Energy Solutions for 60% Carbon Reduction

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Towards Zero Carbon – 2

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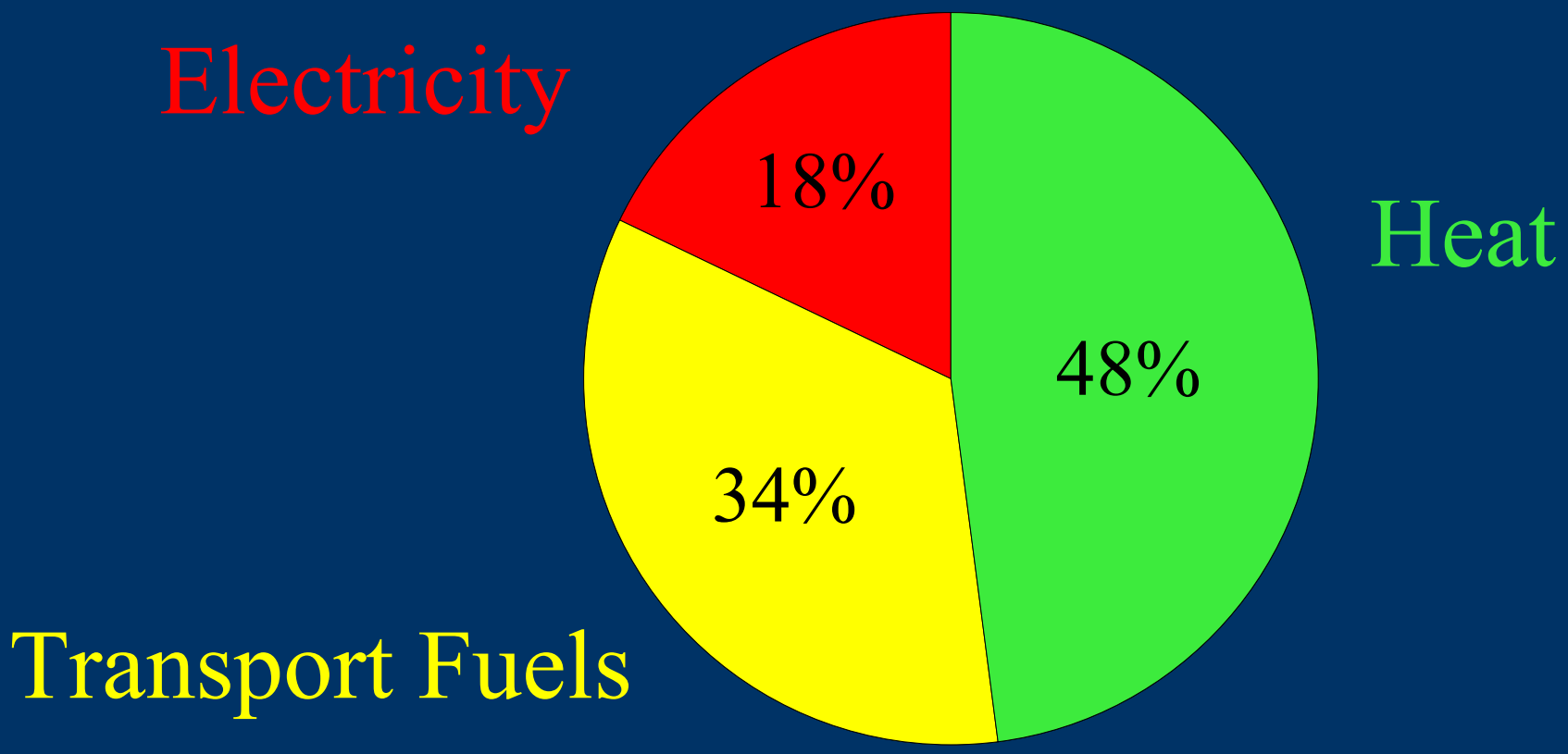
Outline of This Presentation

- Attributes of this study
- Energy Technology Options
- Finding Solutions for 60% Carbon Reduction
- Energy Policy: Delivering the Target

Attributes of This Study

- Driven by impending oil and gas shortages and climate change
- Technology options are best current practice
- Options chosen by thermodynamic criteria
- Options chosen for sustainability
- Quantitative accounting using energy and carbon

