Australian Carbon Trust Report:

Commercial buildings emissions reduction opportunities

Produced by ClimateWorks Australia

Published December 2010

Contents

- Commercial buildings focus area
- The Low Carbon Growth Plan for Australia

Commercial buildings focus area - Key points

There is more to commercial buildings than offices

- Large offices –public and private –only represent 13% of the opportunity, yet are where most efforts from policy makers and business players such as energy service companies are concentrated
- Other sub-segments such as public health, education and small offices, and large businesses with a high energy bills present significant opportunities (respectively 24% and 15% of total opportunity) with relatively low barriers

A large part of the opportunity lies in upgrade of small appliances which come with low capital requirements and short paybacks

- Small appliances (e.g. kitchen appliances, electronics, light bulbs, small space heaters or air conditioners) make up around 44% of the opportunity
- Other occupant-driven equipment such as specialised appliances (medical equipment, commercial refrigeration and ovens) or light fittings and controls amount to another 8%

Some promising solutions are already in place on a small scale in Australia

- Most barriers can be overcome by business- and/or government-led action
- Standardisation and use of third-party service and funding providers is key
- Most of the challenge lies in reaching a significant scale and unlocking the longer payback opportunities

Lack of information is a big impediment in the sector

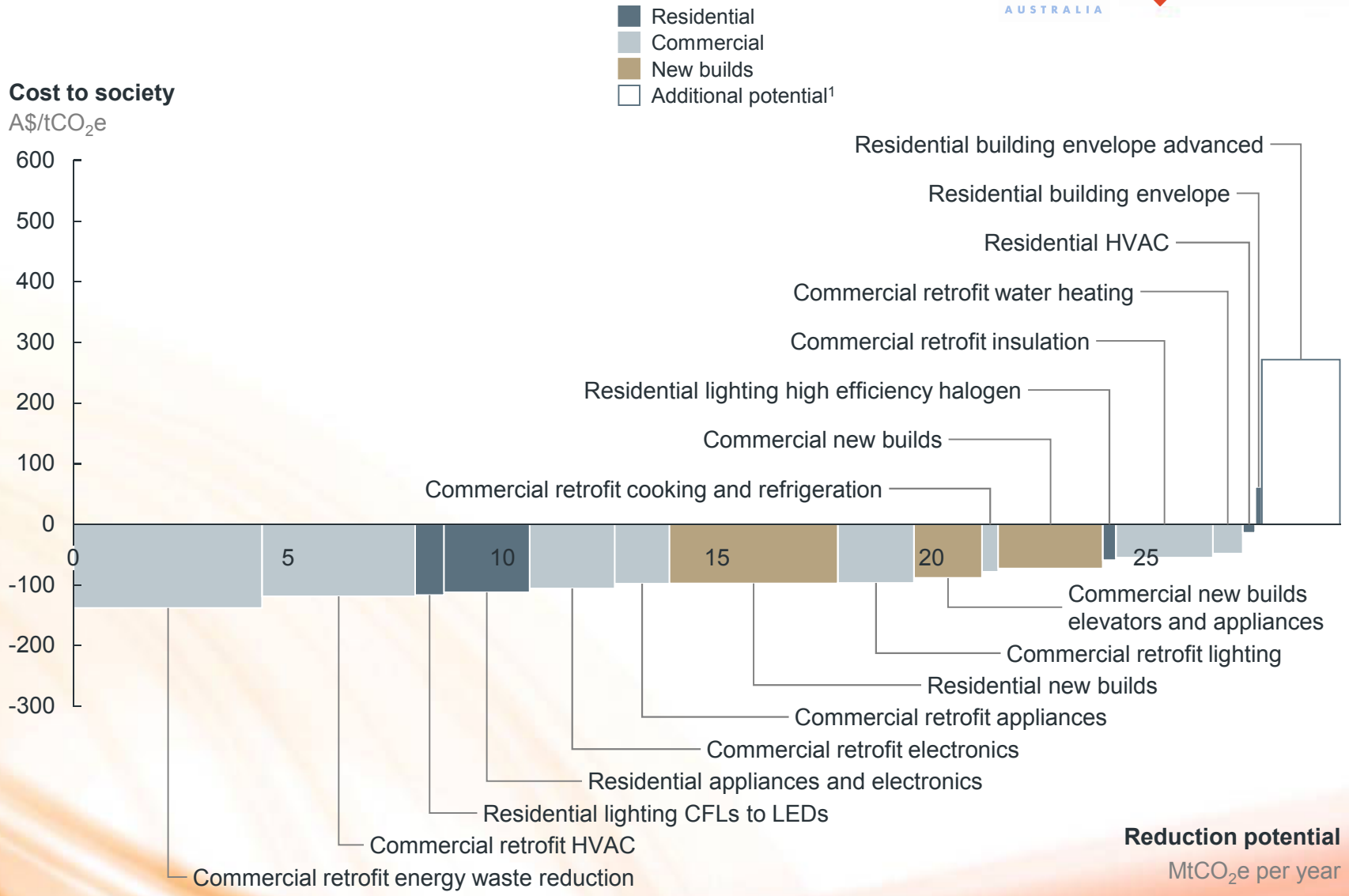
- Very little information is available on local commercial floor space, energy use and potential savings outside of large offices
- Some experts or business players have pieces of information but it is not shared publicly
- Filling this gap is key to raising awareness and interest in sectors other than offices

SOURCE: Team analysis

Contents

- Commercial buildings focus area
  - The opportunity
  - Analysis by technology category
  - Analysis by occupancy category

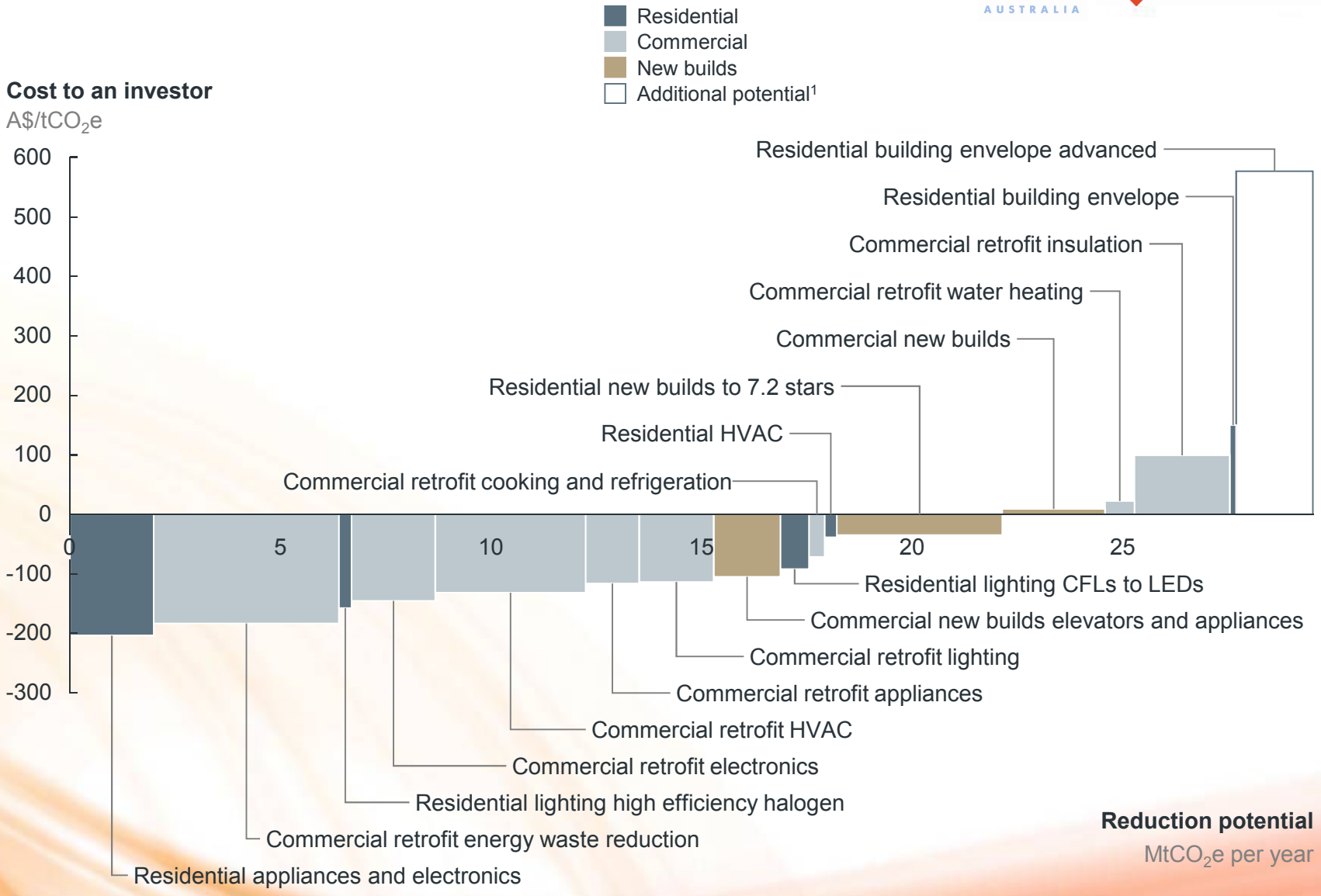
2020 Buildings GHG emissions reduction *societal* cost curve



1 Higher cost opportunities not required to meet target emissions of 25% below 2000 levels

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (p.9)

2020 Buildings GHG emissions reduction *investor* cost curve

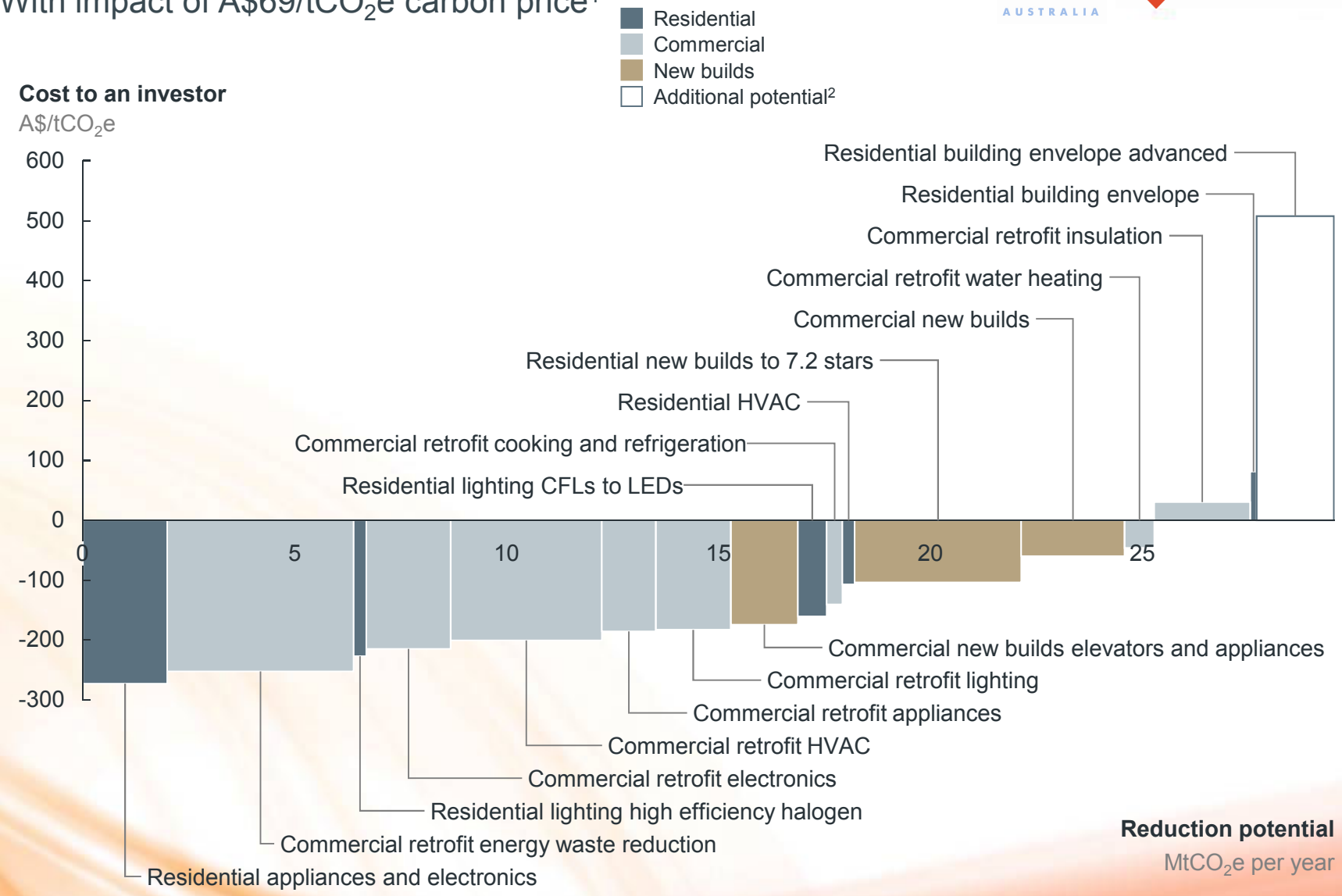


1 Higher cost opportunities not required to meet target emissions of 25% below 2000 levels

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (p.9)

