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Carbon Saving and Carbon Cost Scenarios

from The Carbon Trust's Biomass Acceleration Project

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CARBON TRUST
Making business sense of climate change

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Carbon Saving and Carbon Cost Scenarios

- The Carbon Trust Agenda
- Aims of the Study
- Chain Results Overview
- Resources Conclusions
- Technology Conclusions
- Barriers Identified

The Carbon Trust Aims

- To gain a thorough understanding of the economics of all aspects of Biomass for energy conversion
- To assess the realistic contribution that Biomass could make to lowering carbon emissions in the UK when used for energy conversion
- To identify the main barriers (policy and market) to the further development of the Biomass sector in the UK
- To assess whether The Carbon Trust input to the sector (in this case a 'Technology Acceleration Programme') could be **material** in helping to advance the more widespread uptake of this form of low carbon technology

‘Technology Accelerator’ Programmes:

- Areas where The Carbon Trust intervention (funding, coordination and expertise) will have the greatest impact in accelerating a sector as a whole
- Investment criteria are therefore based not only on the direct reduction of CO_2 emissions from the programme itself but also on the wider impact that this will have on the UK economy
- By filling the technological and commercial gaps The Carbon Trust aims to provide a sector with the missing pieces necessary for growth

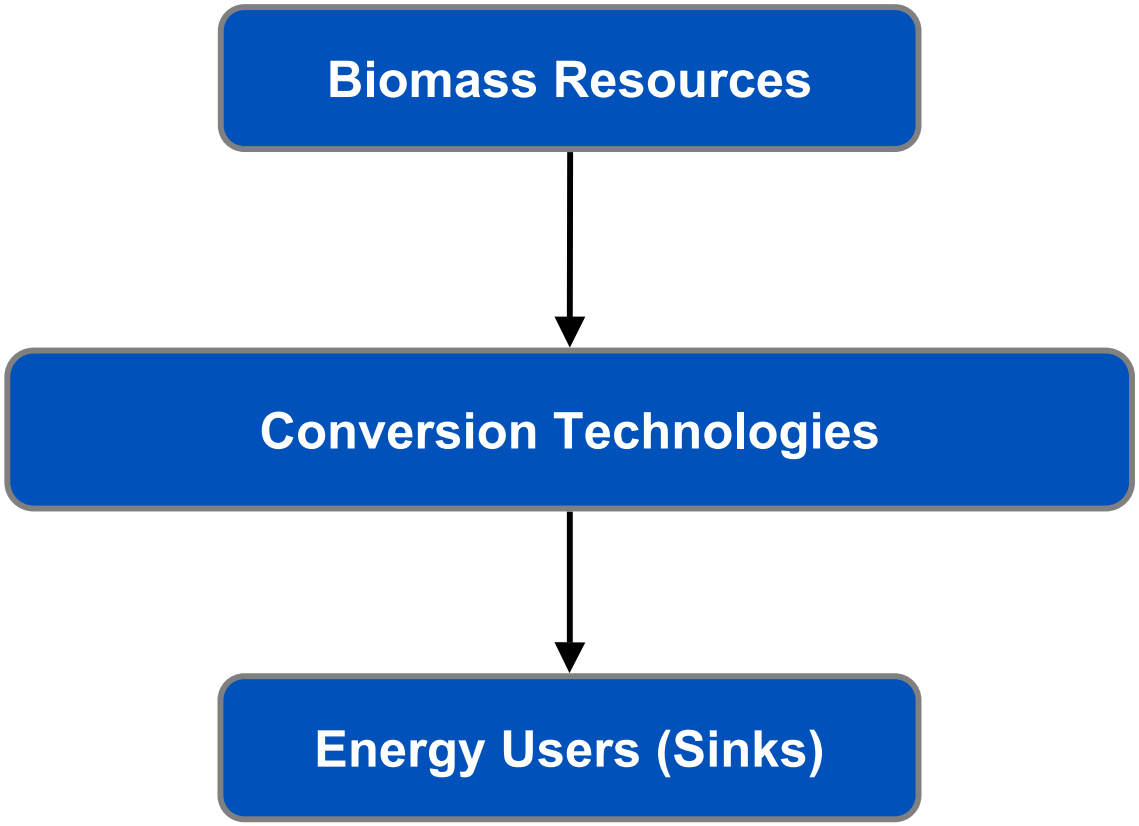
What Carbon Trust means by ‘material’:

- The Carbon Trust has something unique to contribute to the sector that others don’t, e.g. something government capital grants don’t cover
- Where its input will have the biggest impact (“bang for buck”) taking into account other inputs
- The Carbon Trust is not tasked with supporting or stimulating Biomass, its mission is to reduce carbon emissions **NOW** and put the UK on a path to the ‘**Low Carbon Economy**’
- **However, The Carbon Trust will support Biomass if its input is material and will have a significant impact**

Structure of the Study

- Develop potential chains
  - Quantify potential resources
  - Analyse conversion technologies
  - Analyse potential sinks
- Eliminate least promising chains to allow more detailed analysis
- Validate the values for retained chains by:
  - Interviews and Questionnaires with Biomass Industry
  - Literature Review
- Detailed Analysis of retained chains
- Identify the barriers in the market place
- Outline what is required to accelerate biomass development and whether a CT Technology Acceleration Programme could be material

Potential Chains



Resources Quantified

- Wet Agricultural Waste
- Dry Agricultural Waste
- Forestry Waste
- Short Rotation Forestry
- Energy Crops
- Dry Paper
- Waste Wood (Construction and Furniture Waste)
- Sugar Crops
- Oil Crops
- Starch Crops
- Food Waste (from Food Industry)
- Textile Waste
- Leather
- Wet Paper Waste (from Paper Industry)
- Hydroponics
- Sewage Sludge

