



## RETAIL SUPERMARKETS SECTOR

### COLES SUPERMARKETS — ENERGY IMPROVEMENT IN ACTION

“We’re very excited that we can marry our goals in retailing with our goals to

reduce energy usage.

This builds on our existing energy and environmental management capability in a business focussed way.”

GERRY MASTERS

MANAGING DIRECTOR

COLES-MYER

Enhancing retail objectives while minimizing energy costs was the challenge Coles, one of Australia’s largest and most successful retailers, and the Australian Government Department of Industry, Tourism and Resources (ITR) set for themselves — how to keep food refrigerated, products easy to reach and replenish, while improving customer comfort and lowering energy costs.

Through its partnership with ITR’s Energy Efficiency Best Practice Program, Coles developed an innovative ‘Greening of Coles’ initiative — a first in the retail supermarkets sector. The Greening of Coles is a rolling program to improve the energy and environmental performance of Coles stores, founded on research and design methodologies developed with ITR. It complements other Coles programs and builds on substantial existing environmental capabilities and achievements.

The first Greening of Coles store or G1 is being built in Gisborne, 50km North-West of Melbourne. The design and eventual operation of this store incorporates 40 new energy and resource efficiency initiatives. The performance of G1 will be monitored and measured so that the energy and business innovations can be incorporated into other new stores as they are built and into major retrofits of existing stores. This represents a commitment by Coles to continuous energy performance improvement in action.

This case study outlines the project that stimulated the Greening of Coles.

### SCOPING THE PROJECT

Impressed by the achievements of the Bakers Delight franchise in designing and developing an energy efficient bakery, Coles joined with ITR to review energy use in a typical store and identify potential energy reductions. The first step was to scope the study. This involved looking at what Coles had achieved in energy management, understanding energy performance in the retail sector, gathering data on existing energy use and store practices, and identifying potential areas for improvement.

Coles was already acknowledged as a leader in the Australian supermarket sector for energy efficient lighting design, refrigeration, heat recovery and phasing out chlorofluorocarbon (CFC) refrigerants. Its engineers, for instance, had cut power usage in lighting by more than 50 per cent during the 1990’s through better design of its grocery aisle lighting.

“The initiative is building on our successes to date in waste reduction and energy efficiency to produce smarter, more environmentally friendly stores and a better shopping experience for our customers.”

TONY HILL  
NATIONAL ENERGY  
AND ENVIRONMENT  
MANAGER, COLES

Supermarkets in Australia consume more than 7,000 GJ of electricity each year costing around \$200 million, and producing nearly three million tonnes of greenhouse gases. While the energy cost is usually a small percentage of total operating costs, it is a significant proportion of the tight profit margins of many supermarkets. Together Coles and Woolworths account for around 80 per cent of electricity use and sales in the supermarket sector. Refrigeration accounts for most of the annual energy use, at 55 per cent, while air conditioning and lighting each use 20 per cent.

At the outset, Coles and ITR agreed that a more ‘whole-of-system’ approach was needed for energy and environmental management. New stores were being commissioned and others retrofitted to offer a wider choice of goods and services to customers. Looking at the entire life cycle of a store — starting at the design stage — would enable a broader and more in-depth perspective on energy use. Once a store is built, only incremental energy improvements can be made.