2020 Buildings GHG emissions reduction *investor* cost curve

With impact of A$69/tCO$_2$e carbon price[1]

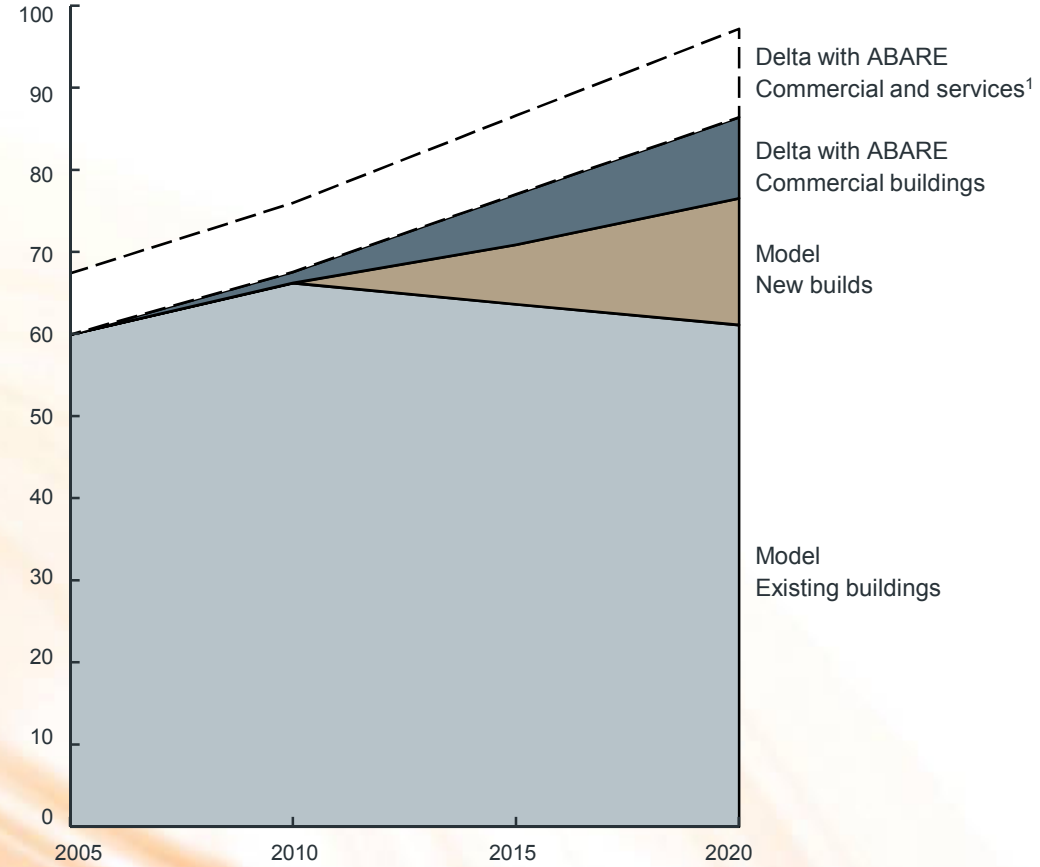


1 Carbon price in 2020 of A$69 per tonne based on Treasury Garnaut -25% estimate *(Australia's Low Pollution Future)* converted to 2010 dollars
2 Higher cost opportunities not required to meet target emissions of 25% below 2000 levels
SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (exhibit 4)

Energy consumption from existing buildings will still represent the large majority of total commercial buildings energy in 2020

Growth in energy consumption in the business-as-usual case

Total energy consumption, TWh per annum



Methodology

- Difference between "Commercial and services" category and Commercial buildings comes from Services such as Water infrastructure and community energy use (such as traffic lights, street lights, etc)
- Our model's energy consumption estimate is built bottom up using estimates of energy use per square metre and floor space area
- Existing buildings are assumed to keep a stable energy consumption per m^2 (increase in penetration of appliances/electronics compensated by BAU improvements in energy efficiency). The decrease is due to the demolition rate of 0.8% per annum
- New builds are assumed to experience a small increase in energy consumption per m^2 as less improvements in central systems can compensate increase in appliances/electronics. Central services consumption is assumed to stay consistent with existing standards.

1 Estimated as part of this project as a share of the total energy consumption

Note: our model has a larger share of electricity than the ABARE data, which leads to a higher average carbon intensity of energy

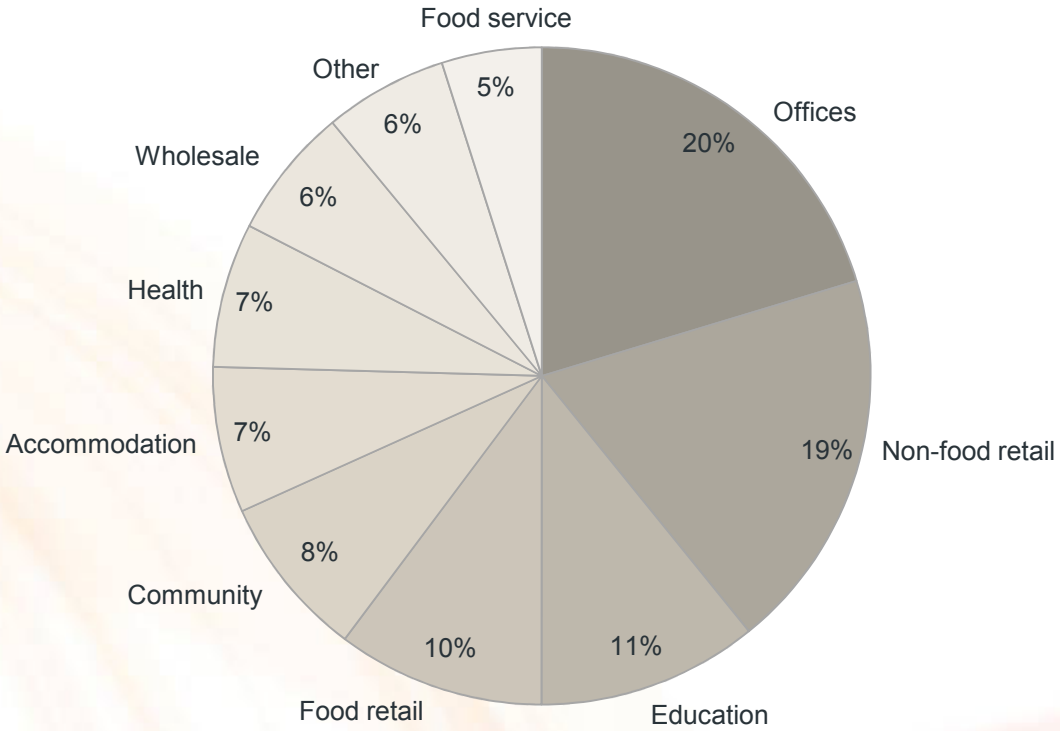
SOURCE: ABARE. Energy projections to 2029-30 - research report and statistical tables. Canberra, Australia: 2007.

Offices only represent 20% of commercial buildings emissions; retail and education are the next two largest emitters with 40% of total emissions

Emissions of existing commercial buildings in the BAU case

% of total, 2020 estimates

100% = 36 $MtCO_2e$



1 Estimated as part of this project as a share of the total energy consumption

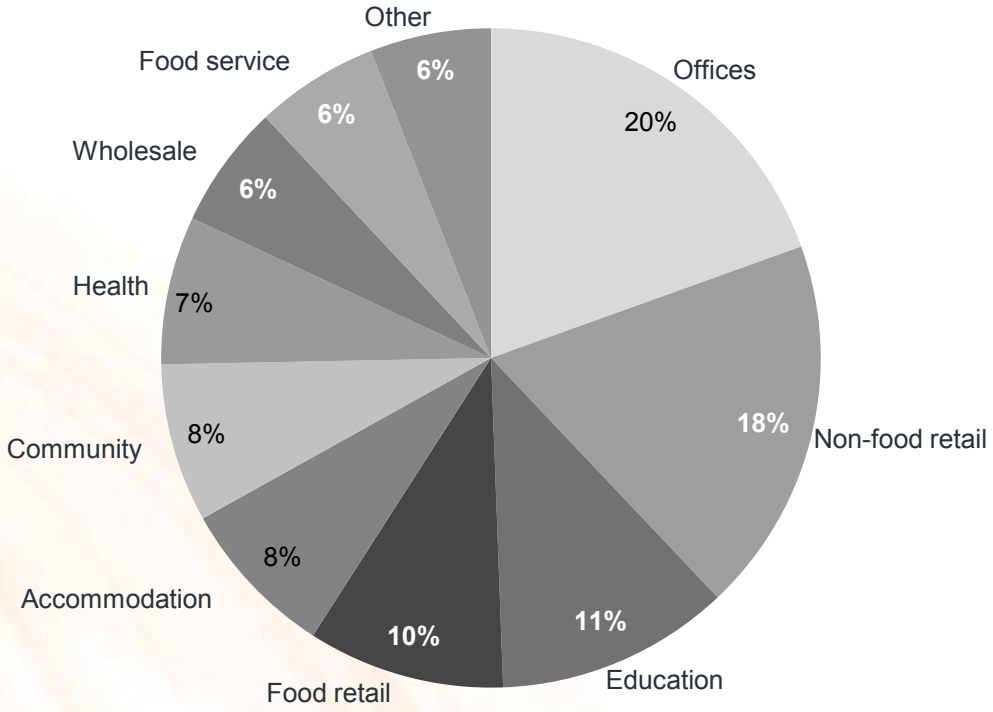
SOURCE: Team analysis

Offices only represent 20% of energy use in commercial buildings; retail and education are the next two largest users with 40% of total energy consumed