Conversion Technologies Analysed

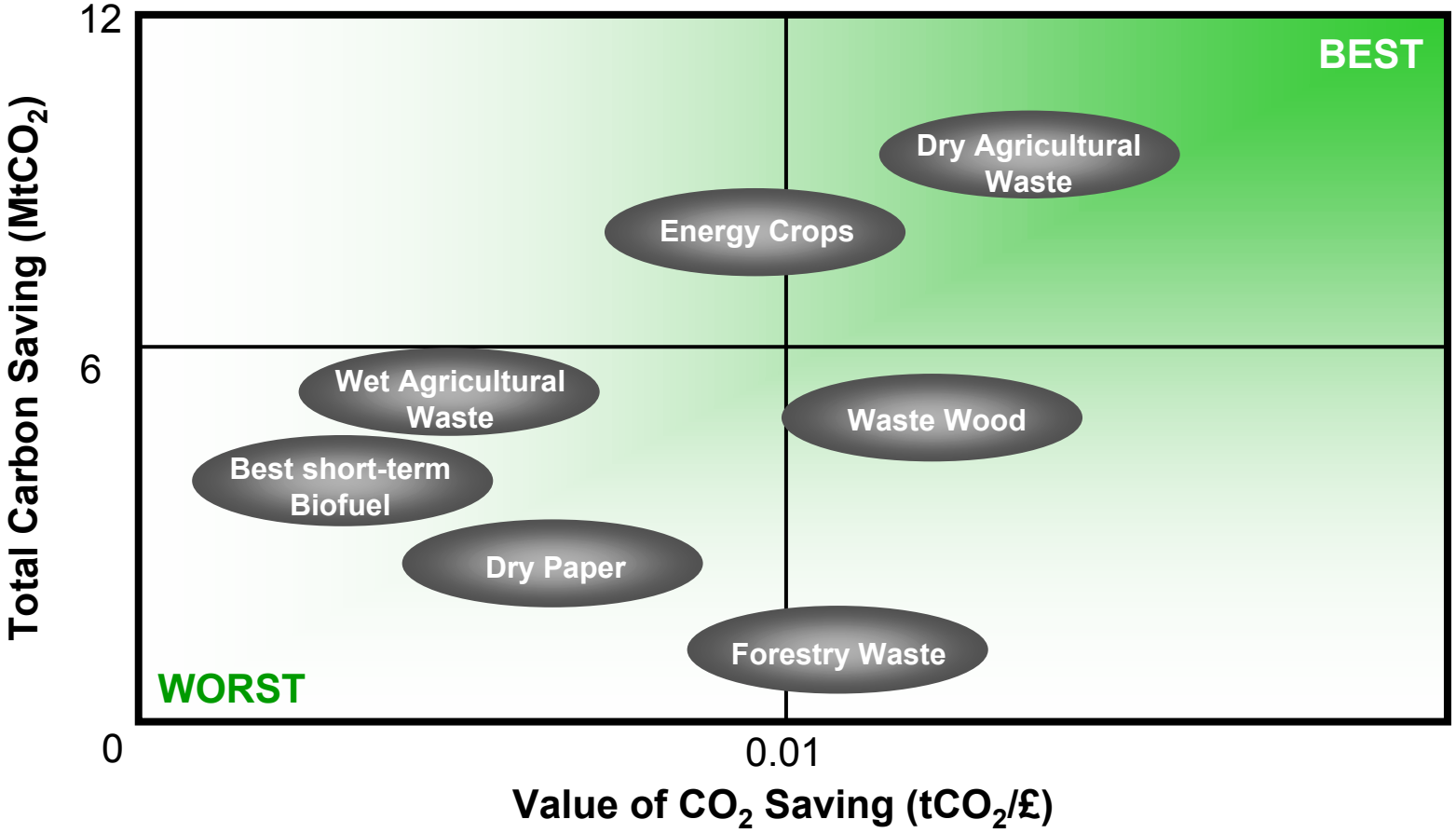
- Combustion:
  - Hot water Boiler
  - Boiler/Steam Turbine
- Gasification / Pyrolysis / Anaerobic Digestion:
  - Gas Engine
  - Gas Turbine
- Stirling Engine
- Fuel Cell
- Liquid Biofuel
- Gaseous Biofuel

Energy Users (Sinks) Analysed

Abbreviation	Technology	Plant Size
CoF - CCGT	Co-firing of producer gas into combined cycle gas turbine	$100MW_e$
CoF - Coal	Co-firing of chips into utility coal-fired boiler	$100MW_e$
LH	Large industrial heating plant	$30MW_t$
LE	Large industrial electricity plant	$30MW_e$
LCHP	Large industrial CHP plant	$30MW_e$
SH	Small industrial / commercial heating plant	$2MW_t$
SE	Small industrial / commercial electricity plant	$2MW_e$
SCHP	Small industrial / commercial CHP plant	$2MW_e$
VSH	Very small heating plant, e.g. commercial or farm	$200kW_t$
VSCHP	Very small CHP plant, e.g. commercial or farm	$200kW_e$
DH	Automatic domestic heating plant (using pellets)	$50kW_t$
DS	Domestic manually fed wood burning stove	$10kW_t$

Chain Analysis Results

CO_2 Saving vs Value of CO_2 Saving



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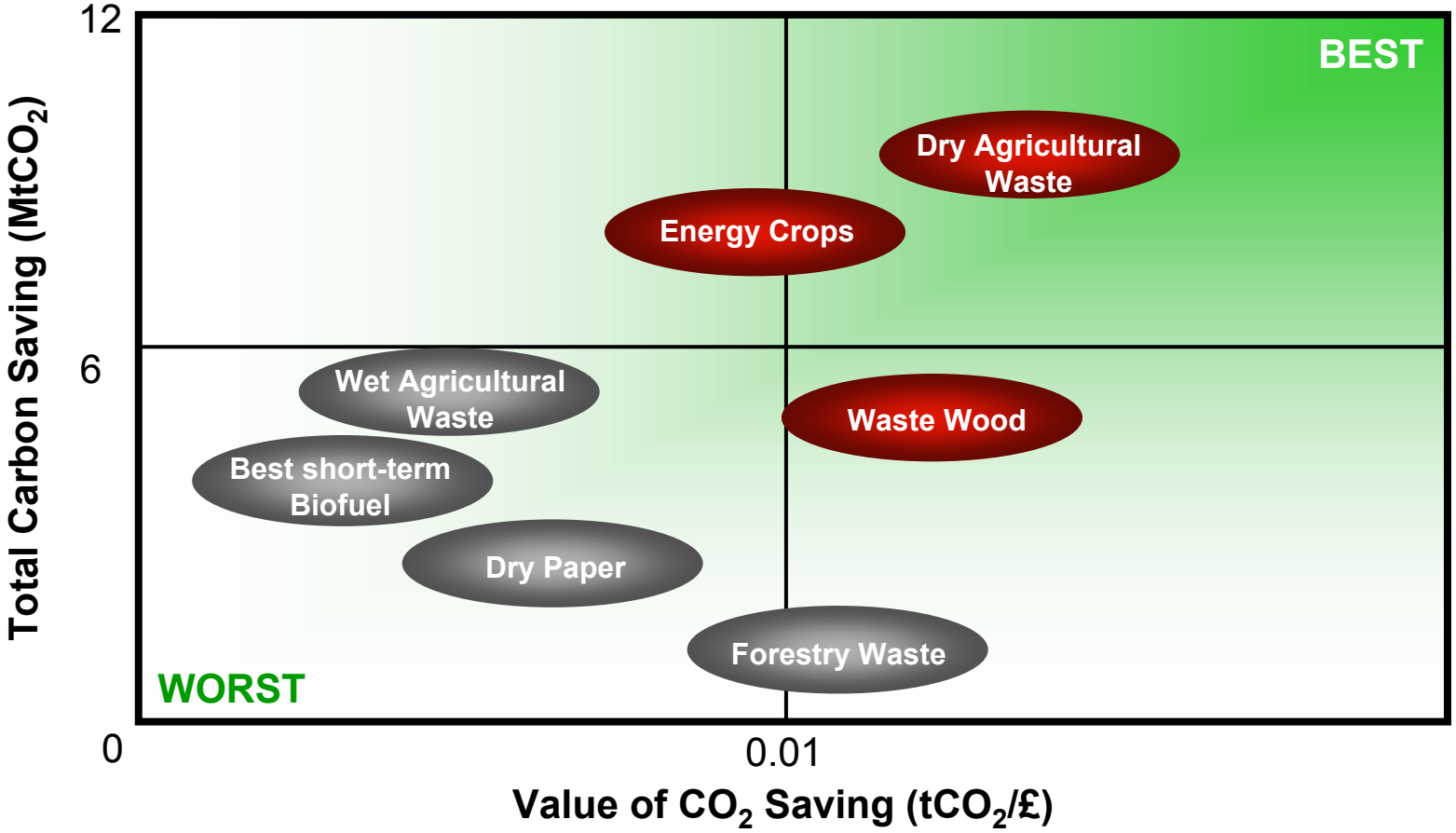