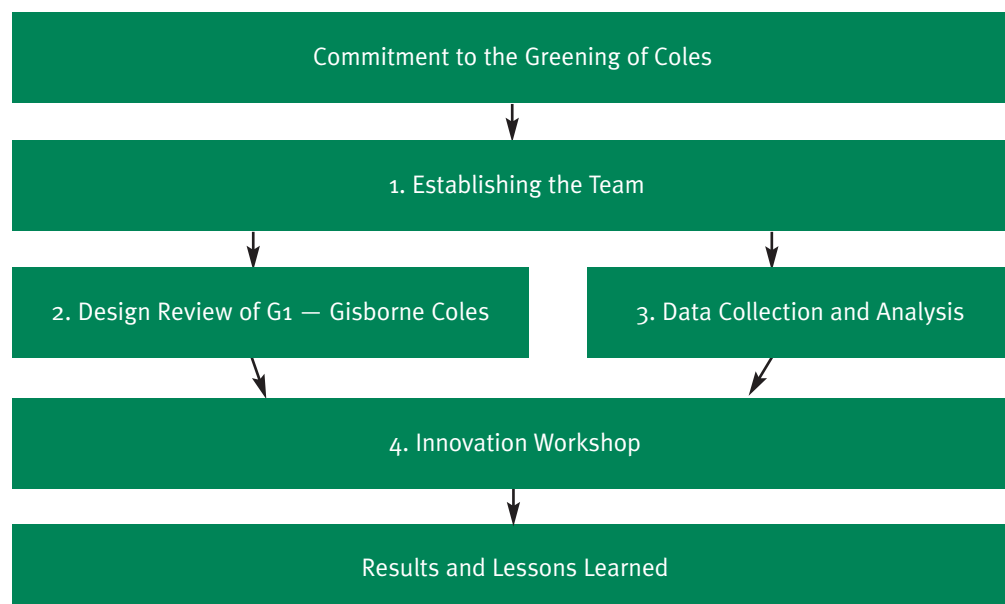
### THE GREENING OF COLES PARTNERSHIP

Taking a ‘whole-of-system’ approach meant engaging the support of Coles management across the organisation. A review team was set up, comprising Coles staff, state and Australian Government agencies, external technical and facilitation consultants, and energy, waste and change management specialists. This team looked at how to align energy efficiency with the many other internal environmental and business development programs in Coles. The resulting *Connectivity Report* drew together data on energy use and environmental performance, identified key personnel and organisational barriers, and assessed the performance of Coles against world’s best practice in supermarket energy management.

This Report recommended that a more encompassing vision be created within Coles: a vision that senior management could endorse and that would engage people across the organisation.

A partnership agreement between Coles and ITR set out the steps needed to achieve the Greening of Coles vision, including the development of G1. It outlined Coles’ commitment to the Greening of Coles stores, building on ITR’s energy efficiency approach known as the Big Energy Project. The initiative aimed to provide Coles with a way to assess and pilot integrated technology and design solutions in its stores, while rallying support across the organisation.

#### Key Project Steps — ITR and Coles Partnership





## 1. ESTABLISHING THE TEAM

The Greening of Coles approach required earlier involvement between Coles and developers of shopping centre complexes. This was recognised as an important factor in expanding the opportunities for effective energy usage and management. As a result, Coles set up a team with people drawn from a wide cross-section of departments, including facilities management, Victorian management, building services, compliance and regulatory affairs, corporate affairs, store design and marketing. Members were sufficiently senior to influence decision making in other parts of the company.

Consultants experienced in organisational facilitation and project management were also engaged to coordinate and facilitate the process. They were supported by leading technical specialists in energy performance and commercial refrigeration systems. The project offered Coles a structured process with external support to gather and analyse data, and to develop new technology and design solutions.

Throughout the project, team members were encouraged to challenge core assumptions and think laterally about innovative solutions to improve energy efficiency.

## 2. GISBORNE DESIGN REVIEW — G1

One of the key issues identified was that developers generally build supermarkets as part of a shopping centre development, with local government setting the planning parameters. Normally it was not until the building was handed over that Coles facilities managers could start to implement energy management.

The Greening of Coles project turned this process around by reviewing the energy efficiency of the new Gisborne supermarket — G1 — at the planning and design stage. ITR facilitated a design review workshop between Coles managers, shopping centre developer (Gisborne Property Holdings), and McGauran Giannini Soon (MGS), architects for the developer. Experts in waste, water, and energy were also involved.

The group brainstormed ways to improve the store's efficiency from the ground level up, keeping an open mind on what was possible. The design review aimed for the best possible environmental outcomes with minimum cost increases.

MGS project architect Mr Paul Dash stated that the design review process enabled design opportunities to be quickly identified and developed. *“The process facilitated the best possible results. It allowed for a wider-ranging investigation of energy efficiency principles and practice than would normally be possible”.*

The following were examined to improve the environmental performance of the shopping centre:

- construction and maintenance contracting issues
- renewable energy opportunities
- passive solar building design
- building envelope performance
- energy efficiency of building equipment, fixtures, services and maintenance
- building materials (life-cycle performance)
- landscaping and outdoor facilities
- water capture, efficiency and recycling
- waste management and facilities.

