Imperial College London

Sainsbury's

Sustainable Energy Futures Conference 2012

19th September 2012

Developing a low carbon roadmap for a food retail chain in the UK: targets & challenges

01

STUDENT: Victor Caritte

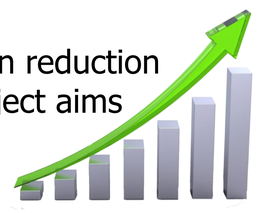
SUPERVISORS: Professor Nilay Shah (Department of Chemical Engineering, Imperial College London)
Dr. Salvador Acha (Department of Chemical Engineering, Imperial College London)
Dr. Ned Ekins-Daukes (Department of Physics, Imperial College London)

INTRODUCTION

The food retail sector accounts for approximately 3% of the total electricity consumption and 1% of the Green House Gas emissions in the UK [1]. The price of energy has already increased substantially in the UK over the last years [2]. The challenge for Sainsbury's is not just to comply with increased regulation on GHG emissions, but also to decarbonise and adapt their business accordingly. Sainsbury's is planning to double its total sale area by 2020. Meanwhile, it committed to reduce its supermarkets' operational carbon emissions by 30% by 2020 and by 50% by 2030 compared to the 2005 baseline. Thus, the challenge for Sainsbury's is to **decouple its carbon emissions from its business growth**.

OBJECTIVES

Develop a Roadmap that proposes pathways to meet the carbon reduction targets while ensuring the best returns on investment. The project aims to capture Sainsbury's stakeholders imagination toward a low carbon future.



METHOD

The framework is inspired by the Backcasting methodology; as described in Figure 1. This method consists in 3 steps: baseline the current state, develop a future vision and work backwards to identify actions. Before doing that, it is necessary to feed the model with the supermarkets' performance and development data. The actions are then divided in 2 wedges: Energy Savings and Low Carbon Technologies. Finally, scenarios are proposed to manage uncertainty and to enhance the vision: **2 different business growth** and **5 different grid decarbonisation** scenarios are considered.