Energy use of existing commercial buildings in the BAU case

% of total, 2020 estimates

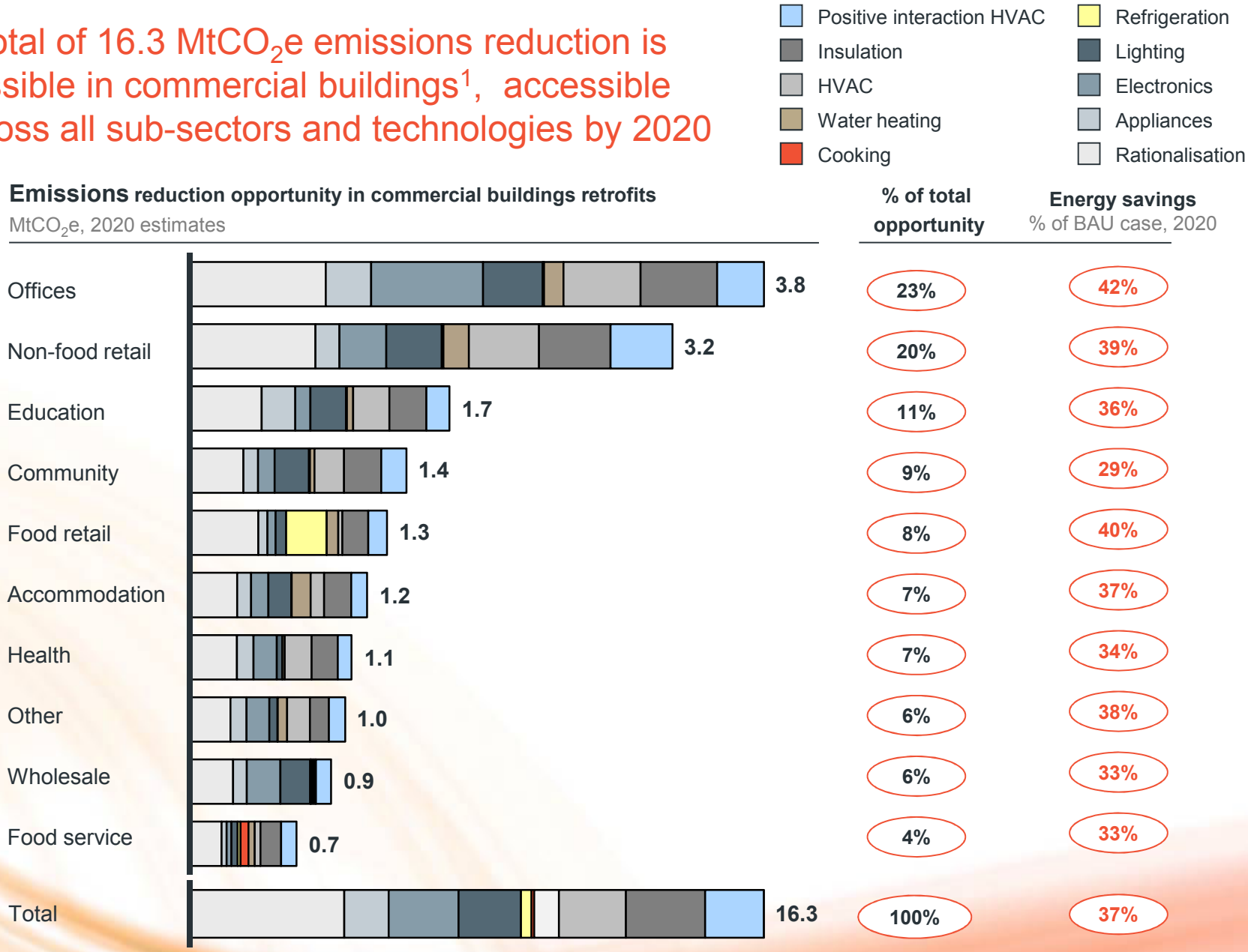
100% = 61 TWh



1 Estimated as part of this project as a share of the total energy consumption

SOURCE: Team analysis

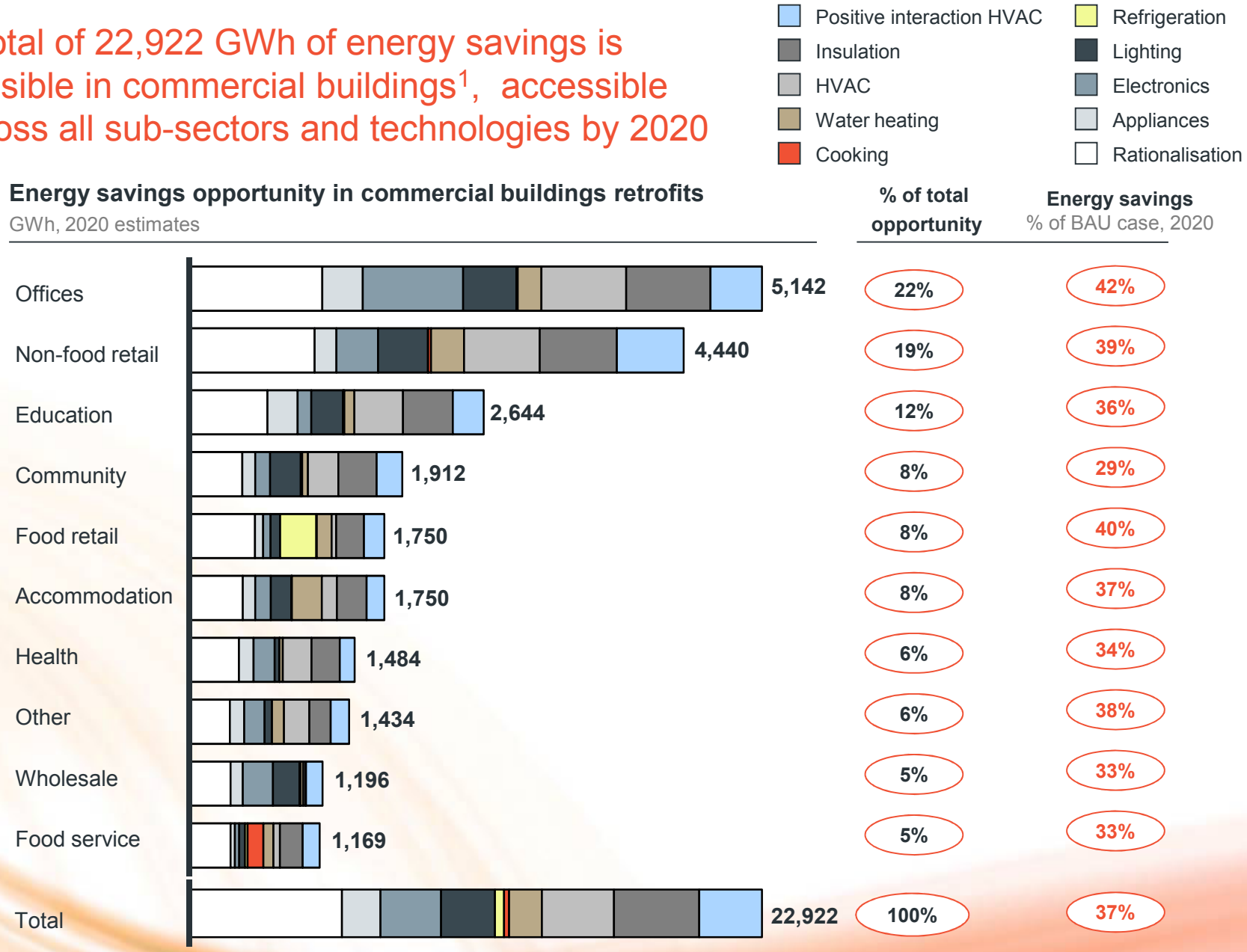
A total of 16.3 $MtCO_2e$ emissions reduction is possible in commercial buildings[1], accessible across all sub-sectors and technologies by 2020



1 Commercial buildings represent 58% of the total 28 $MtC0_2e$ opportunity in the Buildings sector, with residential new builds comprising the remaining 11.8 $MtC0_2e$ of the total opportunity

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (p.9)

A total of 22,922 GWh of energy savings is possible in commercial buildings[1], accessible across all sub-sectors and technologies by 2020



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SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (p.9)

Many barriers are restricting this opportunity today, mostly driven by technology and occupancy types

✓ Primary driver
Secondary driver

	Barrier	Description	Driver: Technology	Driver: Occupancy
Investor profitability	Cost of capital	Makes marginal projects unprofitable		✓
	Interruptions in operations	Make implementation of some technologies non-economic	✓	
	Non-market pricing	Very low energy prices decrease sensitivity to market signals		✓
Capital availability	Finite access to capital	EE projects compete with other internal projects for capital		✓
	Long payback periods	EE projects offer profits, but often with very long paybacks, whereas most companies have policies for short paybacks	✓	
	Investment hurdle rate	Companies often have investment opportunities with higher returns than energy efficiency projects		✓
Informed decision	Access to information	Lack of awareness on energy efficiency opportunity for building owned, lack on information on impact of choices on energy bills	✓	✓
	Lack of understanding	Low awareness; no in-house knowledge of complex processes/business case; fear of decreased performance, etc		✓
	Low business priority	Can be caused by energy bill representing a low share of operating costs, by a focus on growth, etc		✓
	Lack of statistical experience to prove secondary benefits	For example it is hard to put numbers on increased productivity or improved health due to more fresh air		✓
	Administrative structures	For example when building management decisions are made in an entity separate from operating costs management		✓
	Budget allocation processes	Energy savings not always taken into account (eg public sector), procurement policies favor low upfront vs lifecyle cost		✓
Market structure	Split incentives	Happens when building owner makes the building equipment decisions while tenants get the energy savings		✓
	Lack of project scale	Increases transaction costs, prevents dealing with ESCOs		✓
	Long decision cycles	As equipment often has long lifespan, equipment renewal/ retrofits, especially for central services, happen on long cycles	✓	✓
	Availability of equipment, infrastructure	Energy efficient equipment is not always available (eg computers), lack of local expertise in some equipment	✓	
	Reliability/quality of supply	Eg issues with the reliability of savings estimates, inability for energy service companies to offer tailored service		✓
Non-economic	Management tradition	Eg long term procurement relationship		✓
	Other goals of decision makers	Eg decision for building equipment will be driven by staff comfort		✓

SOURCE: Team analysis, United Nations Environment Programme, Lend Lease, Pricewaterhouse Coopers

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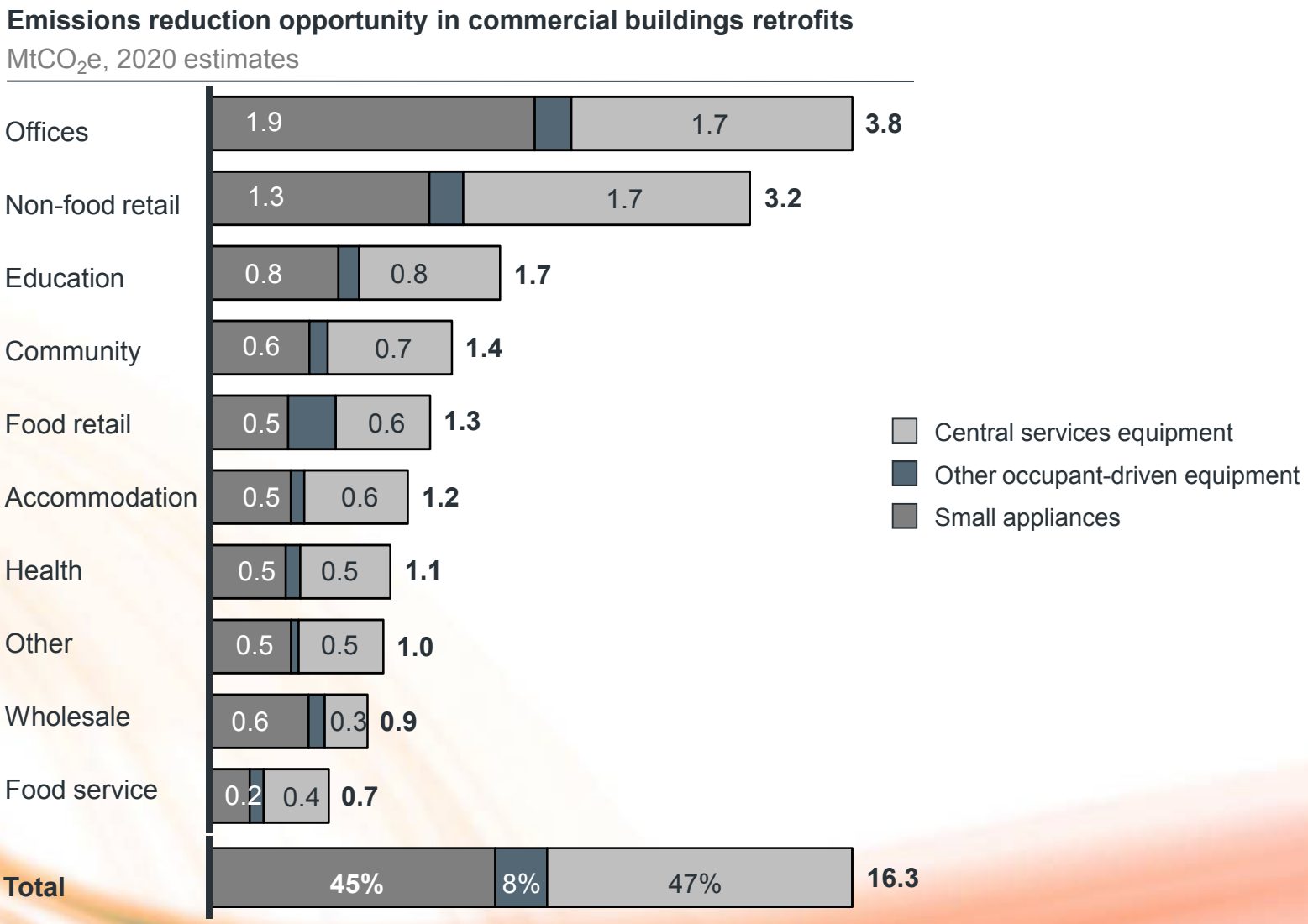
Three categories of technology were defined with similar characteristics