Gisborne Property Holdings, the developer of the Gisborne complex, is implementing the initiatives proposed by the workshop to improve the building envelope thermal performance, use renewable materials, and capture and recycle water, as at Table 1.

**“The Gisborne Design Review has fuelled an ongoing interest in environmentally sustainable development in our firm. MGS and our client are excited to collaborate on a project with the potential to benchmark future green retail developments in Australia.”**

**PAUL DASH,  
PROJECT ARCHITECT  
MGS PTY LTD**

**Table 1. Gisborne shopping centre initiatives.**

Initiatives	Benefit
Day-lighting (more natural lighting).	Reduces artificial lighting and energy use; improves store ambience and comfort.
Airlocks at the main entrance and rear dock seals.	Significantly reduce air ingress and energy used by heating, ventilation and air-conditioning (HVAC) and refrigeration systems.
‘Thermomass’ insulated concrete panel to west and east walls.	Reduces heating and cooling requirements through better insulation.
Eliminating the suspended ceiling.	Reduces material use and provides access to day-lighting.
Insulated roof deck system.	Reduces energy use, material use and air leakage.
Water retention and recycling for toilet flush system and for landscape irrigation.	Reduces water usage and peak load on storm water infrastructure.
Renewable timber construction.	No rainforest timbers used; low embodied energy material.

### 3. DATA COLLECTION AND ANALYSIS

Three review and analysis reports were prepared for the Innovation Workshop. These ensured that ideas and discussion were based on an accurate picture of the current energy use within Coles stores.



#### Background Paper

The background paper identified trends in and factors affecting energy use from data collected from 480 Coles stores across Australia, including the Western Australian Newmart stores. The results showed the annual energy consumption per square metre of trading area differed significantly between stores. In most States the least efficient store typically used three times more energy per square metre than the most efficient.

The results highlighted that energy efficiency could make a big difference, with the potential for substantial savings in Coles’ multimillion dollar national power bill. However, the high level of variation in the figures also raised the fundamental question ‘What are the variants that produce such differences? Was it the building, store design, operating hours, climate or other factors?’

#### Regression Analysis Report

To answer this question, Coles gathered information on 19 variables from 30 Victorian stores. The variables included: store type (within a shopping centre or stand alone); store age and size; type of bakery; weekly customer count; aisle lighting design; and length and volume of refrigeration and frozen food cabinets.

A multiple regression analysis of the data helped to identify the factors in store design and operations which contributed to the widely varying annual energy use between different stores. The two main influences on annual energy use were the volume of open food refrigeration cabinets (cooled and frozen) and a store entry airlock.

The regression model enabled Coles to estimate annual energy use with close accuracy for 20 supermarkets. For example, the Donvale store used 2,723 MWh in a year, compared with a use of 2,770 MWh estimated by the model. The Burwood East store actually used 1,558 MWh, compared with an estimated use of 1,607 MWh.

“For the first time we can now predict what the energy savings will be if we use particular technologies. Previously we knew that air locks saved energy, but this regression model lets us accurately predict what those savings will be. This greatly helps the business case and obtaining the investments funds needed for new energy saving initiatives.”

## GREENING OF COLES TEAM



### Avondale Heights Monitoring Report

A newer Coles supermarket at Avondale Heights was closely measured and monitored to explore further the relationship between food storage needs, humidity levels and overall customer comfort. While refrigeration was confirmed as the main energy user, there were some surprises. Energy usage was expected to be higher in summer with greater refrigeration demands. However, winter and summer energy usage levels were similar. Further work suggested that more investigation was needed on inefficient air conditioning and cold air spillage from refrigerated cabinets.

## 4. INNOVATION WORKSHOP

The Innovation Workshop is a key part of ITR’s methodology to optimise energy efficiency opportunities. The Workshop encourages participants to look beyond daily operations and explore innovative solutions, aiming to improve energy efficiency by between 30 to 50 per cent. It brings together external and internal expertise.