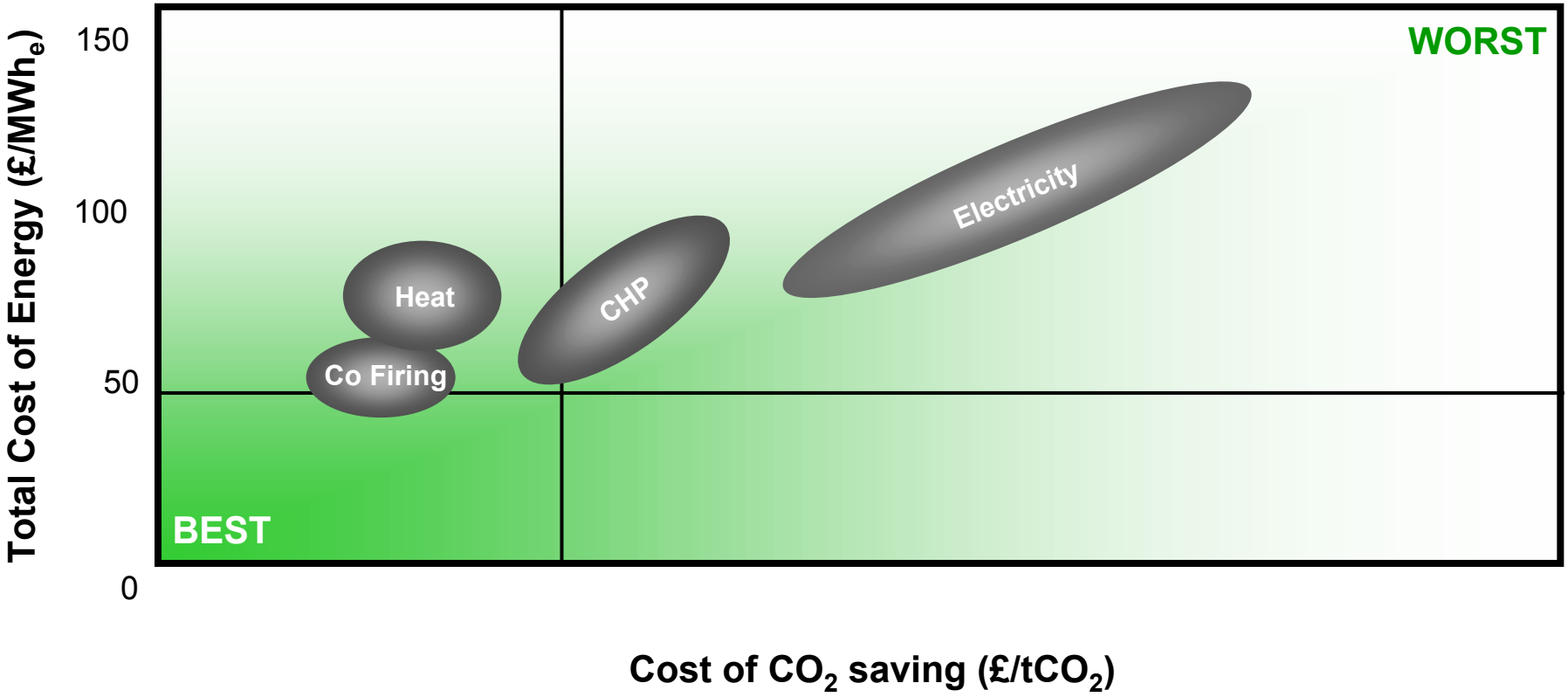
Resource Conclusions

Resource based projects should concentrate on:

- Straw (Dry Agricultural Waste)
- Energy Crops
- Waste Wood and Forestry

Technology Results (without subsidies)

Cost of Energy vs Cost of CO_2 Saving for Energy Crops
(Assuming heat valued at 1/3 of electricity)