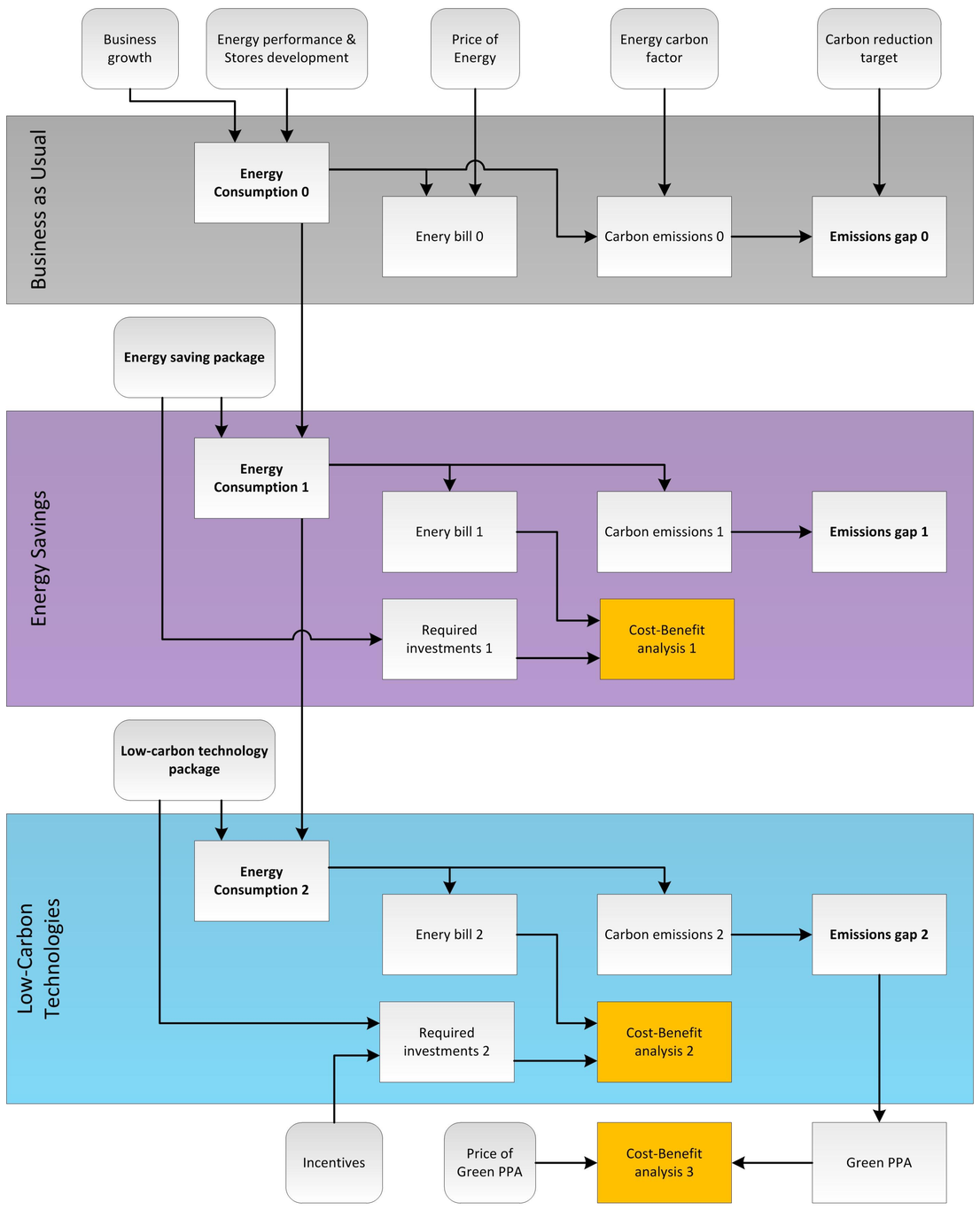


Figure 1: Roadmap flow chart – Key inputs and logical process

REFERENCES

[1] Tassou et al. (2010) Energy consumption and conservation in food retailing. Applied Thermal Engineering. 31 (2-3), 147-156.
[2] National Grid (2011) UK Future Energy Scenarios [Online].

RESULTS

Supermarkets' overall energy intensity has mainly been driven down by energy efficiency improvements in existing stores as well as by the launching of more efficient new stores and extensions since 2005. Figure 2 shows the historical and projected variation of the different categories of supermarkets considered. Inputs of the model include energy intensity, business growth, price of energy, energy carbon factors and technical information on low carbon technologies.

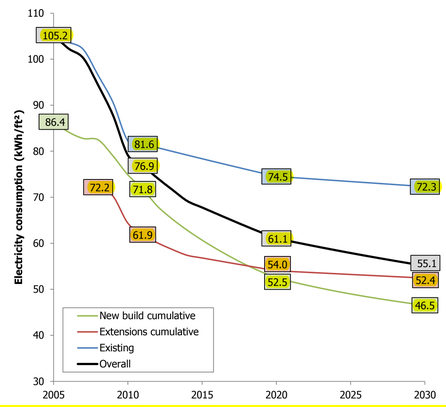


Figure 2: Electrical intensity per store category

The 3 figures below showcase BAU emissions, Energy Savings and Low Carbon Technologies potential to reduce emissions in a given scenario.