In the Workshop, the Greening of Coles team reviewed the store environment with a ‘whole-of-system’ approach. Members explored how to save energy while delivering key business and customer goals for Coles. They brainstormed how to better control temperature and humidity to improve customer comfort while preserving food. They looked at balancing the need to present food well and provide easy access while keeping refrigerator energy use down.

Substantial knowledge and enthusiasm underpinned the Workshop. The Gisborne design review had highlighted the energy saving potential of considering energy efficiency at the design stage. Data gathering and analysis had provided key insights backed up by solid data. Engaging senior management and involving people from across departments had established valuable internal support.

The Greening of Coles team identified areas of opportunity for investigation under the following headings — refrigeration, multi-zoning, system integration and controls, building envelope, and energy alternatives and education. Coles has adopted those marked [G1] for the Gisborne-G1 store, and will continue to consider others for future stores and refits.

### Refrigeration

Refrigeration accounts for about 60 per cent of a store’s energy, with open refrigerator cases using most energy. Recovering spilled cold air to reduce air conditioning load partly offsets the summer energy load of refrigeration. The following actions were identified:

- Where possible use doors on refrigerated cases with low-transmission glass to reduce radiant heat loads by 12 per cent. Coles is considering low-energy doors for 30 per cent compressor size reductions [G1].
- Minimise overuse of refrigerated cases, especially for fresh produce [G1].
- Integrate air-conditioning and refrigeration plant [G1].
- Dual and triple air curtains offer at least 10 per cent energy savings and improve fresh product quality [G1].
- Use night curtains possibly controlled by proximity sensors [G1].
- Look at high and low-level heat recovery and potential uses [G1].
- Modify inlet and outlet fans to increase efficiency by 15 per cent [G1].
- Continue investigating use of natural and secondary refrigerants, eutectics and slurry ice [G1].
- Make modular design cases for more flexibility and use secondary refrigeration.
- For fresh produce use passively cooled trays or dedicated cool room.

### Multi-zoning (internal space planning)

The different climatic needs of the main zones of a supermarket, from refrigerated goods and fresh produce to the bakery and hot deli areas, account for high or excessive refrigeration energy use. The following aspects were identified:

- Apply multi-zoning areas more widely, taking into account that:
  - Physical barriers will be more effective and energy efficient than air pressure or large air curtains in lessening mixing between air from the different zones.
  - Multi-zoning enhances the potential for hybrid displacement heat and ventilation air-conditioning (HVAC) systems.
- Combine thermal modelling and ambient condition studies to determine the most efficient configuration, technologies or other approaches.
- Minimise store air volume by reducing ceiling and roof heights.

### System integration and controls

The periodic renewal of contracts for the supply of control systems offers scope to update or change the current control system to a more flexible, ‘intelligent’ and sophisticated hybrid or integrated system. The level of control, flexibility and programmability, maintenance requirements and benefits need to be closely considered.

Coles decided to trial a PLC (programmable logic control) system in ‘G1’ and to apply lessons learned in designing systems for future stores [G1].

### Building envelope

Air leaks are one of a store’s major energy losses. They occur from exhaust outlets, roof penetrations, windows, and various doors and other openings. Some of the following performance and design features, some of which the developer would be responsible for (marked with \*) were agreed as important factors for greater efficiency in the building envelope:

- \*Install airlocks in new stores. Data shows airlocks provide the biggest energy improvement, with estimated annual energy and cost savings of 719,000 kWh and \$57,000. More effective seals, dampers and timers will improve savings [G1].
- \*Provide better roof insulation, reflective roof material and colours to minimise thermal bridging [G1].
- \*Use skylights and natural lighting, incorporating airflow design, to gain additional savings [G1].
- \*Consider building a substantial concrete wall as part of the store. A 200mm concrete wall can delay peak envelope heat load by eight to 12 hours and shift about 10 per cent of energy use to midnight when off-peak rates apply [G1].
- Consider specific climatic conditions of different regions and use the appropriate design and building forms\* to maximise energy efficiency [G1].