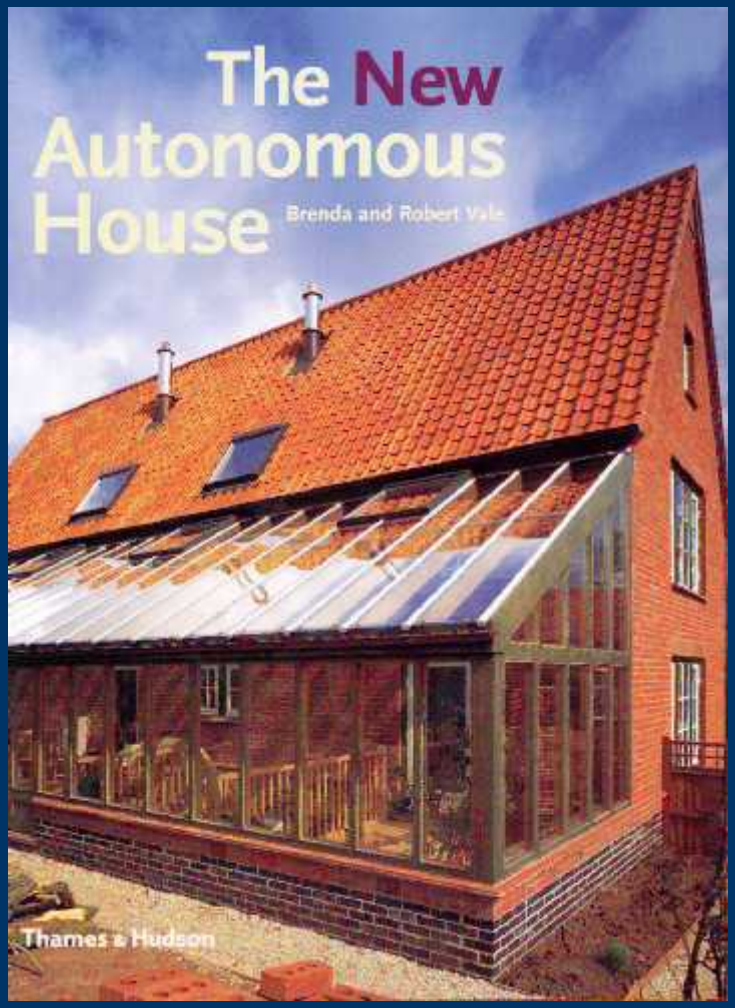
Shares of UK Delivered Energy



Energy Saving in Buildings

- Additional insulation for existing buildings
- Advanced windows for existing and new buildings
- Zero space heating for new buildings
- Low energy appliances – eg Cold and Wet
- Low energy lighting – eg Compact Fluorescents