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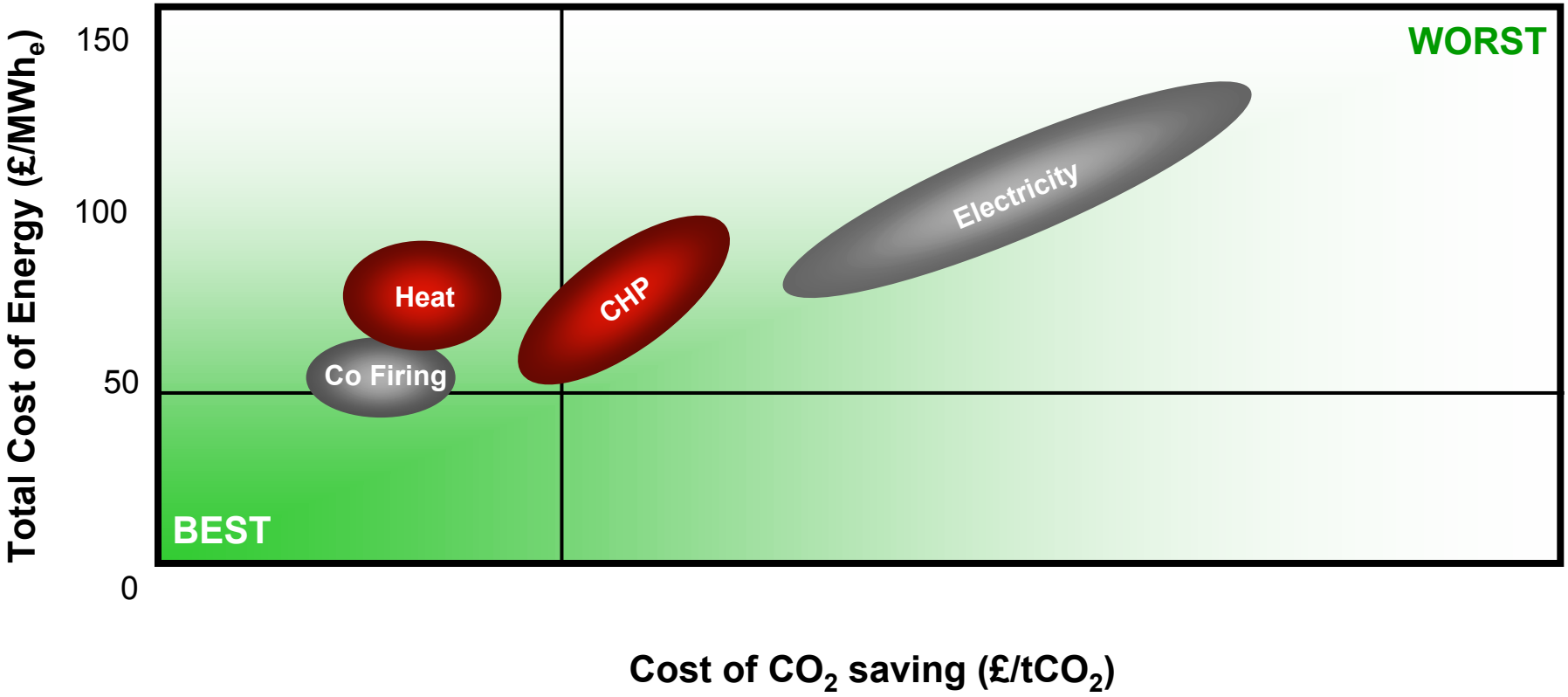
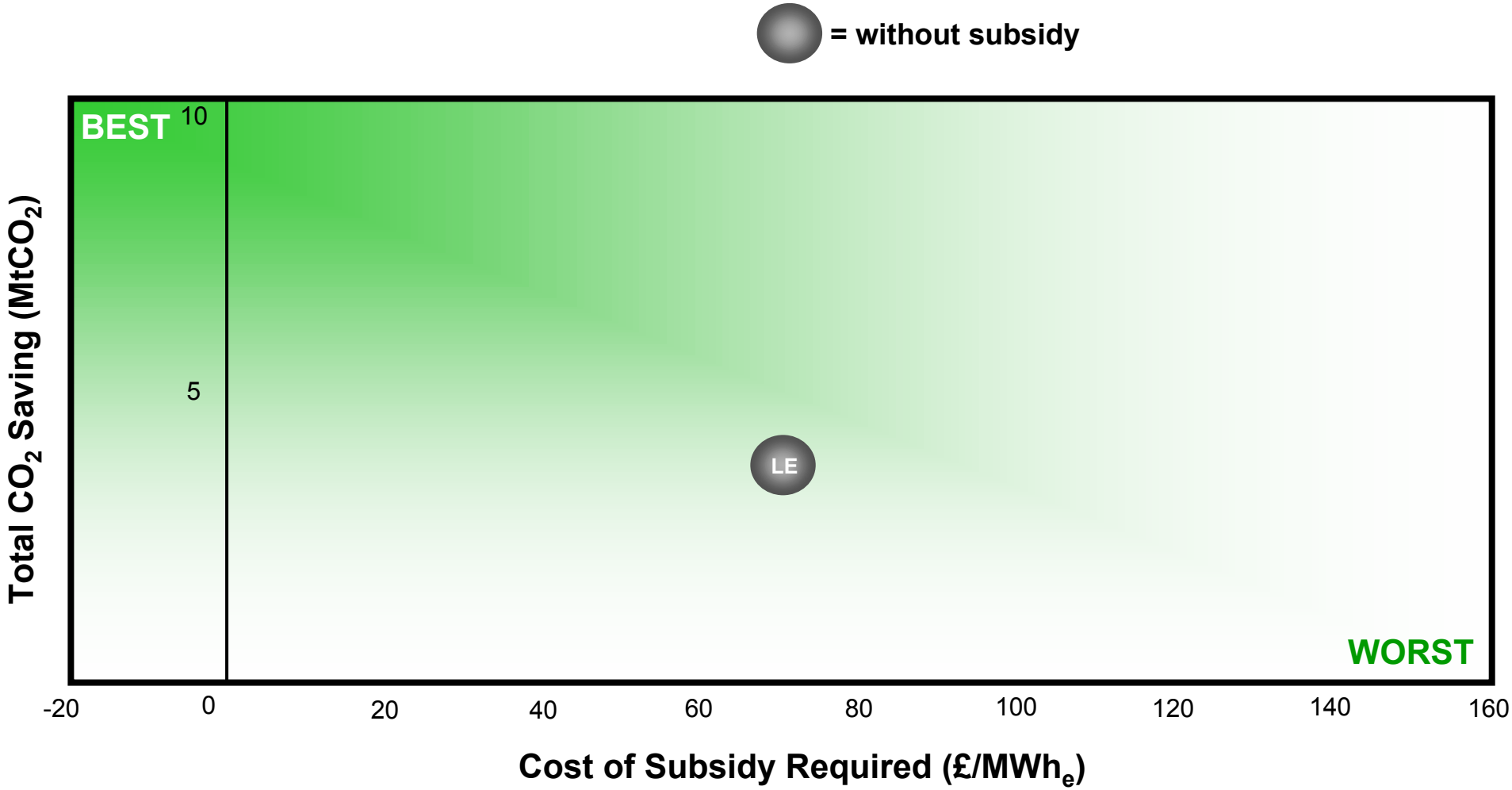


Technology Results

CO_2 Saving vs Cost of Subsidy for Energy Crops



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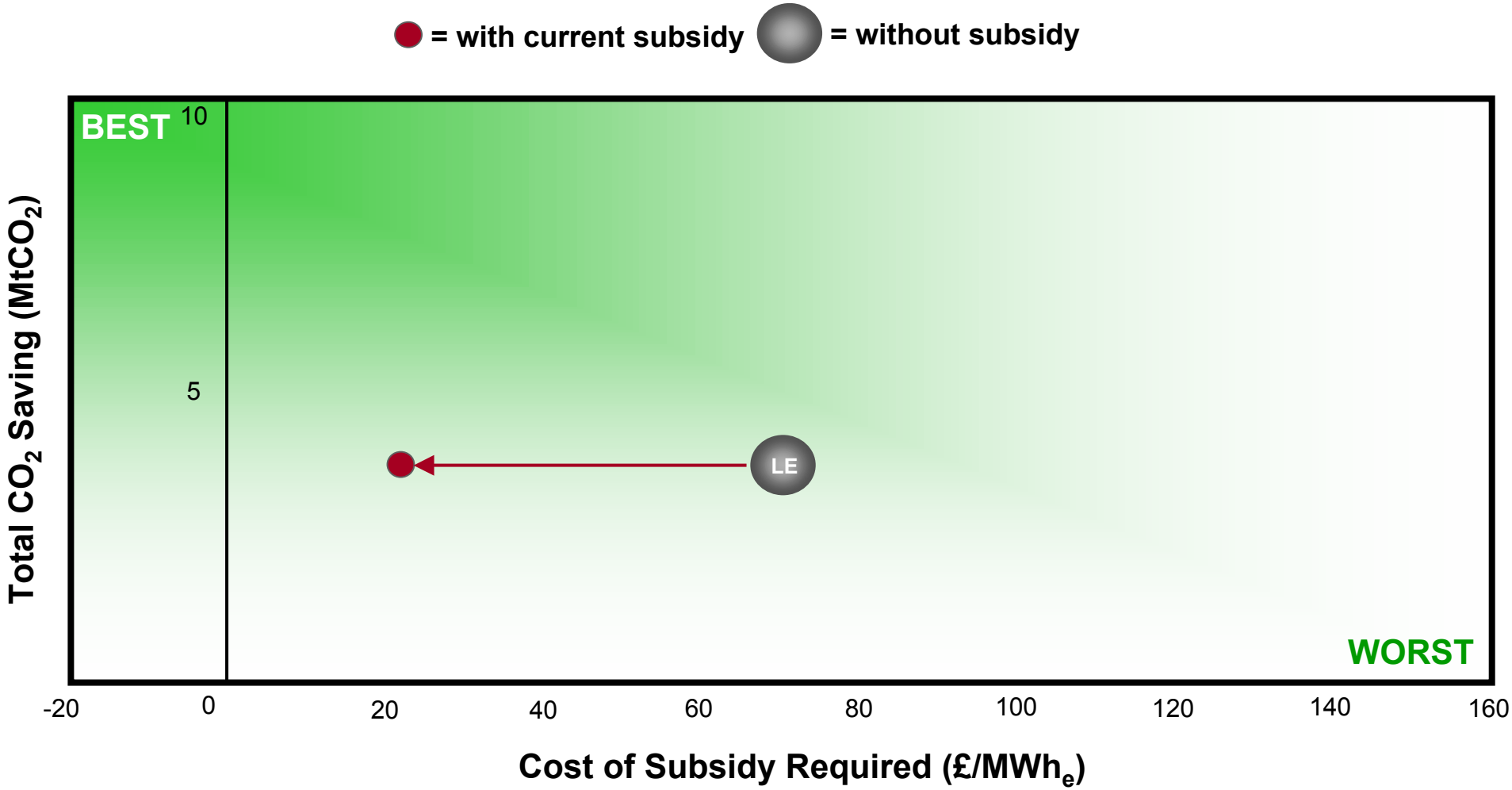