	Equipment/infrastructure included	Characteristics
Small appliances	• Most electronics (e.g. computers, fax and copiers), • Small kitchen equipment (e.g. micro-wave ovens, stand-alone fridges) • Small HVAC equipment (space heaters and air-conditioners) • Light bulbs	• Relatively standard equipment • Improvements usually require little capital investment and offer high returns • Belongs to building occupants: they keep the equipment if they change location
Other occupant-driven equipment	• Large kitchen equipment (eg commercial ovens or refrigeration equipment) • Specialized equipment (eg X-ray or MRI machines) • Lighting fittings and controls outside of common areas	• More complex equipment: - purchase is often driven by characteristics other than energy efficiency (eg medical equipment) - range of offer is more limited - fragmented portfolio - either linked to the building or hard to transfer if occupant change location • Moderate capital investment • Moderate payback periods
Central services infrastructure	• Elevators and escalators • Centralised or large HVAC equipment • Changes to the buildings envelope • Water heating systems • Lighting fittings and controls in common areas	• Higher capital investments • Can offer longer pay-back periods (e.g. insulation) • Implementation can be complex if a whole systems upgrade is necessary (eg changing the hot water or cool air distribution system in a building often requires to partially shut the activity down for a period of time) • Linked to the building structure itself

SOURCE: Team analysis

Half of the opportunity lies in small appliances or occupant-driven equipment



SOURCE: Team analysis

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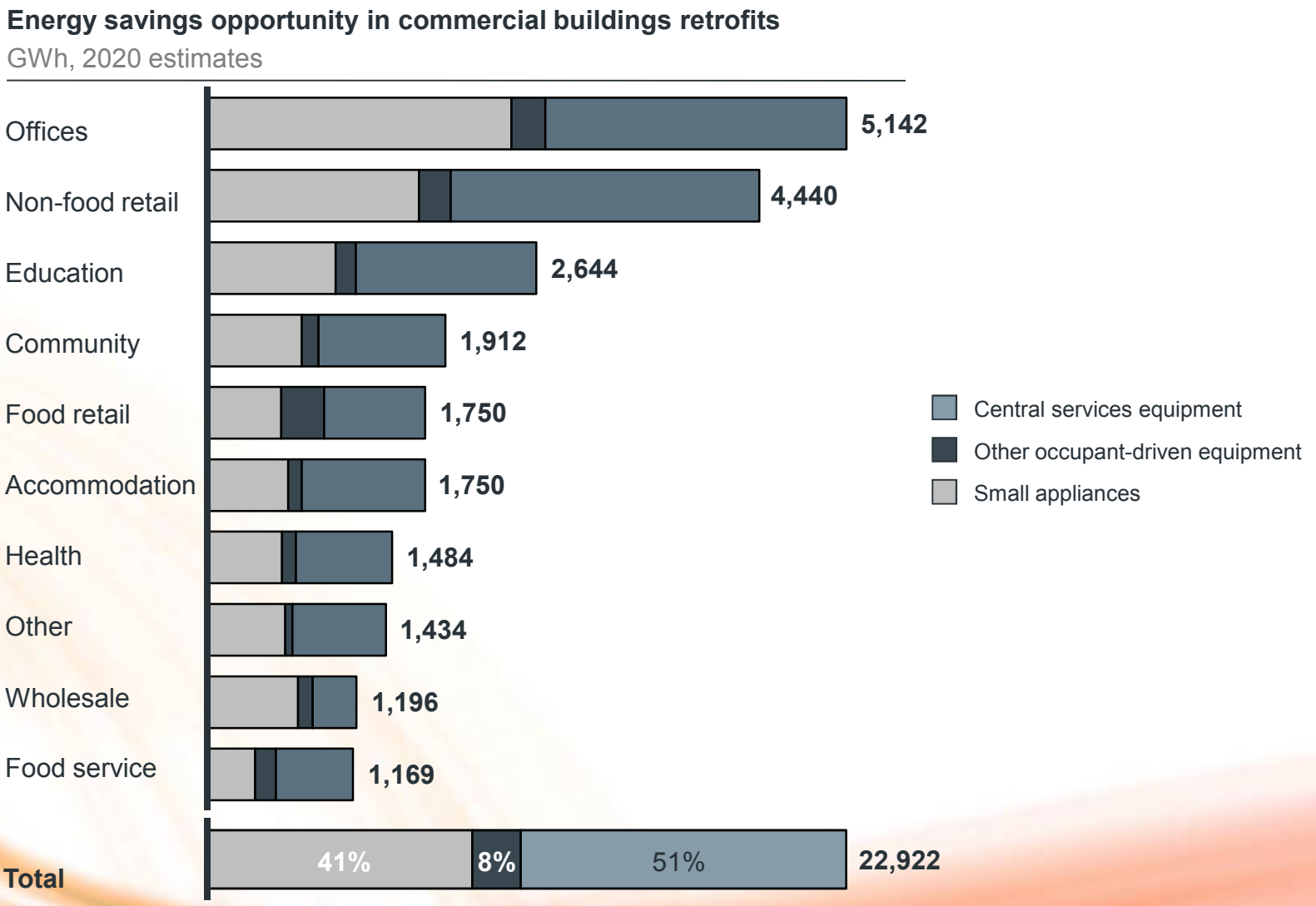

SOURCE: Team analysis

Different types of actions can overcome the major barriers by technology category (1/2)

% of opportunity

	Major barriers	Possible actions
Small appliances (45%)	• No information provided on energy efficiency performance at time of purchase for some equipment • Procurement policies sometimes incentivise to concentrate on upfront vs full life-cycle costs • Appliances mostly have long lifespans (~15 years or even longer if not used intensively)	• Extend MEPS and labelling system to all small appliances and increase stringency • Provide incentives for early retirement of old inefficient small appliances (eg cash for scrap) • Provide financial incentives to buy efficient equipment (eg accelerated depreciation for large quantities, rebates) • Support development of financing solutions (eg suppliers to offer payment over several months)
Other occupant-driven equipment (8%)	• For specialised equipment, efficiency is not a major criteria in buying decision and there can be little offer • Tenants are reluctant to invest in efficient equipment linked to the building structure (eg lighting fixtures) when the pay-back period is moderate and they are on a short-term lease • Fragmented portfolio makes it harder to regulate	• Fund R&D (grants, venture capital) in efficient equipment for local manufacturers (if applicable) • Provide financial incentives to buy energy efficient equipment to businesses (eg accelerated depreciation) • Provide incentives for owners to improve tenants energy efficiency (eg use of whole buildings NABERS ratings) • Mandate disclosure of equipment efficiency at time of purchase • Extend programs such as ABESP (see right box)

Australian Businesses Energy Savings Program (ABESP)

- Local councils are in charge of recruiting small businesses (through information campaign/door-to-door) and reporting
- Global Sustainability Initiatives (GSI) provides end-to-end service (assessment, assistance for financing, implementation, sale)

Key success factors:

- Very focused target –standard electric equipment –which enables:
  - quick assessments
  - low uncertainty on savings
  - high returns (average 22% ROI for 26% long-term savings)
  - low capital intensity (can be either paid cash or be covered by pre-approved bank funds)
  - geographical grouping (few differences between subsectors)
- End-to-end service –they go and negotiate with banks on behalf of customers, they make arrangements with contractors, etc

SOURCE: Team analysis, commercial buildings round-tables

Different types of actions can overcome the major barriers by technology category (2/2)

% of opportunity

Central services equipment

47%

Major barriers

- Higher capital investments coupled with capital availability issues (high hurdle rate or difficulty in obtaining moderate interest rates for external loans)
- Longer pay-back periods (e.g. insulation)
- Implementation can be complex if a whole systems upgrade is necessary
- Suffers from the split incentive barrier if owners cannot pass the costs incurred on their tenants (average length of lease observed in Melbourne is 7-10 years)

Possible actions

- Review leases standards to incorporate rent increase in case of energy efficiency improvement
- Provide financial incentives:
  - Accelerated depreciation or tax rebates
  - Dedicated lines of low cost credit through low interest loans, guarantee fund, public-private partnerships
- Support development of third party financing, eg venture capital in leasing companies –own and operate the infrastructure and sell the service to buildings –energy service companies or tax lien financing (see right box)
- Expand mandatory disclosure of energy performance to smaller buildings and all sectors
- Mandatory upgrade of buildings at refurbishment, preferably based on performance rather than technology requirements to lower cost
- Cap and trade system (eg white certificates or efficient building scheme[1])

Tax lien financing or Property Assessed Clean Energy (PACE)

- Used by some local governments in the USA to fund clean energy or energy efficiency projects
- Local governments raise money through the issuing of bonds
- Repayment over a set number of years through a special tax or assessment on the property tax bill
- The financing is secured with a lien on the property, with little or no upfront cost to the landlord. If the property is sold prior to the loan being repaid, the new owner inherits the repayment obligations and associated property improvements
- Participation in PACE programs in the USA is voluntary and requires agreement from the landlord

Key benefits:

- Access to Finance. Using the building as collateral enables more favourable lending rates
- Overcome split incentive. The landlord can pass through the tax or special charge to the tenant

1 Lend Lease Corporation, Lincolne Scott and Advanced Environmental. Submission to the senate economics – legislation committee inquiry into the safe climate (energy efficient non-residential buildings scheme) bill 2009. November 2009.

SOURCE: Team analysis, commercial buildings round-tables

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  - Analysis by occupancy category

Four major criteria characterise the occupancy type

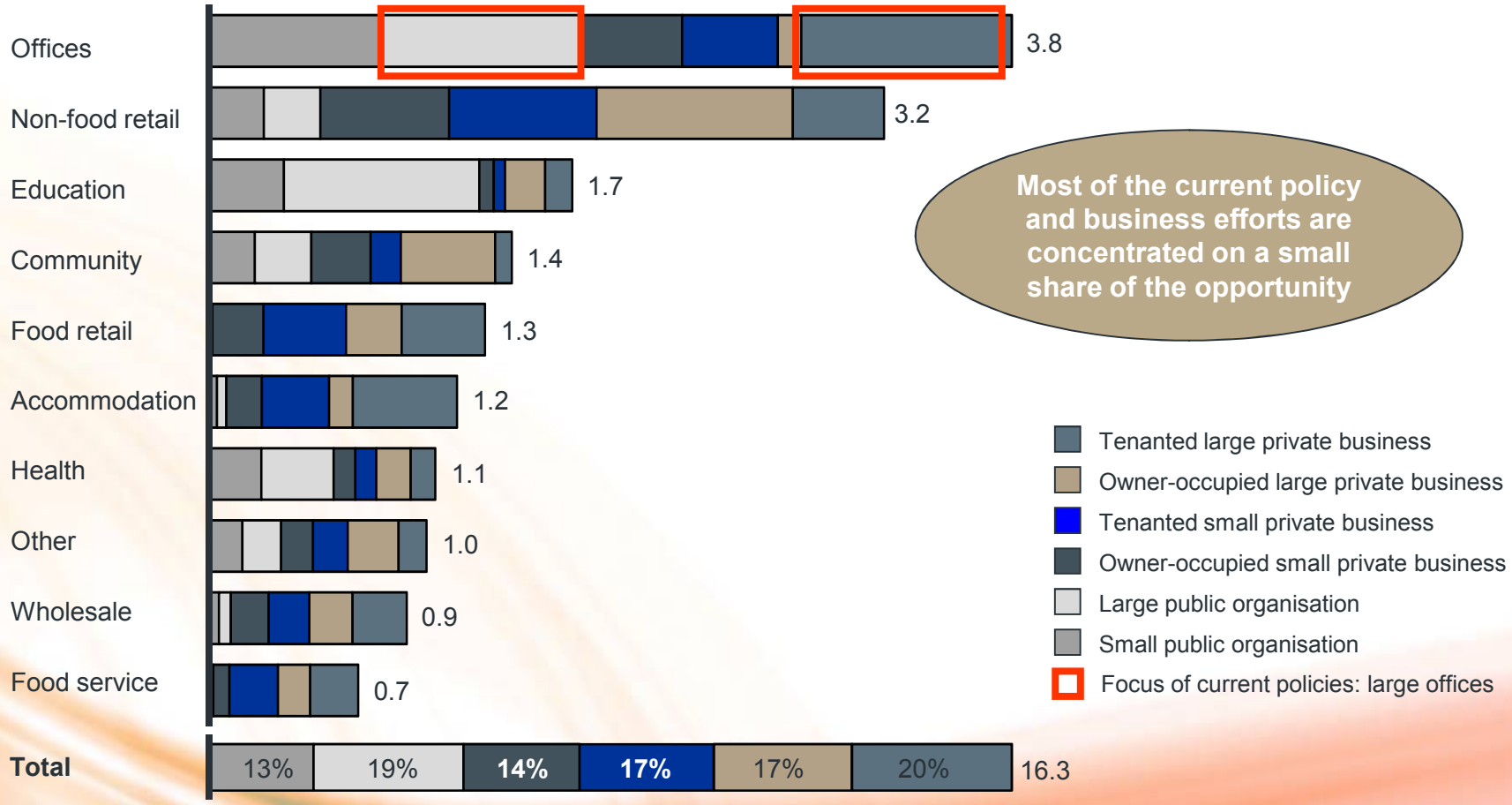
Criteria	Types	Rationale
Public or private	• Public sector (eg public schools, public administration offices, public hospitals, post-offices) • Private sector	The public sector has in particular: • very distinct budget allocation processes • usually lower hurdle rates than the private sector • strong incentives to improve its energy efficiency (eg role modelling)
Activity	• Offices • Education • Accommodation • Health • Food retail • Non-food retail • Wholesale • Food service • Community (eg museums, cinema)	The activity drives the level of awareness and the place energy holds in business priorities, eg: • how much energy represents in the business' operating costs • how important energy efficiency is for public image • what hurdle rate is driving investments
Occupancy	• Owner-occupied • Tenanted (electricity bill is split between two stakeholders, restrictions on amendments to buildings)	• Important impact on barriers because of the split incentive issue, which becomes more important for other occupant-driven and central services equipment. • Tenanted buildings can also have a problem of fragmented decision makers, making it hard to get a consensus across a single building
Business size	• Small businesses (with 20 employees or less) • Large businesses	Small businesses usually have: • lower access to capital • higher transaction costs due to lack of scale (eg hard to go through ESCO) Large businesses often have more pressure on payback period and level of returns, especially for listed companies.

