  - map and model waste and energy crop resources across the county
  - identify concentrations of resource
  - identify suitable plant locations
  - calculate transport distances and associated impacts
- A multi criteria analysis technique (MCA) to:
  - compare the scores of plant technology options on chosen environmental, social, technical and economic criteria
  - add weighting to those criteria as appropriate to making a final decision

Warks EfW scenarios

	Scenario				
	1a & 1b	2a & 2b	3	4a & 4b	5
Description	large	medium	local	medium	local
Technology	combustion	combustion	combustion	pyrolysis/ gasification	pyrolysis/ gasification
Notation	L SC	M SC	Loc SC	M S ATT	Loc S ATT
Scale capacity (tpa)	180,000	60,000	60,000/ 30,000	60,000	60,000/ 30,000
Number of facilities	1	3	5	3	5
Use of WTS	yes	yes	no	yes	no

Site distributions
GIS demonstration

EfW options assessment



Scores – scale related

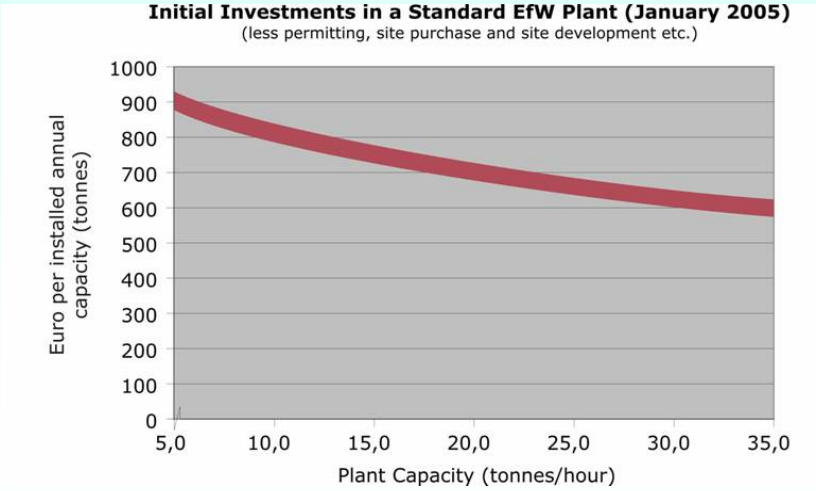
- Regardless of technology
- Winners: Large scale
  - site footprint
  - net cost per tonne (MSW throughput)
  - displaced CO_2 from electricity generation
- Winners: Local scale
  - transport impacts (monetary and environmental)
  - lower costs of WTS
  - lower lorry deliveries impact
  - jobs created
  - flexibility
  - potential for community ownership

Scores – technology related

- Technology derived
- Winners: Combustion
  - technical maturity
  - lower site footprint
- Winners: Advanced thermal treatment
  - lower emissions to air, land and water
  - lower dioxins
  - lower visual impact – both stack and building height

Questions about small-scale and project examples

Is small-scale EfW expensive?



Energy sale revenues are often higher for smaller plants due to better supply/demand balance. *Source: Kristiansen, 2006*

Small-scale combustion

- Lerwick
  - 26 ktpa
  - Combustion
  - Steam only
- Isle of Man
  - 60 ktpa
  - Combustion
  - Electricity only
- Grimsby
  - 56 ktpa
  - Combustion
  - Electricity and heat

Small-scale ATT

- Energos
  - 6 plants
  - 20 to 75 ktpa
  - 2 x Electricity and heat
  - 4 x steam
  - Gasification/Combustion

- Compact Power
  - Bristol
  - 7.5 ktpa
  - 30 ktpa build in progress
  - Pyrolysis/Gasification/Combustion

Planning considerations

- Experience in Denmark shows:
  - Small-scale can be cost-efficient
  - Be designed to meet local energy demand (heat, steam etc).
  - Better comply with proximity principle, tending to lower public protest and political anxiety.

- Community/public ownership can be used to lower costs and ensure locality receives benefit

Kristiansen, 2006

No need for EIA, if less than 35 ktpa. (ODPM, 2004)

Conclusions of Aston project

- The local distributed EfW options:
  - have the best overall scores, followed by the medium options
    - have the lowest transport costs, followed by the medium options
    - provide greater flexibility in managing changing residual waste availability
    - easier to use CHP or steam only role
    - The large-scale centralised option:
      - has superior net cost per tonne of waste throughput
      - has superior CO_2 emission displacement if electricity generation only is considered

Recommendations to WWP

Other councils (Devon and Bristol) are seriously considering the small-scale approach to EfW

Perhaps Warwickshire should too…

- Confirm the number and locations of facilities
  - Surrey County Council
- Public consultation on preferences of public
  - how do they view distributed EfW options compared to a centralised policy
- Undertake detailed small-scale sites review
  - local heat/steam demand/grid connection/ land rights
- Whatever EfW policy chosen – choose CHP
  - climate change/ efficient resource use

Publications/ further information

- Longden D.M., Brammer J.G., Bastin L.B. and Cooper N. (2006) ***Distributed or centralised Energy from Waste policy? Implications of technology and scale at municipal level***. Energy Policy, In Press.
- Bastin L. and Longden D.M. (2006) ***Comparing transport impacts for energy recovery from domestic waste: Large and small-scale options for two UK counties***. Computers, Environment & Urban Systems, In Press.
- Bastin L. and Longden D.M. (2006) ***Comparing transport impacts for energy recovery from domestic waste: Large and small-scale options for two UK counties***. GISRUK, Nottingham, UK.
- Longden D.M. and Brammer J.G (2006) ***County Planning of Energy from Waste Facilities: A new approach to strategic assessment of technology and scale applied to Warwickshire,*** *UK.* Annual CIWM Conference incorporating the 5th International Symposium on Waste Treatment Technologies, Paignton, UK.
- Longden D.M., Brammer J.G. and Cooper N. (2005) ***GIS-based evaluation of energy provision from waste and biomass plant at local community level***. 6th International Conference in Science and Thermal-Chemical Biomass Conversion, Vancouver, Canada.

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