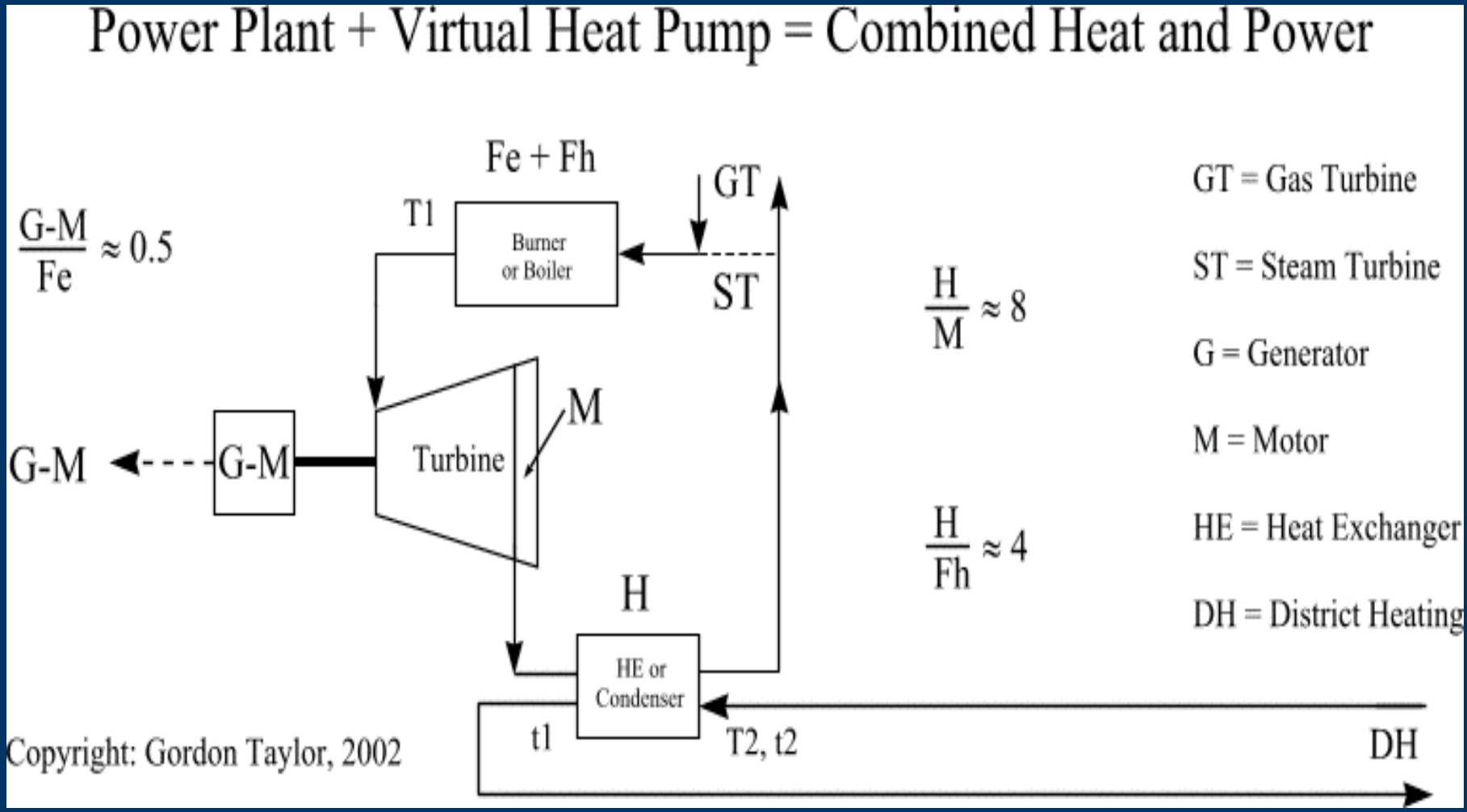
A UK Zero Space Heating House



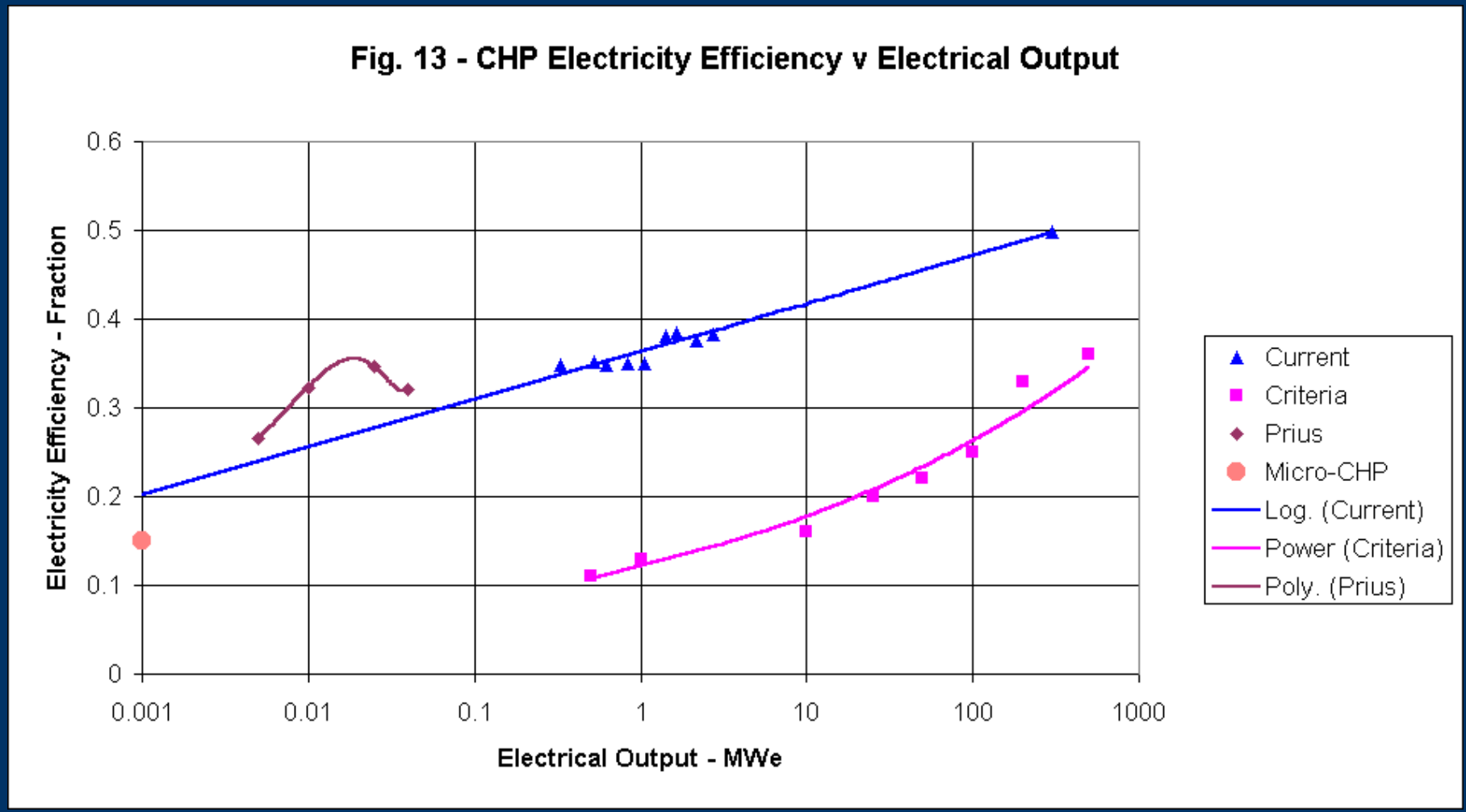
Current UK Primary Energy

- Total Primary Energy is about 219 mtoe
- Losses amount to about 68 mtoe – ie 31%
- The largest loss is in heating – 39 mtoe – ie 18%
- The next is in road transport – 22 mtoe – ie 10%