SOURCE: Team analysis

Public health, education and small offices represent 16% of the total opportunity compared to 13% for large public and private offices

Emissions reduction opportunity in commercial buildings retrofits

% of total, 2020 estimates



SOURCE: Australian Bureau of Statistics (2001 and 2008); Tertiary Education Facilities Management Association (2004); Australian Institute of Health and Welfare (2008); ClimateWorks team analysis

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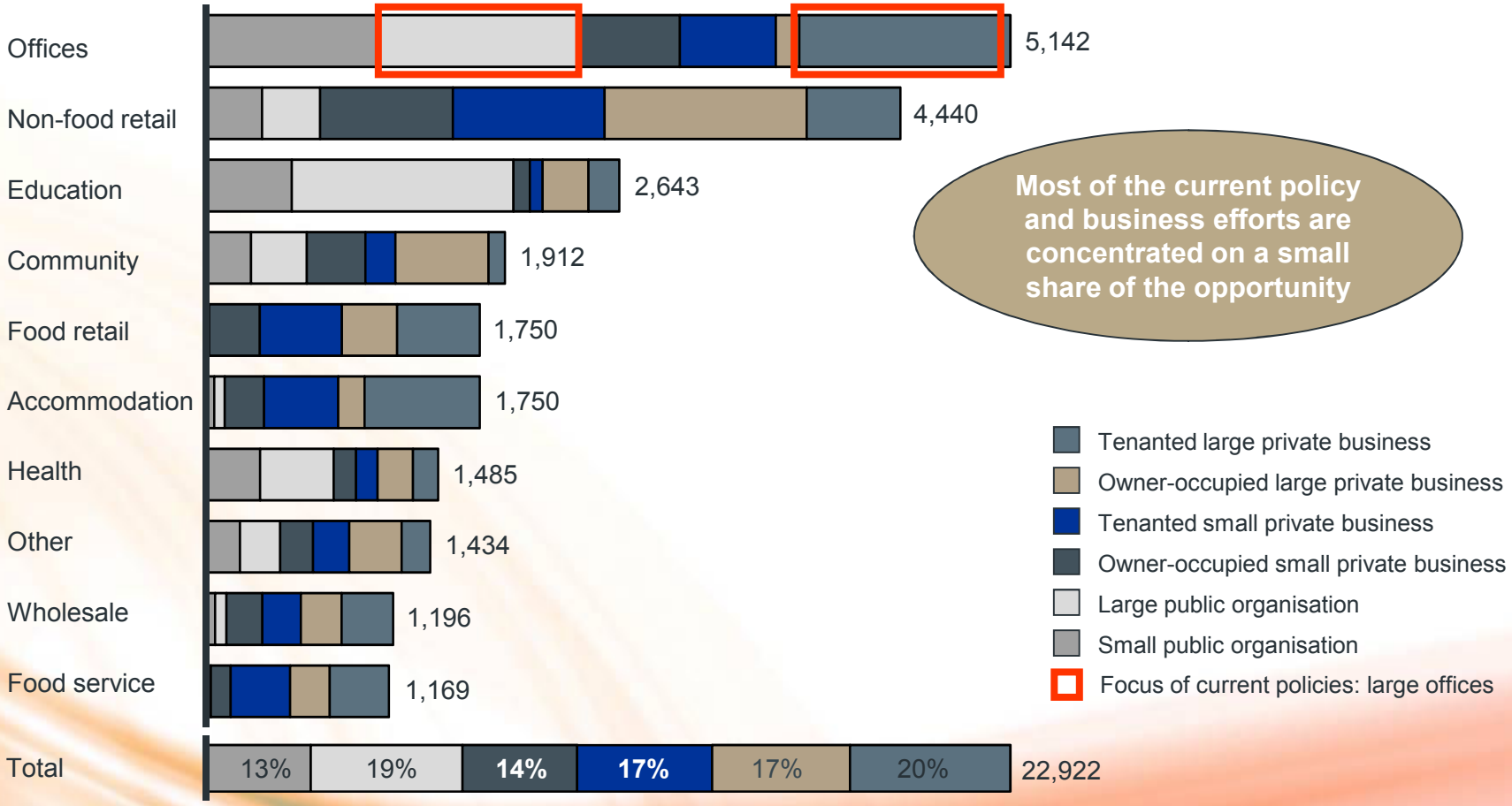
Energy savings opportunity in commercial buildings retrofits

GWh, 2020 estimates



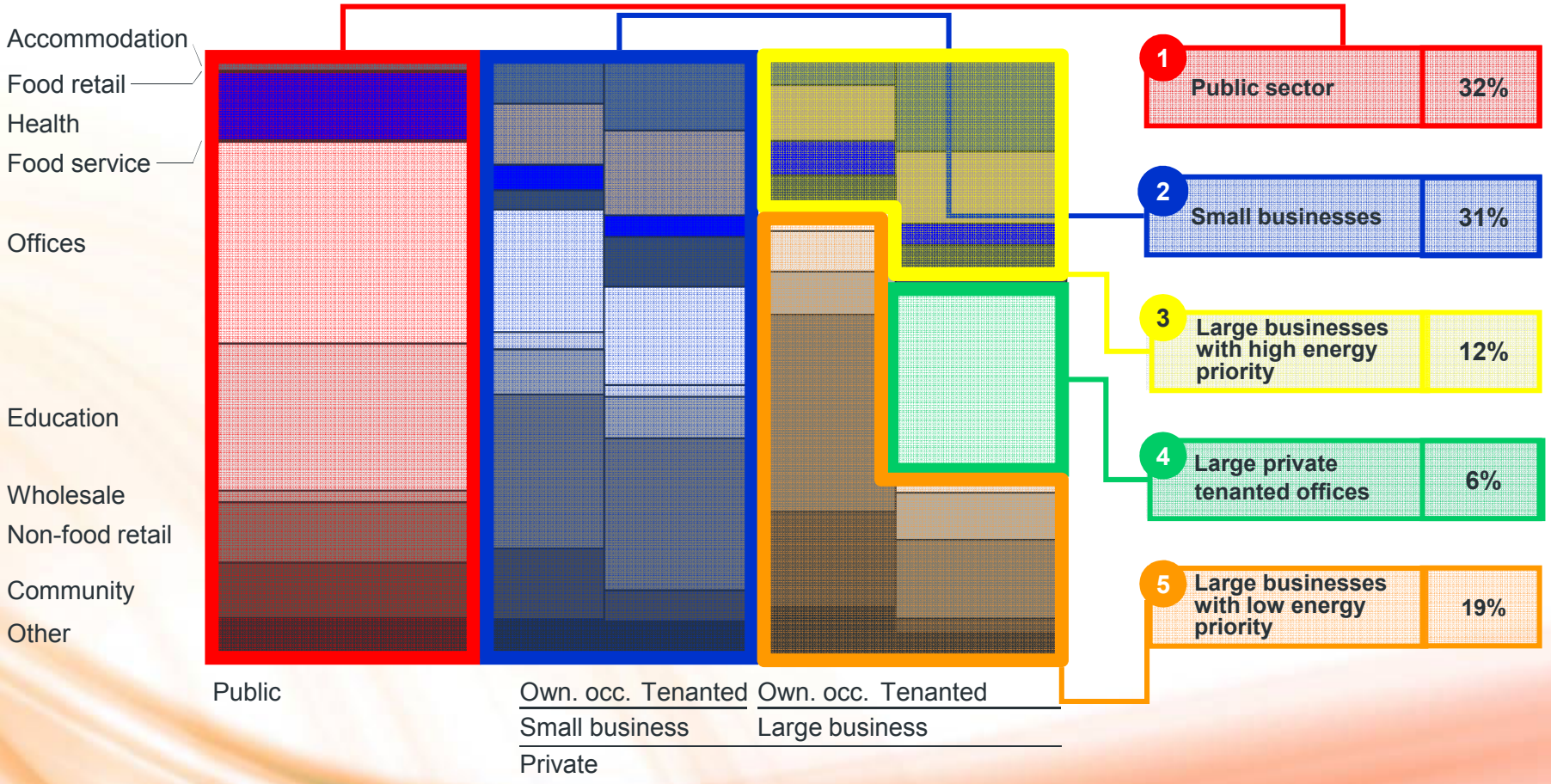
SOURCE: Australian Bureau of Statistics (2001 and 2008); Tertiary Education Facilities Management Association (2004); Australian Institute of Health and Welfare (2008); ClimateWorks team analysis

Five segments of occupancy type summarise the major drivers and barriers to energy efficiency improvements

