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Mitigation Action Plans & Scenarios

TECHNICAL // Commercial

ENERGY MODELLING FOR THE COMMERCIAL SECTOR

A summary of the SATIM Methodology

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Purpose

Energy economy environment models such as TIMES are often used to look at opportunities and costs of reducing greenhouse gases (GHGs). The South African TIMES model (SATIM) has been developed for this purpose and its methodology is documented online. This document presents a overview of the SATIM commercial sector methodology and may be of interest to researchers from countries where the sector is also a relatively small GHG emitter and building survey data is limited, as is the case in South Africa, making a compact modelling approach more appropriate.

The full SATIM methodology is available on the Energy Research Centre website http://www.erc.uct.ac.za/

Introduction

The commercial sector, including public services, was estimated by the Department of Energy (DOE) to account for nearly 8% of Total Final Consumption (TFC) of Energy in 2006 (DOE, 2009). Energy emissions from the sector have been estimated to contribute less than 1% to total greenhouse gas emissions in 2000 (Mwakasonda, 2009). Given the disparities between sectoral emissions, not all sectors in SATIM have enjoyed the same level of investment. Research funding has tended to concentrate on sectors having a high environmental impact and profile like the transport sector and electricity supply sector. Despite the relatively small contribution to TFC and GHGs of the commercial sector in South Africa, this module of the SATIM model has seen a fair amount of research effort. The level of detail has however been hampered by the lack of public data from building surveys and SATIM may be quite aggregate compared to other models for this sector. The basic principles adopted will likely be of interest to MAPS modellers and the data on building activities and energy service may serve as a useful reference point.

Basic principles

In SATIM the commercial sector includes all non-residential buildings, excluding buildings used for industrial and agricultural activities. The basic approach for the commercial sector is that the demand for energy will be dependent on floor area and that the energy services active on the floor area will be dependent on the type of commercial activity undertaken. This can be derived in quite aggregate form from data published by the National Department of Statistics (StatsSA, 2010) as shown in Table 1.

The Long Term Mitigation Scenarios version of the model included eight building activities. This has been consolidated to the three shown to be consistent with available data. This is thus the first building block of the model. The next step is the assessment of energy services used by these building activities briefly discussed on page 2.

TABLE 1:

FLOOR AREA SHARE OF COMMERCIAL BUILDING CATEGORIES

BUILDING ACTIVITY	ECONOMIC SECTOR	PERCENTAGE SHARE OF FLOOR AREA 2001	PERCENTAGE SHARE OF FLOOR AREA 2006
Shopping space	Wholesale, retail, motor trade and accommodation	37%	36%
Office and banking space	Finance, real estate and business services	30%	39%
Other non-residential space	Personal services	33%	24%

Model structure and energy service shares

Energy consuming activities in the commercial sector are represented by seven energy services in SATIM and along with the six major sources of energy in the national energy balance, form the basic structure of the SATIM Commercial Sector model as shown in Table 1. The final share of energy services presented will be of interest as a point of reference for researchers from other countries but it must be emphasised that it is based on aging data (de Villiers, 2000), augmented for electricity services by the US Commercial Buildings Energy Consumption Survey (CBECS, 2003) and for non-electricity services by a localised survey for Cape Town only (CCT, 2007).

Future demand for energy from the commercial sector

The energy demand from the commercial sector is assumed to be proportional to the floor space used for a given commercial activity. The increase in energy demand is modelled on increasing total floor space area relative to the base year. The floor space is split into two classes, 'Old building code' which has a dropping share of total floor space over the study period and 'New building code' which has a rising share. The latter is allocated an energy intensity that is 20% lower to reflect the greater energy efficiency of newer buildings. Floor space projections are generated using an elasticity derived from a regression of floor area against GDP between 1993 and 2006.

TABLE 2:

ESTIMATED ENERGY CARRIER SHARE OF ENERGY CONSUMPTION BY END USE AND FUEL

	LIGHTING	SPACE HEATING	WATER HEATING	COOLING & VENTILATION	REFRIGERATION	COOKING	OTHER
ELECTRICITY	40%	5.82%	2.18%	30%	7%		14%
LPG			100%				
PARAFFIN						100%	
COAL		54%	46%				
RESIDUAL OIL		0%					100%
TOWN GAS		0%					100%

South Africa's LTMS

The Long Term Mitigation Scenarios (LTMS) was a cabinet-mandated process from 2005-2008, led by the then South African Department of Environmental Affairs and Tourism, to establish the evidence base for a national low carbon development path. Key to the process was its unique blend of facilitated stakeholder engagement and rigorous research.

The LTMS arose out of the realisation that South Africa would need to contribute its fair share to greenhouse gas mitigation. Greenhouse gas emissions in South Africa come mainly from energy use and supply. Moving to a low carbon development path would require a major shift in thinking and in action. Hence a blend of process and research was critical when assessing mitigation potential within the country. Having accurate numbers would build confidence, but equally important was that a wide range of key stakeholders within South Africa agreed that the numbers were credible.

The LTMS research was peer-reviewed and found to be of best practice. Reviewers recommended sharing the experience with other developing countries. From this recommendation the MAPS Programme was born. For more information see http://www.erc.uct.ac.za/Research/LTMS/LTMS_project_report.pdf.

Conclusion

The SATIM methodology for the commercial sector may prove to be a useful reference for researchers needing guidance on basic principles for modelling energy consumption by the sector and resulting GHG emissions. Researchers from countries where building survey data is similarly or more limited will likely also benefit from consulting the more detailed methodology.

References

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MORE ABOUT MAPS

Mitigation Action Plans and Scenarios (MAPS) is a collaboration amongst developing countries to establish the evidence base for long term transition to robust economies that are both carbon efficient and climate resilient. In this way MAPS contributes to ambitious climate change mitigation that aligns economic development with poverty alleviation.

Central to MAPS is the way it combines research and stakeholder interest with policy and planning. Our participative process engages stakeholders from all sectors within participating countries and partners them with the best indigenous and international research.

MAPS grew out of the experience of the Government mandated Long Term Mitigation Scenarios (LTMS) process that took place in South Africa between 2005 and 2008. The LTMS, with its home-grown stakeholder-driven approach, its reliance on scenarios and the rigour of its research and modelling were key to its approach. The LTMS informed South Africa's position for Copenhagen and is the base of much of the country's domestic policy.

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