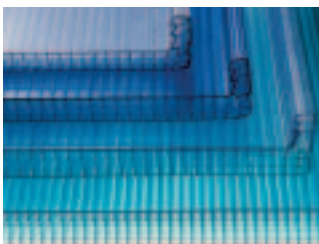


Image of proposed skylight material – DANPALON

### Energy alternatives and education

The project team considered using alternative energy sources as a way to rally the support of customers and staff for energy saving initiatives. Some options for Coles were:

- Introduce energy sources such as photo-voltaics, solar water and space heating, wind turbines, biomass, hydro- and co-generation.
- Use store displays or promotions to raise awareness of the Greening of Coles, particularly where in-store changes impact customers [G1].
- Consider the use of Green Power, as contracts are renewed.

A comparison between the features of a typical generic supermarket design and a possible future energy efficient supermarket design are at Figures 1 and 2.

Figure 1. Design Features in a Current Typical Supermarket

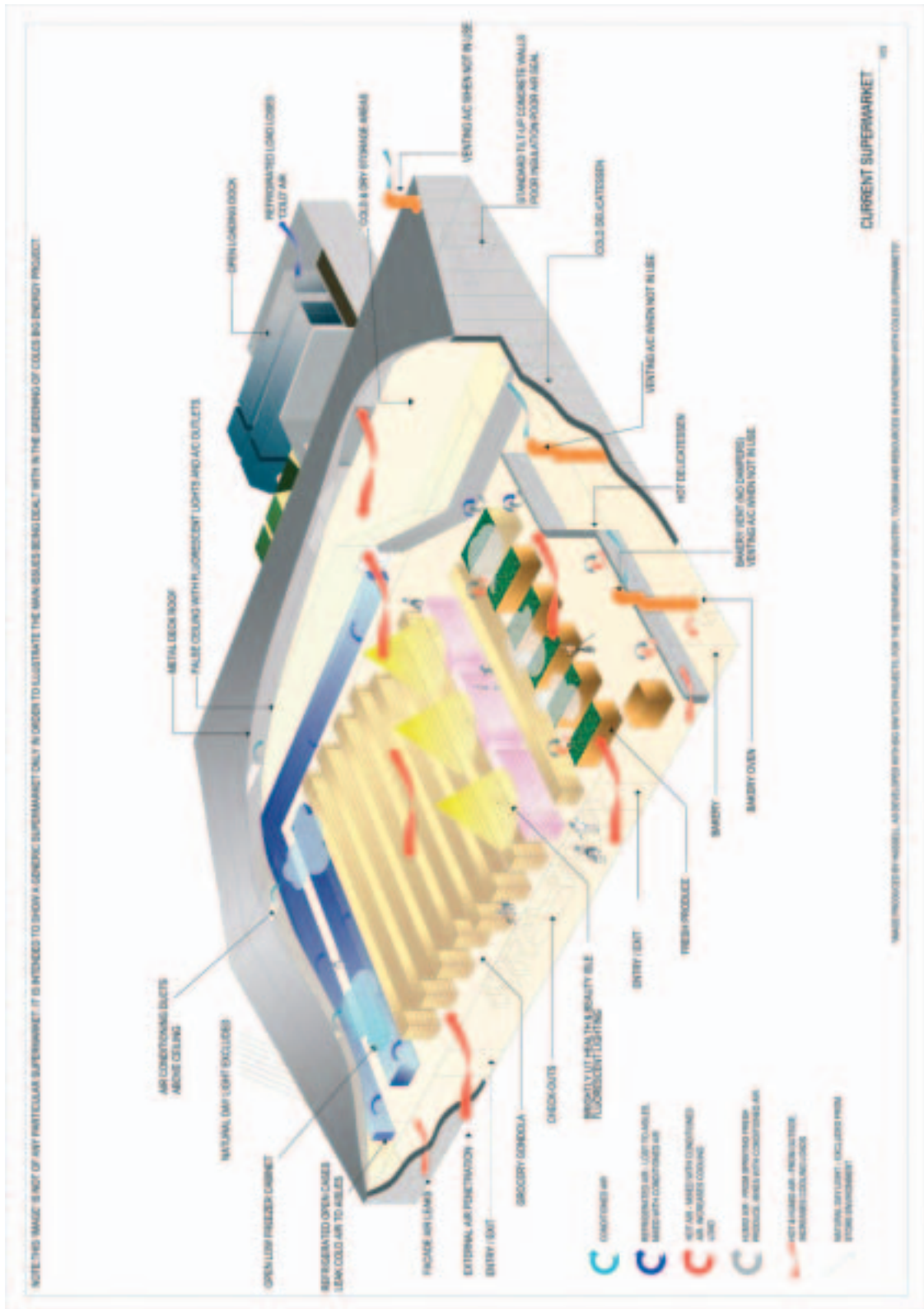
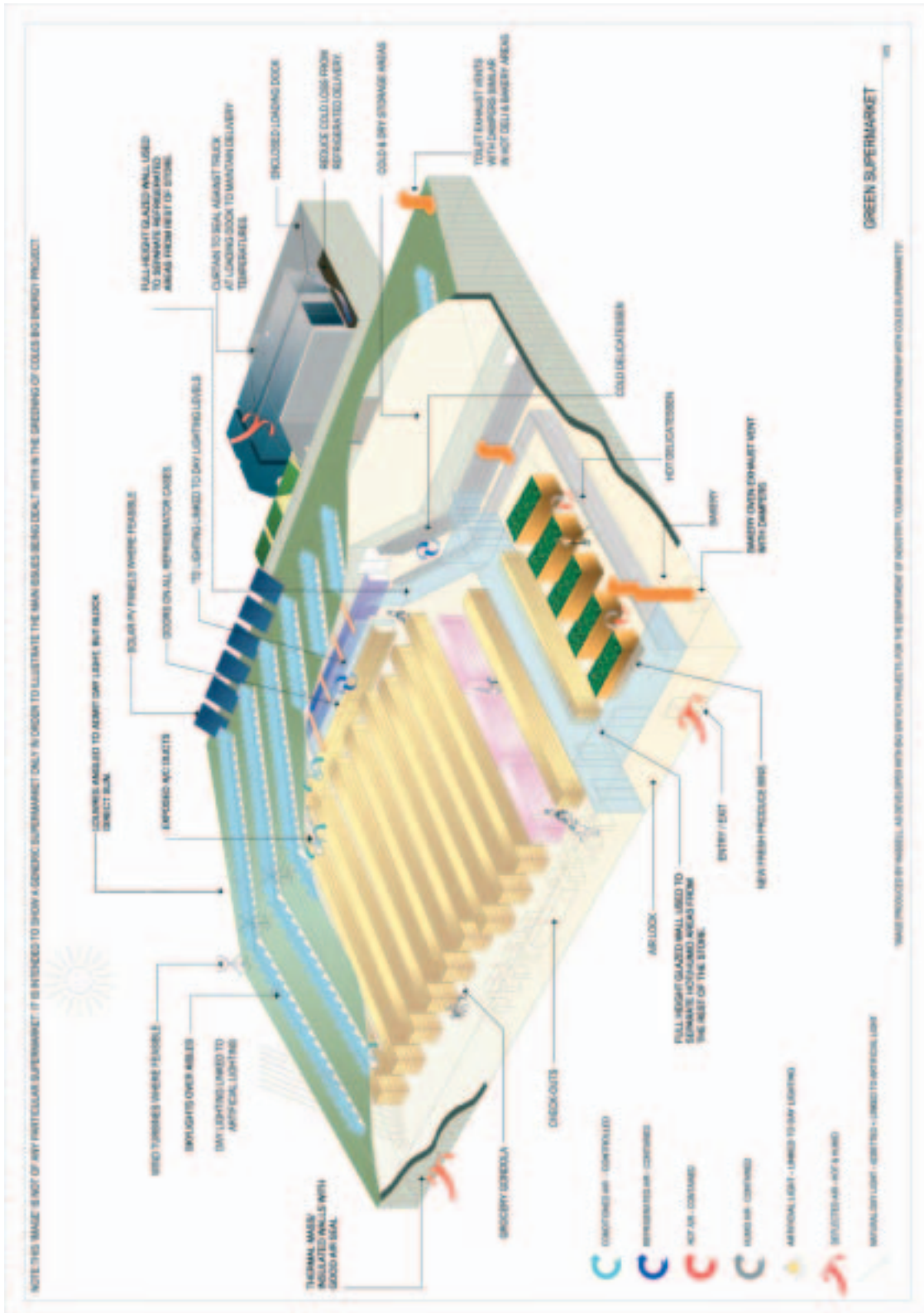


Figure 2. Possible Design Features in an Energy Efficient Supermarket







## DESIGN FEATURES FOR GISBORNE

Developing the G1 project from the ‘ground-up’, allowed architects to design the store to optimise environmental improvements while making the G1 concept as unique as possible. By engaging local agricultural and industrial typologies, the built form design utilises a rural theme approach and features a cluster of shed-like volumes — breaking down the big-box model of other retail developments.