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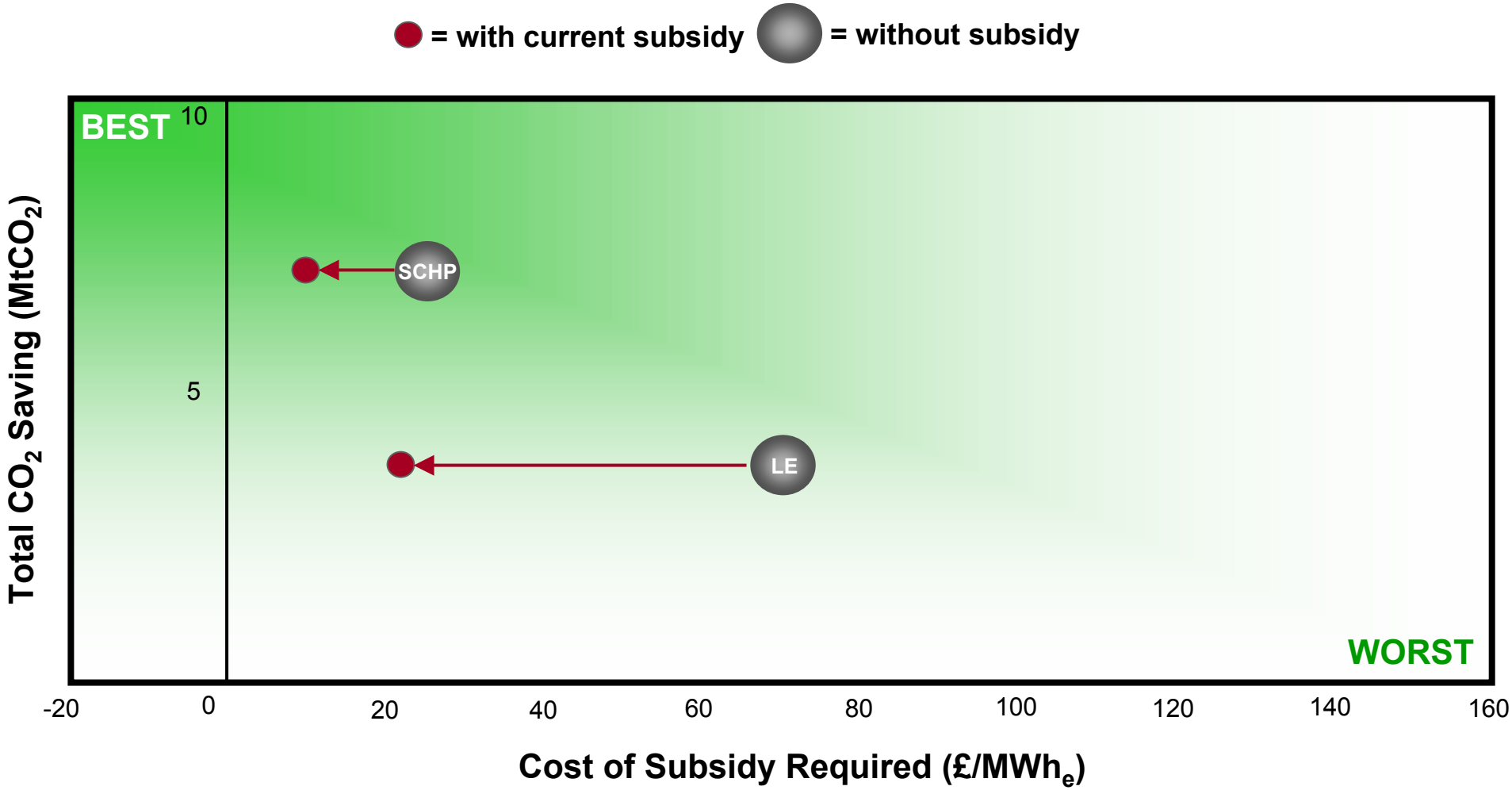

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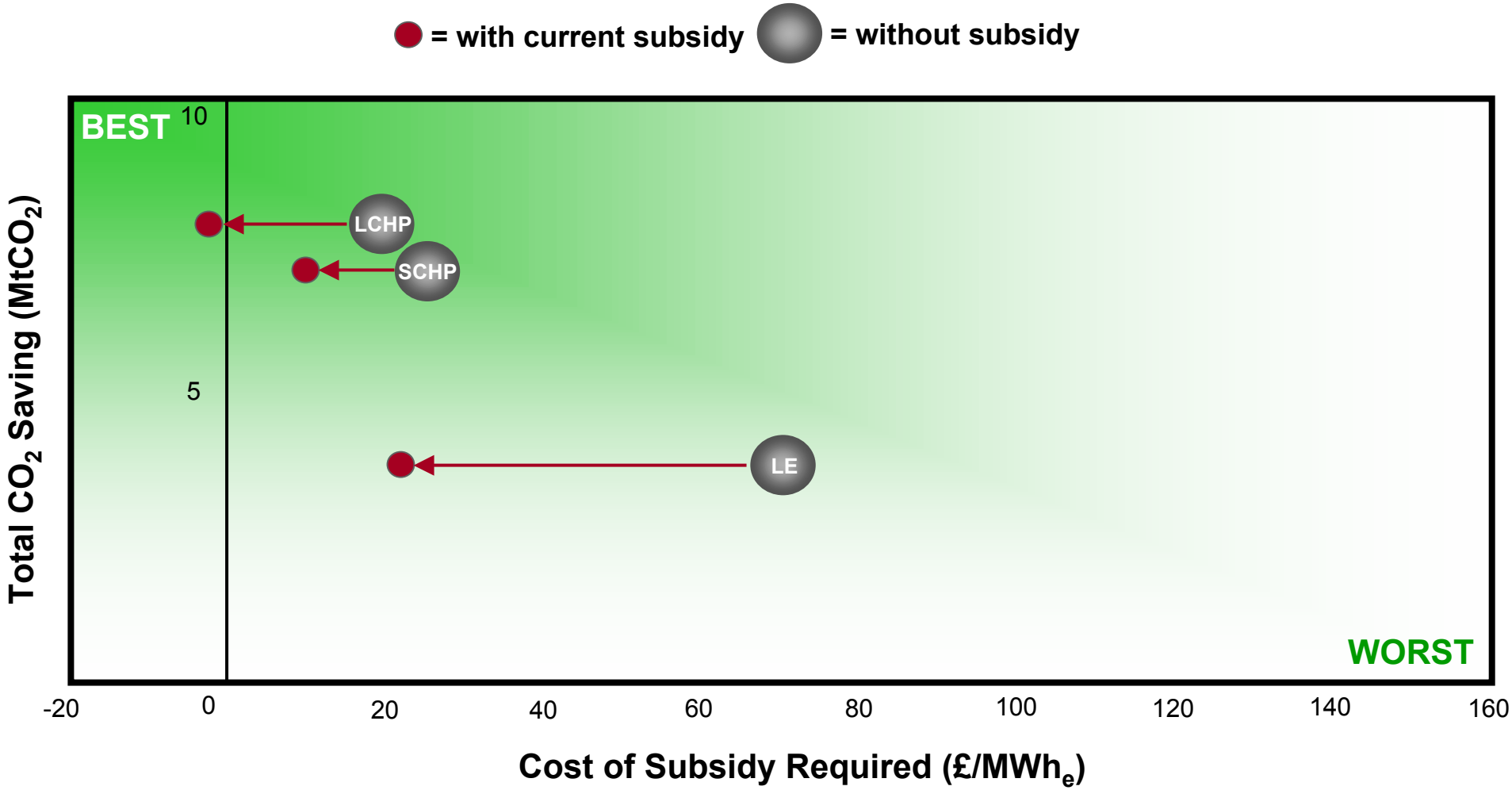