A New Analysis of CHP



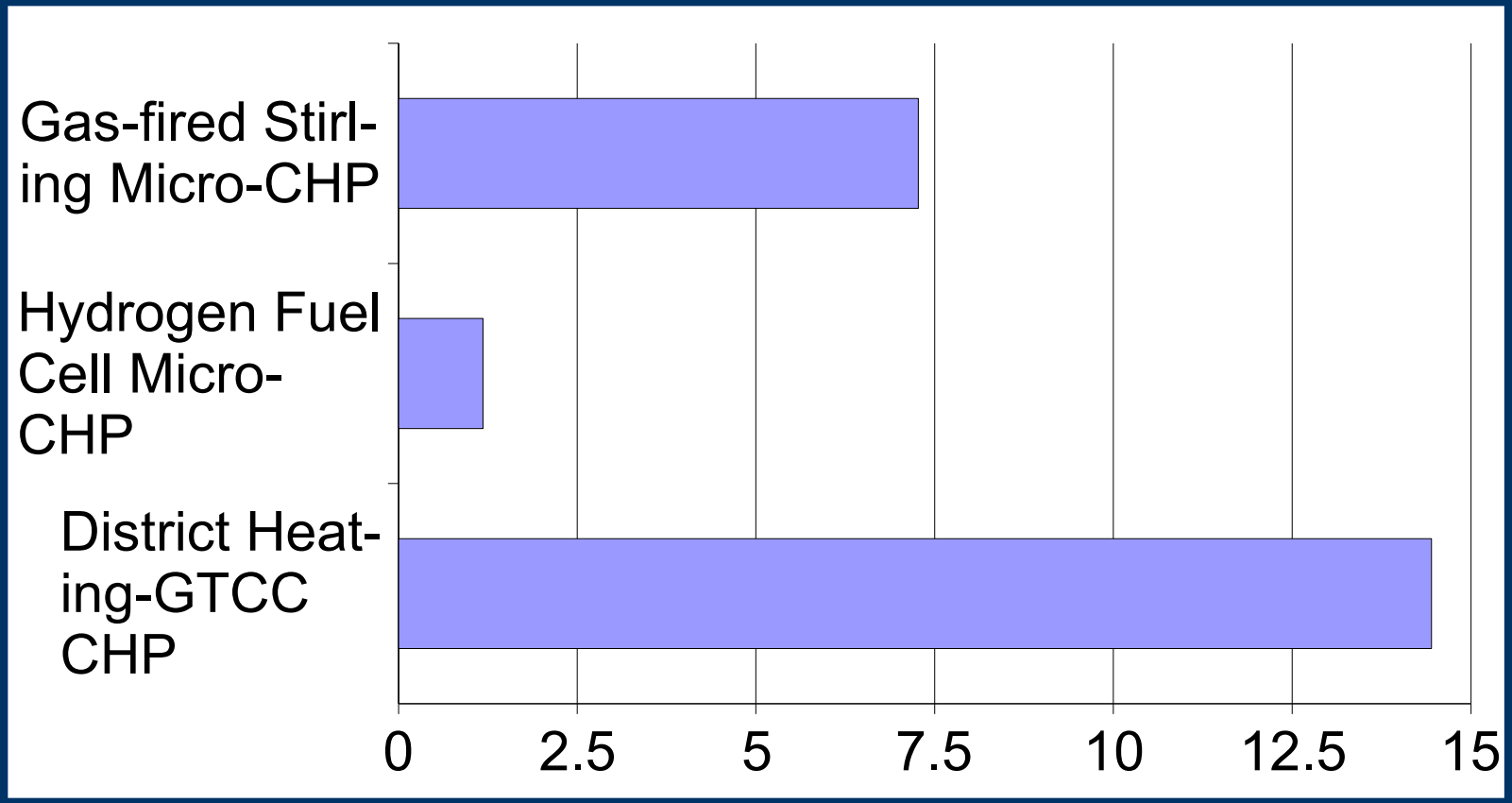
Scale Effect in Thermal CHP Plant



Options for More Efficient Heating

- Currently Gas Boilers with thermal efficiency of 65%
- Gas-fired Micro-CHP with THE of 86%
- Hydrogen Fuel Cell Micro-CHP with THE of 210%
- District Heating from GTCC CHP with THE of 334%

Carbon Savings - MtC/y



Supplying Heat and Electricity

- Phase out Nuclear, Coal, and Oil
- Use Gas to Carbon Limit for CHP and Heat
- Use UK Biomass wastes for CHP and Heat
- Use UK Energy Crops for CHP and Heat
- Use Imported Biofuels for CHP and Heat
- Use Wind (backed by Hydro) for Electricity

Energy Savings in Transport

- Reduced air travel, due to oil shortage
- Switching from air to rail
- Reduced road transport, by working nearer home
- Switching from car to bus, tram, rail, and bicycle

Options for More Efficient Vehicles

- Petrol IC Engine hybrids of about 37% efficiency with crude oil to petrol at 88% efficiency gives a Well-To-Wheel efficiency of 32%

- Hydrogen Fuel Cell hybrids of ~ 50% efficiency with natural gas to hydrogen at 58% efficiency gives a Well-To-Wheel efficiency of 29%.