Emissions reduction opportunity in commercial buildings retrofits

% of total, 2020 estimates

100% = 16.3 $MtCO_2e$



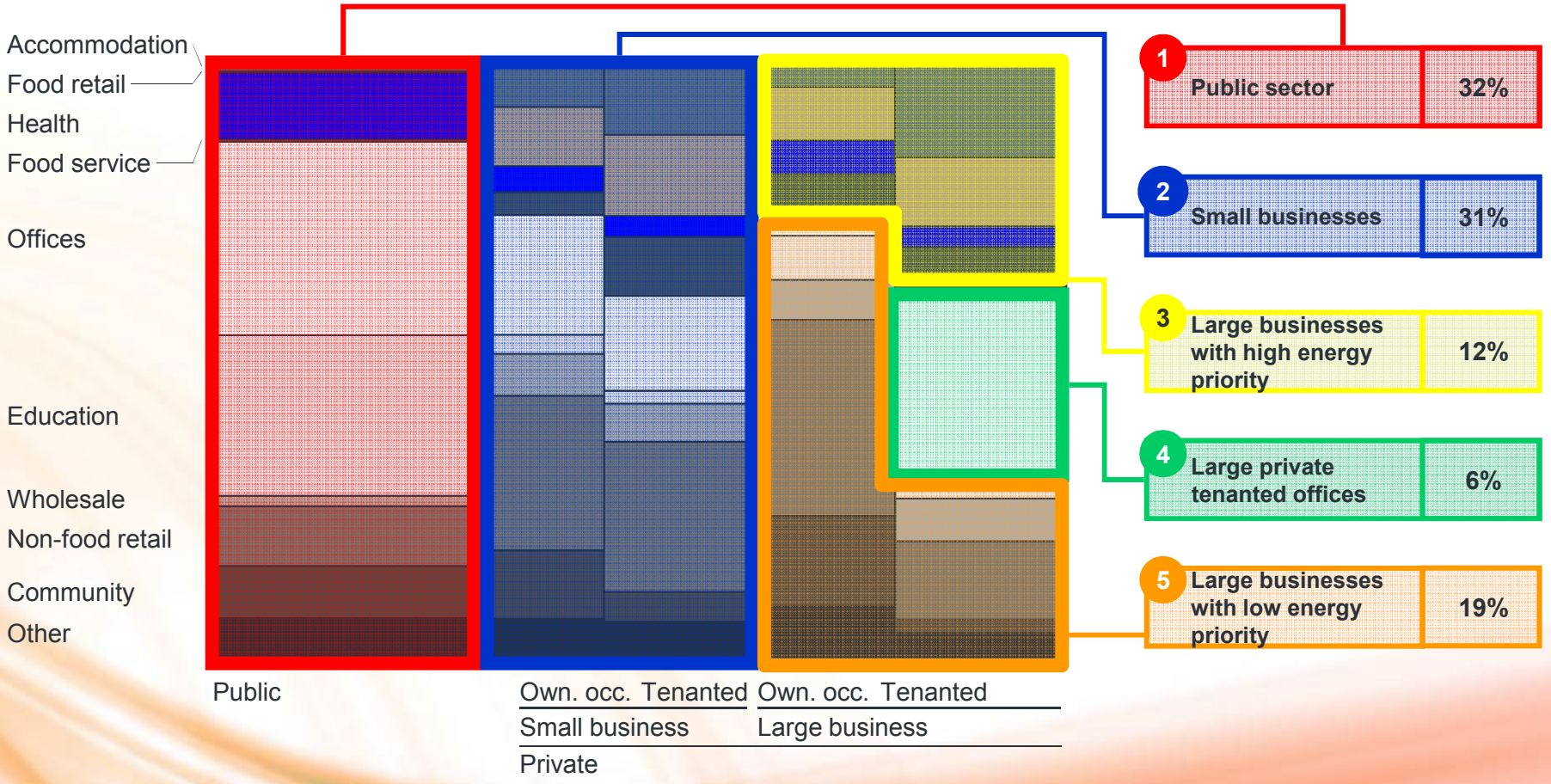
SOURCE: Team analysis

Five segments of occupancy type summarise the major drivers and barriers to energy efficiency improvements

Energy savings opportunity in commercial buildings retrofits

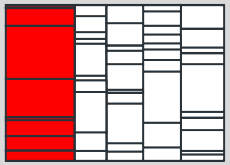
% of total, 2020 estimates

100% = 22.9 TWh



SOURCE: Team analysis

1 Public sector



Emissions reduction opportunity:
5 Mt CO_2e
Share of total:
32%

Includes:
•Public offices, public schools, public hospitals, public retail (eg post offices), public community space (eg libraries, museums)

Does not include:
•Private hospitals, private schools, public infrastructure (eg street lighting)

Drivers for energy efficiency decisions

	Name	Description
Incentives	High opportunity	Opportunity is usually bigger than for private buildings (less investments in the past)
	High proportion of owner-occupied space	This simplifies the split incentive issue
	Want to be a role model	Government usually is a leader in environmental policies
	Low hurdle rate	Public entities usually have a lower cost of capital and less pressure to achieve very high rates of return than private companies
Barriers	Access to capital	Budget is usually attributed first to projects with societal impact (vs internal impact)
	Administrative processes	Procurement policies are making it hard to use the energy performance contracting (EPC) model
	Administrative structure	Little incentives to reduce energy use (first year spends used as base for next years budgets, savings and investments often attributed to different entities)
	Many small scale projects	Local public entities are usually small and with fragmented management, knowledge sharing and transaction costs optimisation is hard to achieve
	Lack of knowledge	There are few people specialised in building management in local public entities
	Lack of accountability	Lack of accountability, measurement and verification decreases the impact of voluntary or mandatory targets

SOURCE: Team analysis

1 Public sector

Partially overcomes
Overcomes
Gap in policy
Partial gap in policy

	Policy measures[1]	National (N) or local (L)	Major barriers: Access to capital	Admin. processes	Admin. structures	Many small scale projects	Lack of knowledge	Lack of accountability	Comments
Current	Energy efficiency in government operations policy (Commonwealth offices)	N	✓				✓		• Minimum energy performance standards for new builds, major refurbishments & new large leases
	NFEE – Government Leadership via Green Leases	N	✓	✓		✓	✓		• Covers commonwealth, state and territory governments offices
	NSW Treasury Loan Fund	L	✓	✓		✓			• Fund to finance EE upgrade, different mechanism for small and large projects
Future options	Voluntary energy efficiency targets for all public buildings with reporting		✓				✓	✓	• This should be associated with support and incentives to get buy-in
	Mandatory energy efficiency targets for all public buildings with reporting		✓	✓		✓	✓	✓	• Mandatory targets have to be accompa-nied with tracking system to be effective
	Incentives to develop use of bank credit for energy efficiency projects (through government guarantee, facilitation centre, dedicated credit lines, etc)		✓						• As energy efficiency generate profits, they could justify a higher cost of credit
	Simplified administrative processes for ESCO contracting			✓					• Some entities have already set such improvements in place
	Facilitation centre to share knowledge and support small scale projects (aggregate, admin help, etc)					✓	✓		• Similar models as used for small private businesses can be used (see segment 2)
	Review administrative processes so that entities are incentivised to invest in energy efficiency (make sure savings go back to investors, budget allocation based on benchmark among public buildings and not on past energy costs)				✓			✓	• This might take time to achieve as it involves a deep redesign of some administrative processes

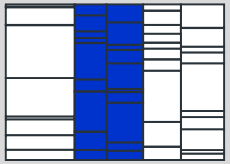
Key success factors

- Modify internal processes to increase simplicity and incentives for undertakers of energy efficiency projects
- Ensure tracking of results and accountability
- Make the most of external financing options and technical expertise

1 Major examples, not exhaustive

SOURCE: Team analysis

2 Small businesses



Emissions reduction opportunity:
5 Mt CO_2e
Share of total:
31%

Includes:
•Businesses with 20 employees or less

Does not include:
•Small buildings which are part of a large company (transaction costs can be decreased through a centralised facilitation center)

Drivers for energy efficiency decisions

	Name	Description
Incentives	Hurdle rate	Relatively lower pressure on returns and payback periods than large listed companies
	Pressure on costs	Margins are usually small for small businesses, giving a significant incentive to reduce costs
	Low capital requirement	Smaller buildings have less complex and centralised HVAC or water heating systems, giving access to more opportunity with a low capital intensity
Barriers	Access to capital	Small businesses can be limited in cash flow and cannot get loans from finance providers for uncollateralized projects such as energy efficiency retrofits at a reasonable rate (interviewees mentioned loans at more than 20%) as they are considered a risky counterparty (high perceived risk of default)
	Lack of scale	It is hard to group small businesses to enable sharing of knowledge sharing and optimisation of transaction costs
	Lack of knowledge	Small businesses managers usually do not have specific knowledge in building management and equipment/infrastructure choices
	Low business priority	Utilities bills are not a high concern for most small businesses, especially is they represent a small portion of their operating costs
	Suppliers	Equipment choices are often driven by contractors such as plumbers or electricians, which have no incentive to either downsize equipment when possible or use more energy efficient appliances (not well known to them, less revenue, etc)

SOURCE: Team analysis

2

Small businesses

Partially overcomes
Overcomes
Gap in policy
Partial gap in policy

	Policy measures[1]	National (N) or local (L)	Major barriers: Access to capital	Lack of scale	Lack of knowledge	Low business priority	Suppliers	Comments
Current	Energy Efficiency for Small Business Program (NSW)	L	Partially overcomes	Partially overcomes	Partially overcomes	Gap in policy	Gap in policy	• The program subsidises energy assessment and action plan and provides rebates up to $5,000
Future options	Support development of local initiatives such as ABESP (see slide 9)		✓	✓	✓	✓	✓	• Public-private partnership helps increase take-up rate (initiatives led by council get people's interest)
	Raise awareness on readily available funds such as public funds or pre-approved bank funds		✓					• Many improvements come at a low capital intensity and can be covered by pre-approved funds
	Create public database with savings that can be expected from fairly standard improvements			✓	Partially overcomes		Partially overcomes	• Incentivise energy service companies who have the data available to share it
	Mandate energy efficiency training for all contractors						Partially overcomes	• Will be quite complicated to set up as the base is quite fragmented and reluctance might be high
	Create financial incentives for contractors to use more energy efficient equipment (eg tax rebates, cash incentives, etc)						✓	• This action would be more expensive but probably more efficient in getting interest from contractors (see example of solar hot water)
	Create a guarantee fund to support loans for deeper retrofits		✓					• Might be difficult as it requires government to put it on its balance sheet
	Set-up tax lien financing in local communities (see slide 10)		✓					• Need to get banks to accept to provide funding at a reasonable rate (cannot choose customers)
	Create a standard for "peripheral" energy assessment and offer free training to contractors			✓			✓	• Difficult to assess what the take up would be. Public database would be a pre-requisite to get satisfactory results from such an initiative
	Create sale force to recruit businesses					✓		• There is a high potential for recruitment (eg through banks, but currently not enough capacity in the service offering business)

Key success factors

- Create standardised products: that can be applied across a wide range of businesses, easy to assess and group, easy to implement, low cost
- Unlock funding, starting by raising awareness about funds that are already available
- Train workforce, either by upgrading training of existing contractors or increasing number of intermediaries

1 Major examples, not exhaustive

SOURCE: Team analysis

3 Large businesses with high energy priority

Emissions reduction opportunity:
2 Mt CO_2e
Share of total:
12%

Includes:
•Large food service, food retail, private hospitals, accommodation

Does not include:
•Non-food retail, wholesale[1]

Drivers for energy efficiency decisions

	Name	Description
Incentives	Share of costs	Energy costs represent a high proportion of operating costs
	Brand image	With rising public awareness, brand images can benefit from good environmental performance (eg also potential bad impact for EEO participants)
	Regular operations interruptions	Customer-facing businesses have regular operations interruptions (eg for modernising design, superficial retrofits) which offer a good opportunity for conducting EE retrofit
	Can outsource easily	Large energy users are an attractive target for energy service companies
Barriers	Energy pricing	Companies with large energy bills often have been able to negotiate long-term contracts with very favorable terms, which increases the payback period for energy efficiency projects Large energy users can also have a larger part of fixed costs (separate contract for network costs)
	Lack of measurement	Absence of sub-metering systems and of significant case studies make it hard to estimate potential savings from energy efficiency improvements: capital investment is necessary to prove the business case
	Hurdle rate	Returns are usually low compared to other investment possibilities in the private sector
	Not core-business activity	Investments with higher impact on business (eg saving lives for hospitals, opening new locations for food retailers or hotels, etc) often get priority over capital intensive cost reduction projects
	Business risk	Equipment choices often driven by performance and favouring energy efficiency over other features can present a business risk (e.g. medical equipment is driven by accuracy/technical performance for hospitals or lighting and refrigeration systems is driven by customer preference for retail)

1 Very large scale non-food retail (eg EEO participants), food warehouses or data-centres could be included in this category in a more detailed analysis

SOURCE: Team analysis

3 Large businesses with high energy priority

Partially overcomes
Overcomes
Gap in policy
Partial gap in policy

	Policy measures[1]	National (N) or local (L)	Major barriers: Energy pricing	Lack of measurement	Hurdle rate	Not core-business	Business risk	Comments
Current	Energy efficiency Opportunities (EEO)	N		✓		✓		• Only very few players are concerned
Future options	Support the development of third party financing: • Support growth of ESCOs and leasing cies • Support the development of pay-as-you-save repayment by retailers/manufacturers • Set-up tax-lien financing schemes, guarantee funds or public-supported lines of credit		✓		✓	✓		• Little governmental support should be needed due to attractiveness of players in this field for energy business players
	Improve the business case by providing financial incentives (eg accelerated depreciation, rebates, low interest loans)		✓		✓			• Can especially be interesting for longer-payback improvements
	Finance installation of sub-metering systems in a few voluntary locations to create database			✓				• Build statistics on potential benefits
	Finance test programs to check customers reaction to changes in light/refrigeration/etc equipment						✓	• In many cases the perceived risk is much higher than the real risk
	Incentivise voluntary targets for energy efficiency (eg through regulatory or financial incentives)				✓	✓		• It will be hard to push for ambitious targets without solving the lask of measurement and business risk issues
	Increase business priority by mandating reporting of energy use and/or opportunities (eg expand EEO program to smaller energy users)		✓	✓	✓	✓		• Beware of avoiding conflicting programs from various governmental entities which add complexity for business without adding focus
	Introduce mandatory targets for energy intensity or mandatory building standards at time of retrofit, preferably based on performance		✓	✓	✓	✓	✓	• Based on local benchmarks