The above image provides a design perspective of the G1 store with external design features including:

- Landscape treatment utilises rural elements (such as post and wire fencing) and incorporates stormwater recycling through a series of swales which capture carpark runoff water for irrigation. Roof stormwater is also retained on site for irrigation.
- Verandah shading over glazed shopfronts reinforces the solar orientation of the building to minimise heat gain and loss.
- Use of rough-sawn plantation timber cladding for rural feel and low embodied-energy, with recycled timber elements
- Input from RMIT Centre for Design Eco Specifier on green materials and finishes for external use
- Thermomass pre-cast insulated concrete treated with oxide finish and corrugated profile for low maintenance, and to reinforce the 'rural shed' imagery

## RESULTS AND LESSONS LEARNED

Coles is expecting to open its first Greening of Coles store — G1, at Gisborne late in 2004. Coles will introduce over 40 new energy and resource saving initiatives into G1. In addition to the initiatives that came out of the partnership with ITR, additional internal work by Coles has identified changes such as replacing the chrome used in bumper-rails and bollards with more environmentally friendly materials, and introducing a cardboard box container at the front of the store to reduce plastic bag use.

The partnership between Coles and ITR has established a solid base for the success of the Greening of Coles program. The ‘whole-of-system’ approach adopted through the partnership project has highlighted the potential for enhancing Coles’ existing energy efficiency and environmental performance.

The initiatives that flowed from the Gisborne design review will contribute to the store being more environmentally friendly and energy efficient. This was made possible by opening a dialogue between Coles and the design team, and both parties keeping an open mind about design options and potential for new financial and contractual arrangements.

The planning for the Gisborne store marks the beginning of a process of continuous improvement where initiatives will be trialed and rolled out, as costs allow, to each new Coles supermarket... G2, G3, G4, and to retrofitted stores. Recognising the potential gains and benefits of energy management, Coles is continuing its Greening of Coles program through the Coles-Myer Ltd Environmental Steering Committee and a Greening of Coles Facility Design and Management Team.

Some of the key learnings of the Coles and ITR project include:

- Adopt a 'whole-of-system' approach to energy use in the retail supermarket sector to identify big potential savings and generate internal company support, while taking customer goals into account.
- Collate and analyse comprehensive national and regional data, to accurately quantify energy and cost savings. Analysis, such as multiple regression and modelling, can help firms better develop and understand the business case for investing in energy efficiency.
- Undertake an energy review at the design and planning stage to lead to embedding energy efficiency in the life cycle of a new supermarket or facility, and gain greater efficiencies than would otherwise have been possible.
- Bring people together from across the organisation to build internal senior management and staff support and influence decision making.

## MORE INFORMATION

The Greening of Coles partnership project was part of an Australian Government Department of Industry, Tourism and Resources initiative. Case studies, related publications and a web-based innovation and training tool kit (later in 2004) from the former Energy Efficiency Best Practice Program provide useful information and methodology on energy efficiency. See ITR's website — [www.industry.gov.au/energybestpractice](http://www.industry.gov.au/energybestpractice) or call (02) 6213 7878.

The lessons learned from the Gisborne Design Review are incorporated in a new tool for developers — *Building Greener Shopping Centres: a sustainability checklist for neighbourhood shopping centre developers* — which will be available later in 2004 through the Centre for Design — RMIT website at <http://www.cfd.rmit.edu.au>

## ACKNOWLEDGEMENTS

### Photos pp. 4,9:

*(example indicative of design methodology and external design perspective of G1 store)*

McGauran Giannini Soon (MGS) Pty Ltd Architects, Melbourne.

### Illustrations pp. 7,8:

*(based on MGS design and presentation material)*

Hassell Pty Ltd, Sydney.

### All other photos:

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