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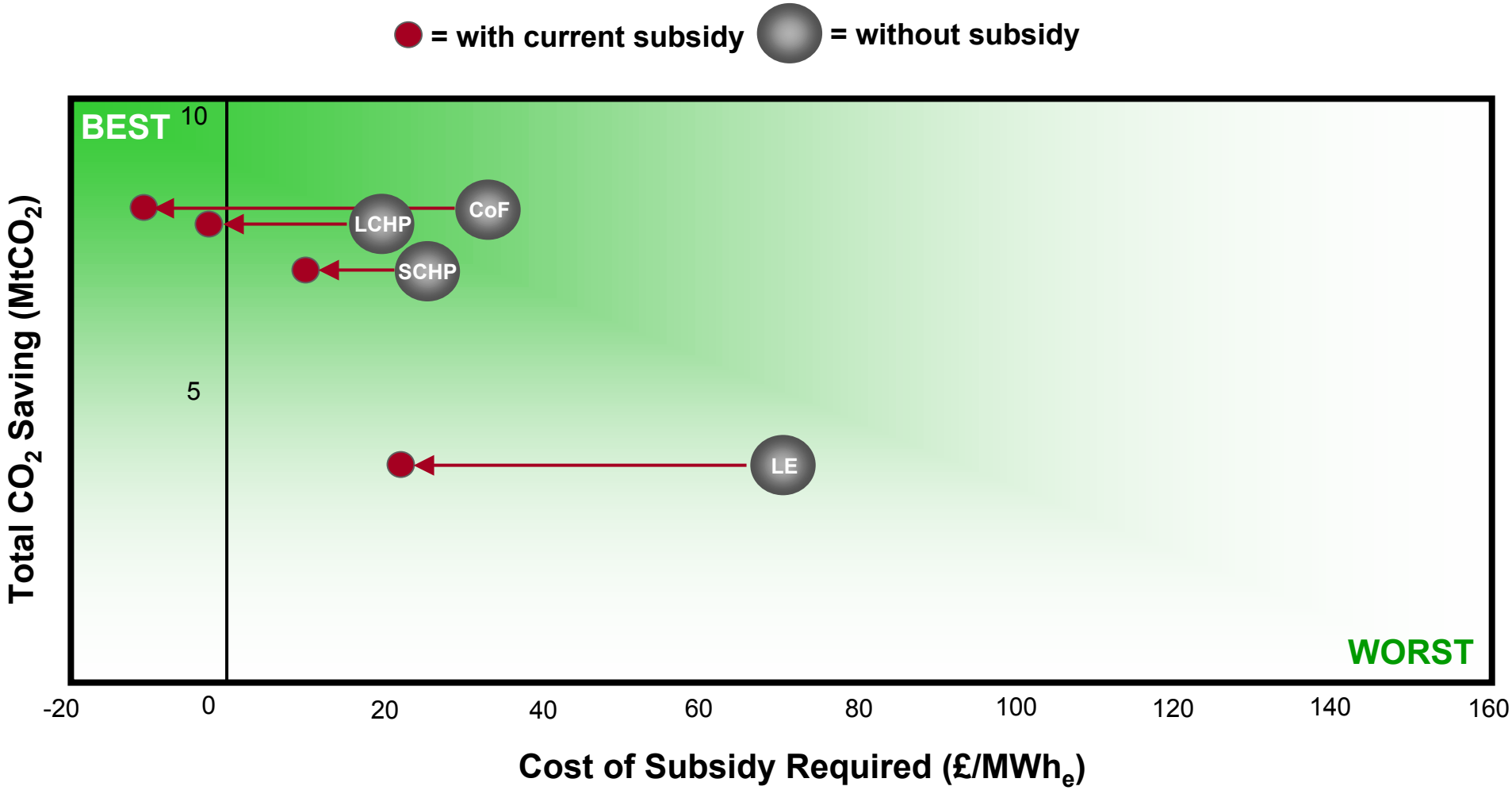

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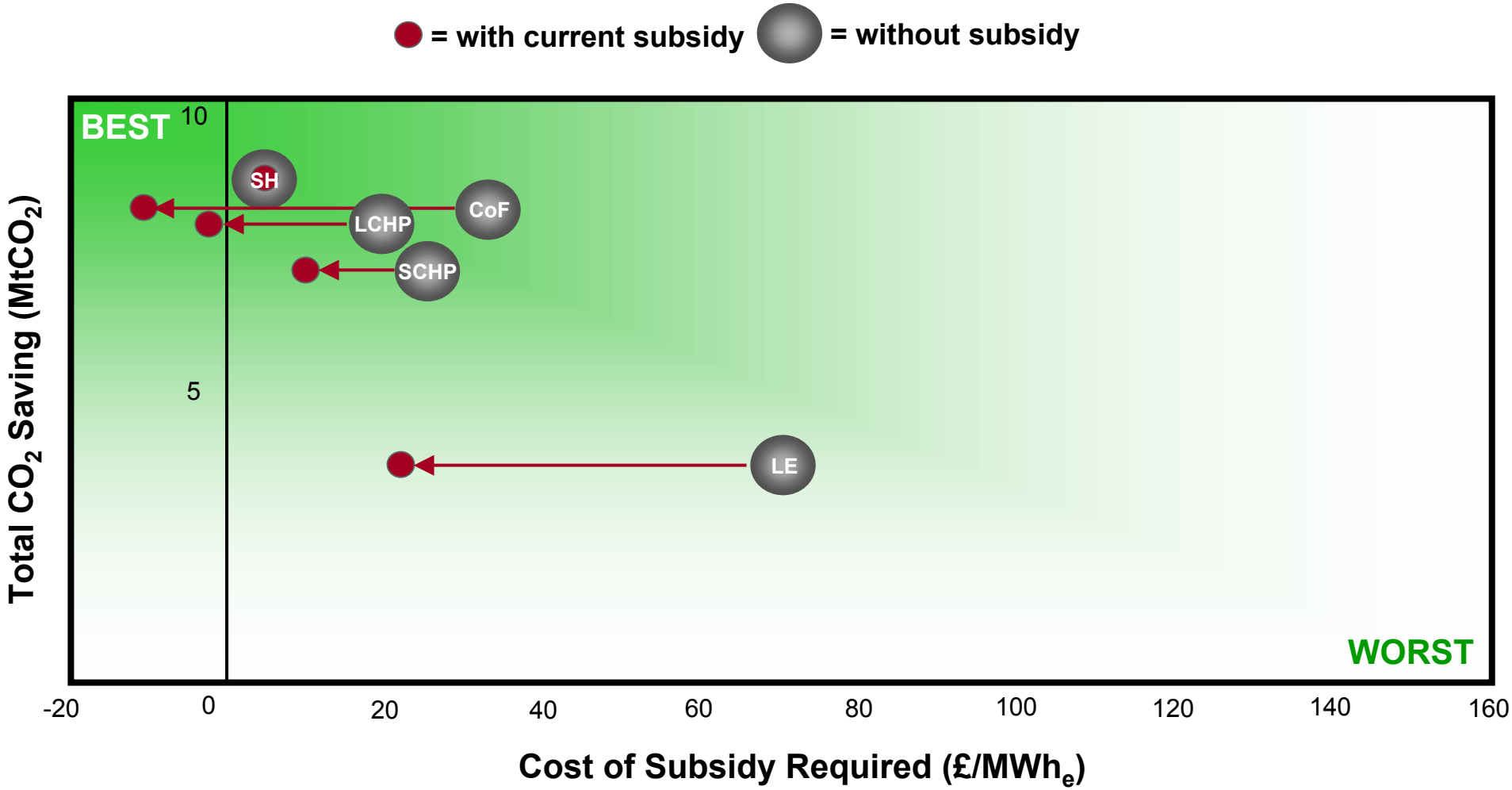