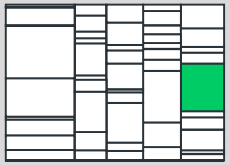
Key success factors

- Outsource project management and capital investment (can be done entirely by businesses due to attractiveness of these customers)
- Increase knowledge about potential savings and impacts on operations/customers
- Incentivise setting up of targets to reach higher energy cuts

1 Major examples, not exhaustive

SOURCE: Team analysis

4 Large private tenanted offices



Emissions reduction opportunity:
1 Mt CO_2e

Share of total:
6%

Includes:
- Private-occupied offices

Does not include:
- Private offices rented by public entities

Drivers for energy efficiency decisions

	Name	Description
Incentives	Share of costs	Energy costs represent a high proportion of operating costs
	Cost-led decisions	Building equipment choices are often led by costs and not other performance features
	Level of expertise	Buildings related decisions are often made by buildings managers with high level of expertise
	Risk for revenue	Competition with better performing new builds is starting to increase uptake of energy efficiency improvements (customers sensitivity to NABERS ratings increase)
	Well-known space	High level of knowledge on potential in office buildings in the market
Barriers	Long payback period	Owners are mostly incentivised to make improvements to central services (disclosed NABERS rating are only for central services), which often offer longer payback periods
	Long decision cycles	Major retrofits only happen around every 25 years (mid-life refurbishment). Note: Many commercial buildings are scheduled to be retrofitted in the coming years, and if this opportunity is missed, it will make any later upgrade of central systems retrofits much more expensive
	Co-benefits not proven	Numbers for additional revenue expected (from higher rent and higher occupancy rate), as well as productivity improvements are still uncertain
	Operations disruptions	Deep energy efficiency retrofits necessitate to rotate floors or find other arrangements that impact productivity and tenants' comfort
	Central services focus	There is currently no incentive to undertake improvements on tenancy energy use as disclosure concerns central services only

SOURCE: Team analysis

4 Large private tenanted offices

Partially overcomes
Overcomes
Gap in policy
Partial gap in policy

	Policy measures[1]	National (N) or local (L)	Major barriers: Long pay-back period	Long deci-sion cycles	Co-benefits not proven	Operations disruption	Central ser-vices focus	Comments
Current	Mandatory disclosure of the energy efficiency of commercial buildings at time of lease or sale	N	~	~	~	~		• Initial scope: large commercial office buildings (2,000m² or larger).
	Energy efficiency Opportunities (EEO)	N						• Only very few players are concerned
Future options	Extend mandatory disclosure to whole building rating						✓	• To incentivise tenancy improvements
	Build knowledge and communicate on rent and occupancy increase following EE retrofits		~		✓			• To help build business case for long pay-back investments
	Mandate disclosure in a shorter time-frame			~				• Display of energy performance each year (less costly), first NABERS rating in next 2-3 years
	Offer financial incentives to extend retrofit scope (eg accelerated depreciation, low interest loans)		✓		✓			• To get full potential when retrofits are conducted (most favorable time)
	Review leases standards to incorporate rent increase following EE improvements				✓			• Could be supported by a listing of accepted cost increase depending on energy savings/work accomplished
	Incentivise voluntary targets for energy efficiency (eg through regulatory or financial incentives)		~	~	~	~		• To push for more ambitious targets
	Introduce mandatory building standards at time of retrofit, preferably based on performance		✓	~	✓	✓	~	• Performance based enables implementation of lowest cost opportunity but requires tracking
	Introduce mandatory targets for energy intensity		✓	✓	✓	✓	~	• Based on local benchmarks

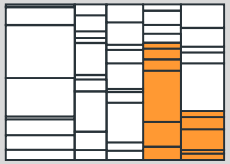
Key success factors

- Pursue action already undertaken (disclosure) as it has been quite effective in unlocking significant opportunity
- Don't miss the opportunity represented by mid-life retrofits (especially as a significant share are supposed to happen shortly)
- Encourage deeper retrofits when possible through financing support, target setting or extension of disclosure scope to whole building

1 Major examples, not exhaustive

SOURCE: Team analysis

5 Large businesses with low energy priority



Emissions reduction opportunity:
3 Mt CO_2e

Share of total:
19%

Includes:

- Large non-food retail, wholesale, community, private schools/universities, owner-occupied offices

Drivers for energy efficiency decisions

	Name	Description
Incentives	Brand image	With rising public awareness, brand images can benefit from good environmental performance
	Regular operations interruptions	Customer-facing businesses have regular operations interruptions (eg for modernising design, superficial retrofits) which offer a good opportunity for conducting EE retrofit
Barriers	Low business priority	As energy costs are a small part of operational costs, little attention is given to the subject by the management
	Perception of benefit	Energy consumption reduction does not usually result in direct reductions in energy costs but in smaller increases, which is hard to sell, especially when energy costs are not a significant part of overall operating costs
	Hurdle rate	Returns are usually low compared to other investment possibilities in the private sector
	Lack of understanding	Buildings management and utility cost reduction are not a focus of the business, leading to low level of expertise and understanding in-house
	Lack of measurement	Absence of sub-metering systems and of significant case studies make it hard to estimate potential savings from energy efficiency improvements: capital investment is necessary to prove the business case
	Business risk	Equipment choices are often driven by customer preferences/behaviours (eg lighting in retail)

SOURCE: Team analysis

5 Large businesses with low energy priority

	Policy measures[1]	National (N) or local (L)	Major barriers[1]: Low business priority	Perception of benefits	Hurdle rate	Lack of understanding	Lack of measurement	Business risk	Comments
Current	Energy efficiency Opportunities (EEO)	N	~			~	~		• Only very few players are concerned
Future options	Create public database with savings that can be expected from fairly standard improvements (can include funding of case studies)			✓	~		~		• Incentivise energy service companies who have the data available to share it
	Support the development of end-to-end service offering (ABESP type on large scale)		~		~	✓	✓		• To overcome low mind share • Concentrate on higher return upgrades
	Support the development of third party financing: tax-lien, public-private lines of credit, etc		~		✓				• It will be hard to get ESCOs or leasing companies interested in small energy users
	Improve the business case by providing financial incentives (eg accelerated depreciation, rebates, low interest loans)			✓	✓				• Can especially be interesting for longer-payback improvements
	Finance test programs to check customers reaction to changes in lighting/air conditioning level etc							✓	• In many cases the perceived risk is much higher than the real risk
	Incentivise voluntary targets for energy efficiency (eg through regulatory or financial incentives)				~	~			• It will be hard to push for ambitious targets without solving the lask of measurement and business risk issues
	Increase business priority by mandating reporting of energy use and/or opportunities (eg expand EEO program to smaller energy users)		~	~	~	~			• Will be hard to get engagement from small energy users
	Introduce mandatory targets for energy intensity or mandatory building standards at time of retrofit, preferably based on performance		✓	✓	✓	✓	✓	✓	• Based on local benchmarks

~ Partially overcomes
✓ Overcomes
Gap in policy
Partial gap in policy

Key success factors

- Increase knowledge about potential savings and impacts on operations/customers
- Push for standardisation to simplify process and offer higher returns (little specific equipment in those sectors)
- Outsource project management (and capital investment when possible)

1 Major examples, not exhaustive

SOURCE: Team analysis

Summary of key success factors

1 Public sector

- Modify internal processes to increase simplicity and incentives for undertakers of energy efficiency projects
- Ensure tracking of results and accountability
- Make the most of external financing options and technical expertise

2 Small businesses

- Create standardised products: that can be applied across a wide range of businesses, easy to assess and group, easy to implement, low cost
- Unlock funding, starting by raising awareness about funds that are already available
- Train workforce, either by upgrading training of existing contractors or increasing number of intermediaries

3 Large businesses with high energy priority

- Outsource project management and capital investment (can be done entirely by businesses due to attractiveness of these customers)
- Increase knowledge about potential savings and impacts on operations/customers
- Incentivise setting up of targets to reach higher energy cuts

4 Large private tenanted offices

- Pursue action already undertaken (disclosure) as it has been quite effective in unlocking significant opportunity
- Don't miss the opportunity represented by mid-life retrofits (especially as a significant share are supposed to happen shortly)
- Encourage deeper retrofits when possible through financing support, target setting or extension of disclosure scope to whole building

5 Large businesses with low energy priority

- Increase knowledge about potential savings and impacts on operations/customers
- Push for standardisation to simplify process and offer higher returns (little specific equipment in those sectors)
- Outsource project management (and capital investment when possible)

SOURCE: Team analysis

Contents

- Commercial buildings focus area
- The Low Carbon Growth Plan for Australia

Introducing ClimateWorks Australia's Low Carbon Growth Plan

- ClimateWorks Australia was founded in 2009 through a partnership between The Myer Foundation and Monash University and has international links with the US-based ClimateWorks Foundation.
- We have developed a Low Carbon Growth Plan for Australia, which was a commitment made by all national leaders at the Major Economies Forum in 2009.
- The Low Carbon Growth Plan is based on the McKinsey cost curve methodology, and has been built on the following principles:
  - Establish a comprehensive fact base
  - Identify the lowest cost means to reduce GHG emissions
  - Examine GHG emissions reduction opportunities from both a societal and business perspective
  - Understand barriers to GHG emissions reduction and develop measures to overcome them
  - Build momentum for collaborative action
- The next step for ClimateWorks is to work with both business and experts to identify the lowest cost emissions reduction opportunities, the barriers to implementation and the means to overcome them.

The Low Carbon Growth Plan for Australia – Key Findings (1/4)

- **Australia has the potential to achieve GHG emissions reductions of 249 $MtCO_2e$ at a low cost**
  - Australia has the potential to reduce GHG emissions by 249 $MtCO_2e$ by 2020—a 25% reduction from 2000 levels—at an average annual cost to society of A$185 per household without changing lifestyle or the mix of businesses that comprise Australia's economy.
  - This Low Carbon Growth Plan identifies 54 separate opportunities—across all sectors—that can be implemented over the next ten years to reduce emissions in Australia to 25% below 2000 levels.
  - Almost one third of these emissions reduction opportunities offer a net savings to society, and the remaining two thirds have a weighted average cost of A$41 per tonne of carbon dioxide equivalent (CO_2e).
  - The power and forestry sectors offer the largest emissions reduction opportunity (59% or 147 $MtCO_2e$) but come at the highest cost (average of A$40 per tCO_2e). Industry, buildings, agriculture and transport each offer smaller reduction opportunities, but together still represent a 102 $MtCO_2e$ opportunity. They are also mostly economically attractive with net savings to society of A$40 per tCO_2e.

The Low Carbon Growth Plan for Australia – Key Findings (2/4)

- **Reducing GHG emissions can be profitable for businesses**
  - Almost a quarter of these opportunities (or 54 $MtCO_2e$) generate a positive return for businesses, even without a carbon price. By using resources more efficiently and thus reducing input costs, many businesses will be able to achieve returns above their cost of capital while at the same time reducing their GHG emissions. These profitable opportunities are concentrated in the buildings, transport and industry sectors.
  - Reducing GHG emissions will also provide additional growth opportunities for businesses. As the world moves towards a low carbon economy, demand for carbon-efficient products and services will steadily increase, providing significant opportunities for businesses that supply these, such as engineering and construction companies, and equipment and product manufacturers and installers.