  And hydrogen would need a new infrastructure

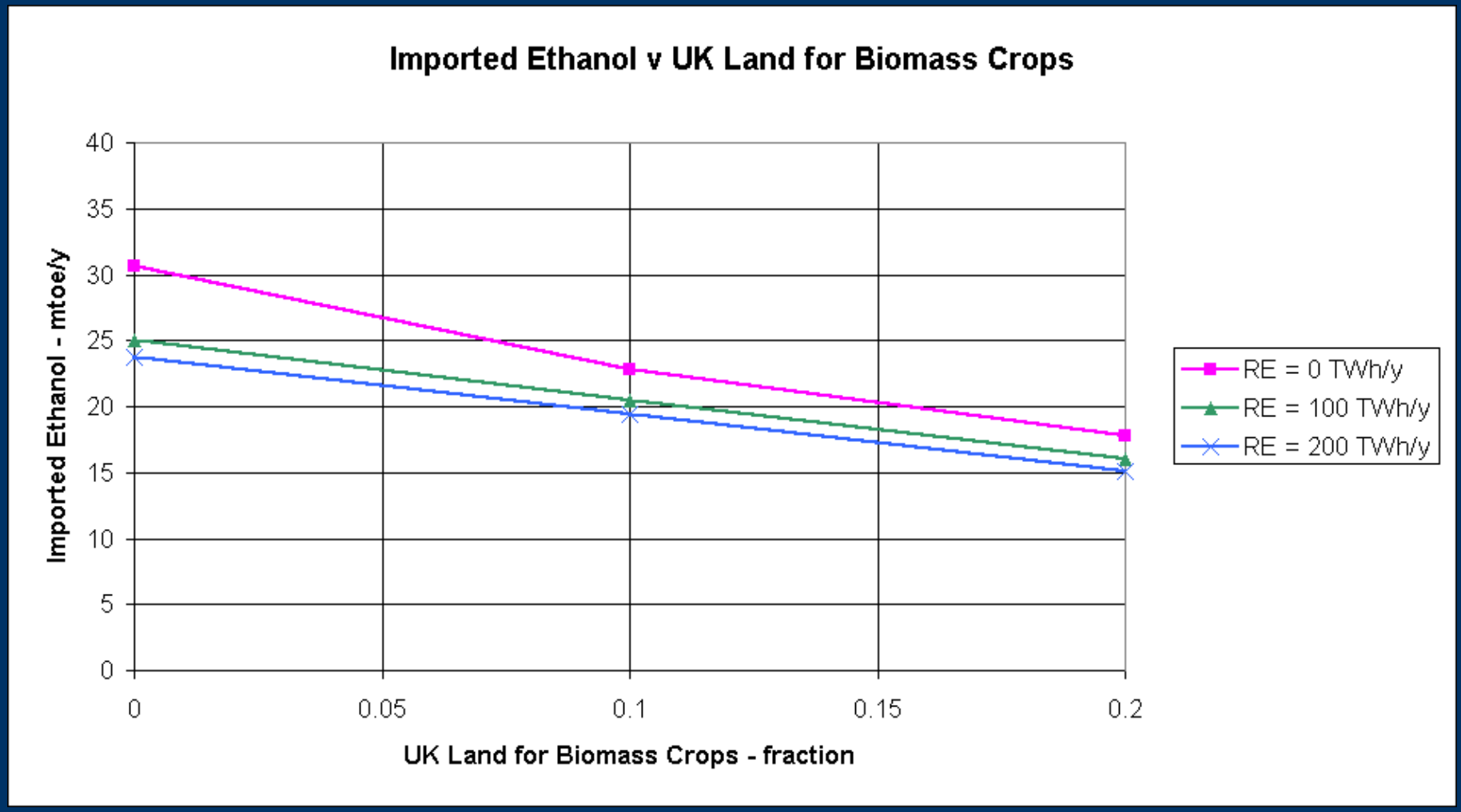
Fuels for Transport

- Retain oil-based fuels for air, marine, and rail transport, due to their special suitability
- Ramp up to 90% ethanol for road transport (up to 85% for SI engines, 95% for CI engines)
- Ethanol from biomass, synthesised, and imported

Modelling the UK Energy System

- Energy savings of 30% assumed for all four sectors
- Carbon emissions constrained to -60%
- Oil limited to air, marine, and rail, plus 10% of road
- Gas usually limited by carbon emissions target
- Marginal fuel was taken as imported ethanol
- Solutions found for (bio) land fractions up to 0.2
- And wind electricity up to 200 TWh/y

Solutions for -60% Carbon Emissions



The Chosen Options give:

- Solutions that meet the carbon emissions target
- Flexibility to accommodate oil and gas shortages
- Increased energy security and reduced fuel poverty
- Reduced import costs and increased UK employment
- Low technical risks and firm prices
- Hence ease of financing – which is vital for delivery

Delivery of the Target - 1

Present conditions are unfavourable because:

- End-users lack the required information
- Some options are too large for end-users
- End-user test discounts may be 25% or more
- Large organizations can borrow at 5% or less

Delivery of the Target - 2

- Divide energy markets into large franchises
- Grant franchises to Energy Service Companies
- Conditional on Carbon Emission Obligations
- ESCOs would implement saving and supply options
- CEOs would meet the Government's obligations

Thank you for your attention

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www.energypolicy.co.uk