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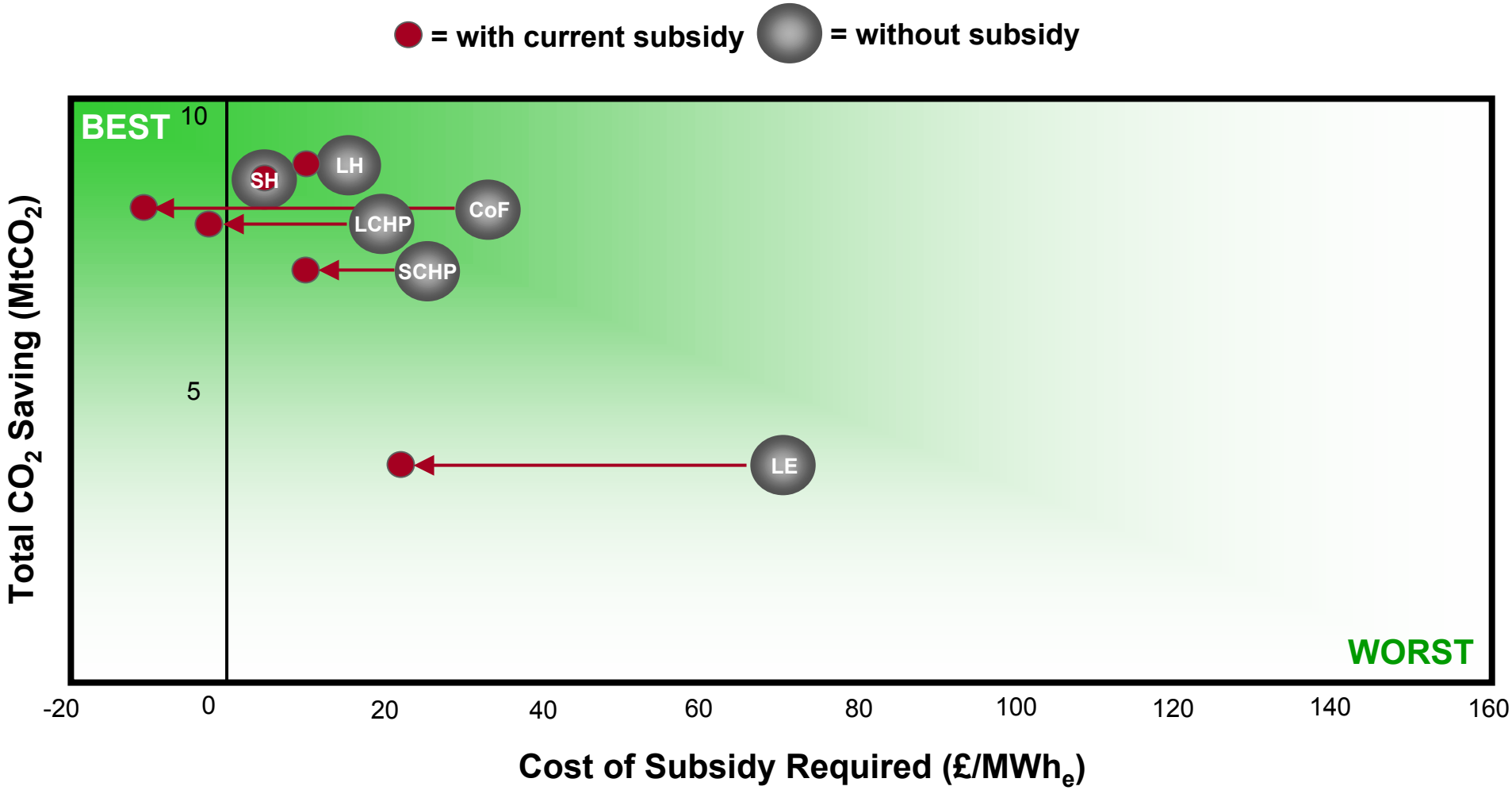

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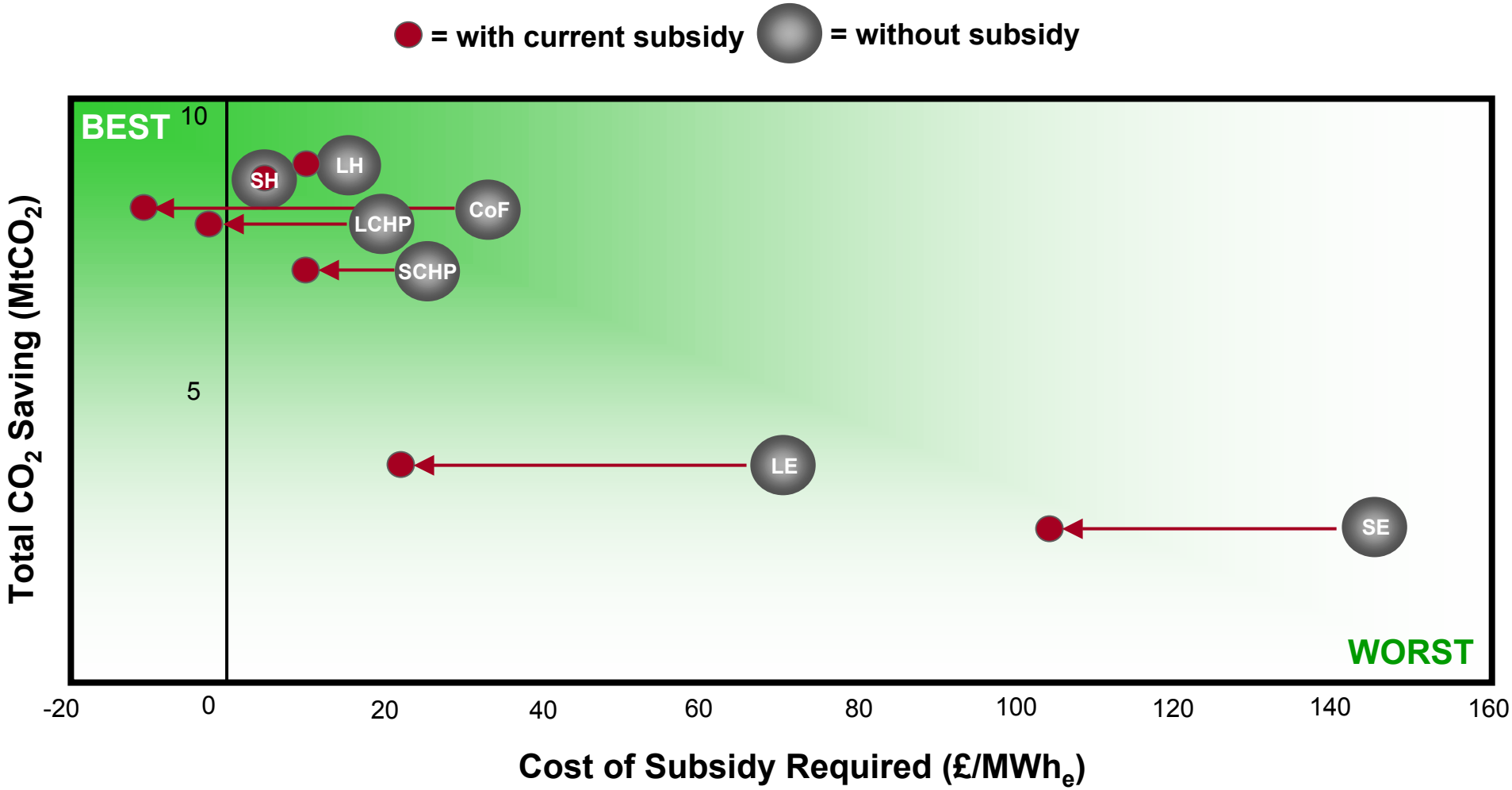