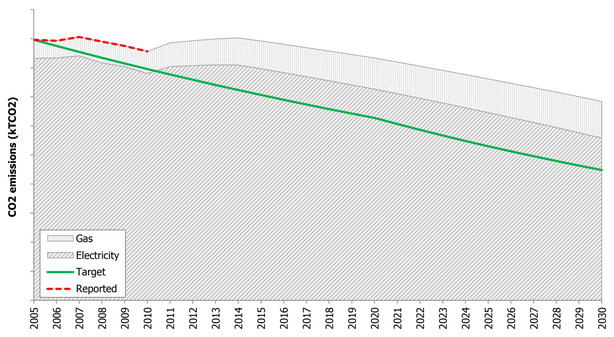


Figure 3: Business as usual carbon dioxide emissions

Under **BAU Scenario**, the analysis shows that Sainsbury's energy needs are projected to increase substantially resulting in a much higher energy bill. Additionally, except for the most optimist grid decarbonisation scenarios, carbon dioxide emissions will be above 2020 and 2030 targets.

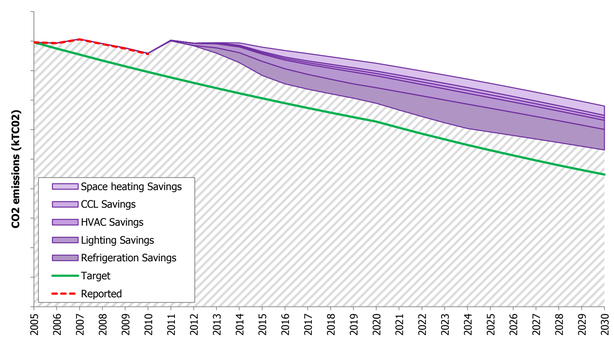


Figure 4: Energy Saving Opportunities potential

Research shows that **Energy Saving Opportunities** could reduce the overall energy consumption by as much as 17% by 2020 and by 22% by 2030 compared to BAU scenario resulting in reduced emissions and energy bill. Most of the savings would be achieved on refrigeration and lighting.

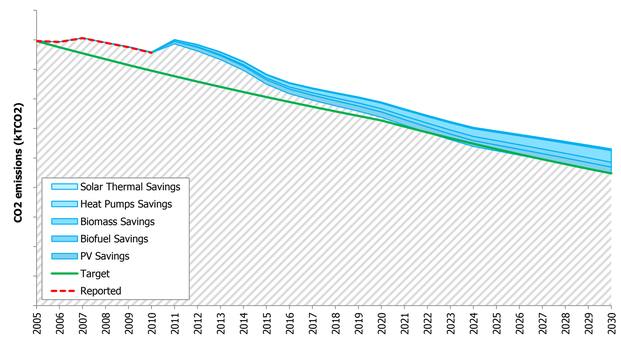


Figure 5: Low Carbon Technologies potential

Investments in **Low Carbon Technologies** (*e.g.* Solar PV, Biofuel) are expected to reduce energy consumption from the grid by as much as 8% by 2020 and by 15% by 2030 compared to post energy saving demand; helping Sainsbury's to meet its carbon target.

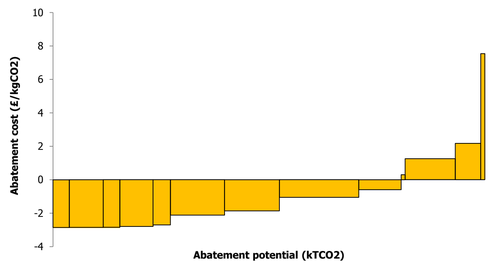


Figure 6: CO2 abatement curve

On average Energy Saving Measures have a very low abatement costs of **£-2.40/tCO$_2$**. In contrast, Low Carbon Technologies have a much higher abatement cost of **£1.16/tCO$_2$**. Furthermore, over 70% of the carbon abatement potential is within Energy Saving measures.

CONCLUSION

Sainsbury's 2020 and 2030 **carbon reduction targets are achievable in all scenarios**. However, Sainsbury's will have to consider purchasing energy from green electricity suppliers in the most pessimistic grid decarbonisation scenarios. There are a substantial number of zero cost solutions to reduce energy consumption, minimising Sainsbury's exposure to external factors and providing a competitive advantage over its competitors. This thesis also recommends to maintain the efforts in monitoring stores energy consumption accurately because information is vital for energy management.

energy futures lab