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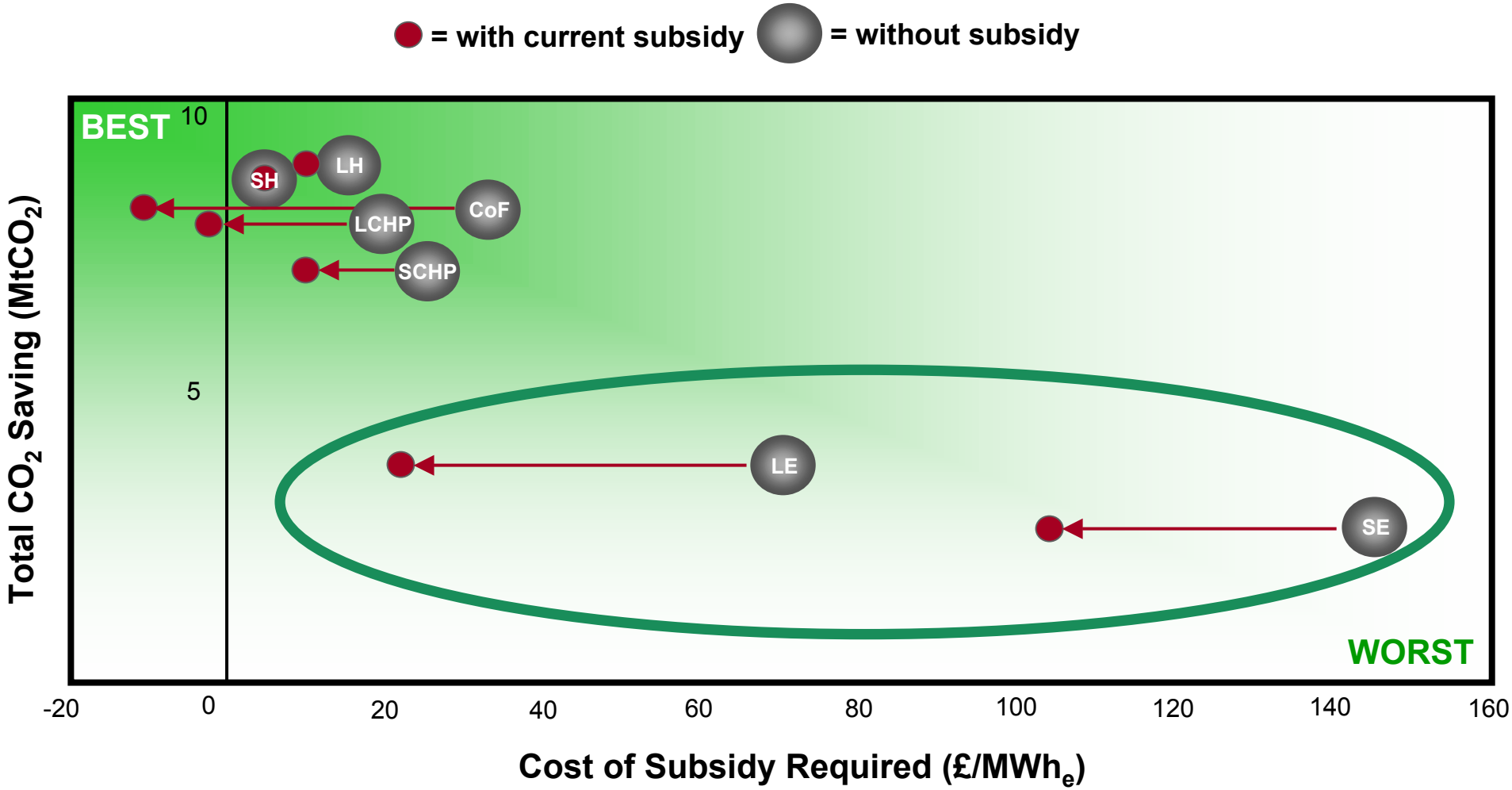

Technology Conclusions

- **Electricity only**
  - Lower CO_2 savings at higher costs than for heating or CHP options, therefore The Carbon Trust would be unlikely to support an acceleration project within this technology area
- **Co-Firing**
  - High CO_2 savings at low costs, however The Carbon Trust is not “material” in this sector and therefore would not support an acceleration project within this technology area

Technology Acceleration projects should concentrate on:

- **Heating**
- **CHP**

Phase 2 - Main Barriers Identified

- Current economics for a “generalised project” are marginal
- **Lack of support for ‘renewable heat’**
- **For CHP and electricity**, and especially for small scale projects, this is exacerbated by the current RO system, which results in large discounts from market price in order to achieve bankable long-term Power Purchase Agreements (PPA) for projects
- **The lack of fuel supply infrastructure** results in a lack of bankable long-term fuel supply contracts - therefore higher uncertainty in costs, and potentially higher costs

Phase 2 - Main Barriers Identified

- **Lack of support for 'renewable heat'**
  - Skews the economics of the different electricity, heat, CHP schemes and results in more electricity-only (i.e. non-CHP) biomass projects being developed than would otherwise be the case with a "level playing field"
  - Government grant schemes have focused on high technology / CHP initiatives at the expense of heat only schemes. In UK, capital schemes are (and as importantly are seen to be) switched on and off, so therefore do not achieve expected market development
  - The Biofuels Directive will again distort the market but is not the most cost effective way of reducing carbon

Phase 3 Methodology

Solutions Identified

Potential solutions to the various barriers in Phase 2 identified.

↓

Acceleration Projects

Development of these solutions into Acceleration Projects

↓

Favoured Acceleration Project

An optimal Acceleration Project for The Carbon Trust will be identified

Questions

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