The Low Carbon Growth Plan for Australia – Key Findings (3/4)

- **A combination of a carbon price and targeted actions are required to achieve Australia's full potential of low cost emissions reductions**
  - A carbon price will increase the incentive for business to invest in emissions reduction. For example, the carbon price estimated by Australian Treasury in its Garnaut -25 forecast[1] is likely to more than triple the emissions reduction opportunities with a positive return for business, increasing the total of profitable opportunities to199 $MtCO_2e$ (80% of the total identified opportunity).
  - Additional action will be required to overcome other barriers that do not respond to a carbon price. These include market structure and supply, information gaps, decision processes, capital constraints and investment priorities. Overcoming these barriers will most effectively be done through targeted action. The barriers to emissions reduction vary by specific opportunity and sub-sector and so a portfolio of tailored measures is needed.
  - Business-led solutions are critical to address the emissions reduction challenge. In some cases, the complexity or difficulty of a barrier will make business-led solutions less feasible or less efficient, thereby necessitating government action to create market conditions where full capture of emissions reduction is possible. But in many cases, businesses have the ability now to achieve more cost-effective emissions reductions.

[1] Australian Treasury. *Australia's Low Pollution Future: The Economics of Climate Change Mitigation.* 2008. This price was based on global price forecasts and expected use of Clean Development Mechanism (CDM) offsets; converted to 2010 dollars: A$43 per tonne in 2013 rising to A$69 per tonne in 2020.

The Low Carbon Growth Plan for Australia – Key Findings (4/4)

- **A portfolio of prompt action is required**
  - Three broad types of action now will help Australia implement the 54 opportunities and achieve maximum emissions reduction at lowest net cost to the economy.
  - The type of action depends on the risk of "lock-in" of emissions and the ease of emissions reductions:
    - Remove barriers for those opportunities for which a positive return is already available for business
    - Introduce a price for carbon and remove further non-price barriers to capture opportunities for which technology and economics are well understood, but not currently profitable to undertake
    - Undertake longer term actions to improve the economics and certainty of high potential emissions reduction opportunities that are currently difficult to implement
  - Delaying action will mean some low cost opportunities are lost. Many emissions reduction opportunities, like avoiding the installation of inefficient equipment that has a 20–30 year life, exist only for a finite period. Without prompt action the reduction potential will disappear, and any remedial measure to later "make up" the deficit will cost more.

Acknowledgments

In developing the Low Carbon Growth Plan, ClimateWorks Australia has sought insights, analysis and data from numerous experts in academic, scientific, business and governmental organisations, and received dedicated practical and financial support.

ClimateWorks Australia would particularly like to thank the Commonwealth Department of Climate Change (DCC) and the Victorian Department of Sustainability and Environment and Victorian Department of Transport for contributing staff resources to the project, and McKinsey & Company for providing analytical support and the methodology for the GHG emissions reduction cost curve.

In addition ClimateWorks Australia gratefully acknowledges the contribution of the Australian Government through the Australian Carbon Trust for its financial support particularly focused on the commercial buildings sector analysis, and the practical support from DCC through participation in the project steering committee and review of data and outputs across all key sectors.

The US-based ClimateWorks Foundation has also been integral to this project, and we extend our appreciation for the use of their ground-breaking low carbon growth plan methodology, and for their input to the project steering committee. In addition to developing highly targeted campaigns focused on effecting rapid and significant emissions reductions, the ClimateWorks Foundation has supported the development of low carbon growth plans for several countries to date, including Mexico and Indonesia. ClimateWorks Australia is proud of its association with this dedicated, action-focused network.

The Low Carbon Growth Plan for Australia can be downloaded from www.climateworksaustralia.org

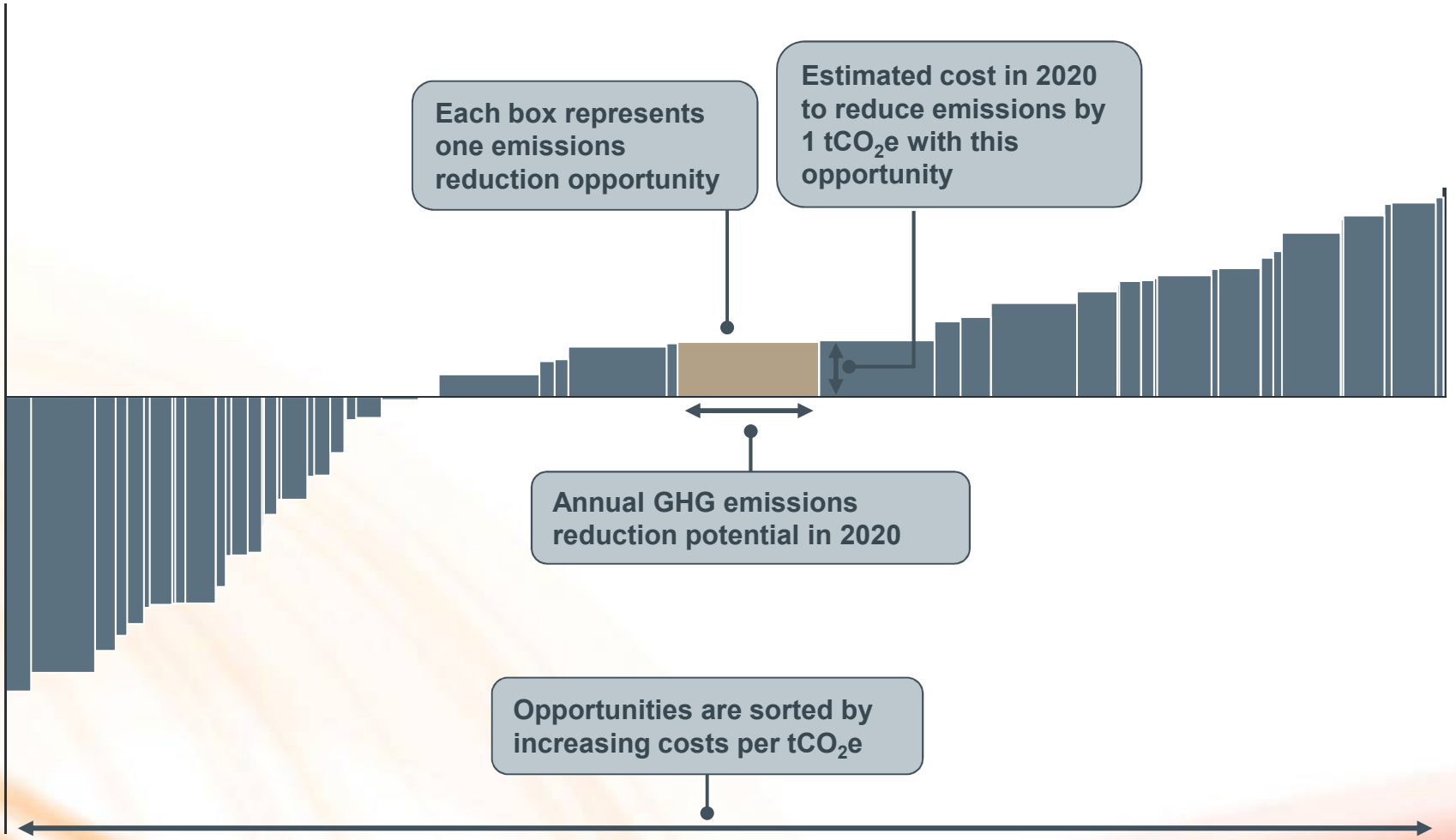
While this report and the ideas expressed in it belong solely to ClimateWorks Australia, we wish to extend our gratitude to the individuals, companies and organisations named in the report for their valued input.

In addition, we extend our sincere appreciation to the following people who donated their time as members of the Advisory Panel to this project, providing highly constructive and relevant input, which was critical in setting the direction and tone of the report:

Cath Bremner Head of International Development, UK Carbon Trust; Russell Caplan Chairman, Shell Australia; Dr Cameron Hepburn Senior Research Fellow, Smith School of Enterprise and the Environment, Oxford University; Professor Tom Heller Stanford Professor; Project Catalyst lead member; Executive Director, Climate Policy Initiative; Mick Keogh CEO, Australian Farming Institute; Sam Mostyn Director, Sydney University Institute for Sustainable Solutions; Tony Nicholson CEO, Brotherhood of Saint Laurence; Ann Sherry AO CEO, Carnival Australia; Mike Waller Director and Partner, Heuris Partners; former BHP Billiton Chief Economist; Chair of Sustainability Victoria; Jennifer Westacott Partner in Charge, Sustainability, Climate Change & Water, KPMG; Bob Williams Senior Research Scientist, The Energy Group, Princeton Environmental Institute, Princeton University; Dr Alex Wonhas Director, CSIRO Energy Transformed Flagship.

ClimateWorks Australia thanks all those named above for their contribution, and acknowledges that they bear no responsibility for the final content of this report.

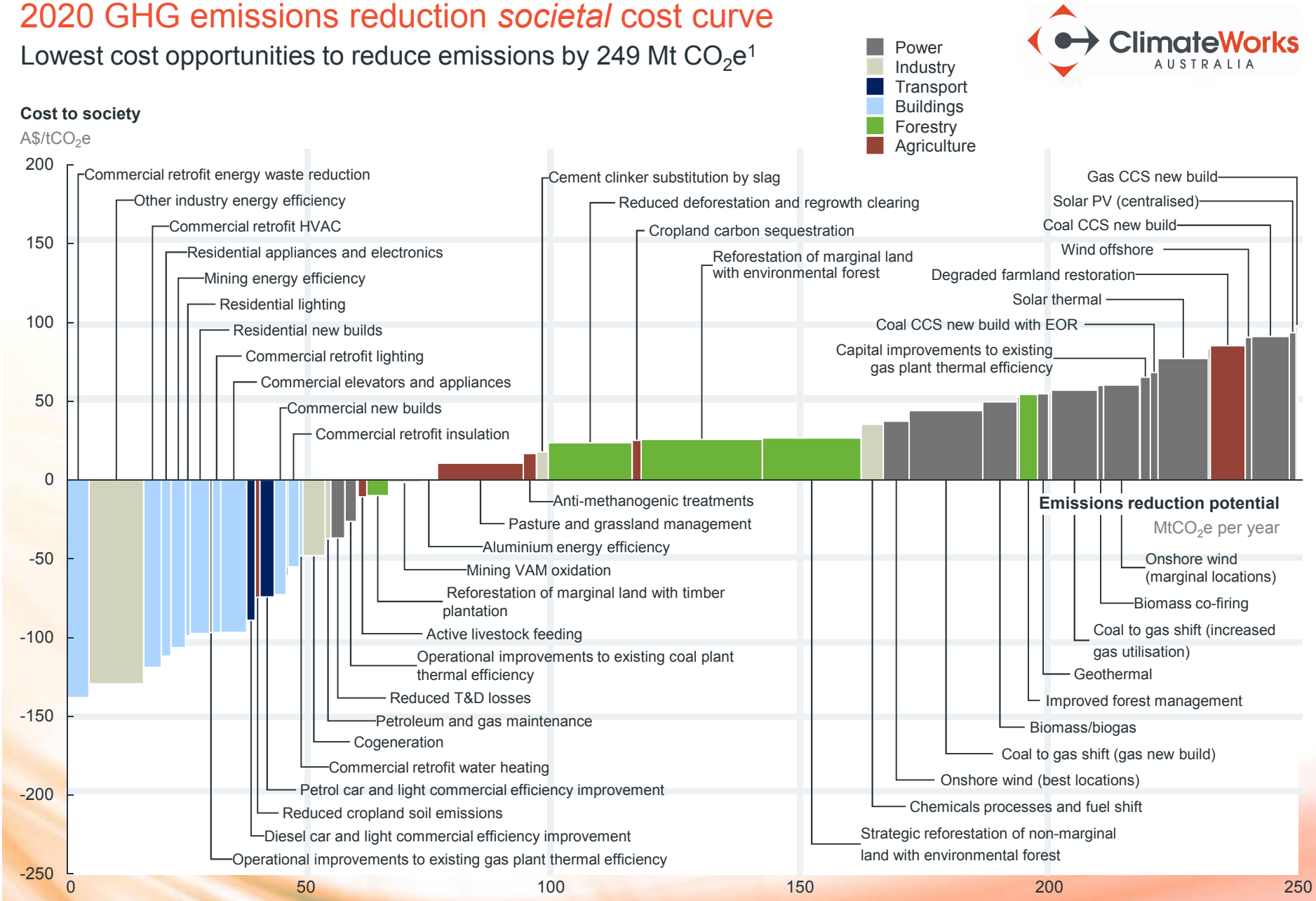
How to read an emissions reduction cost curve



SOURCE: ClimateWorks team analysis

2020 GHG emissions reduction *societal* cost curve

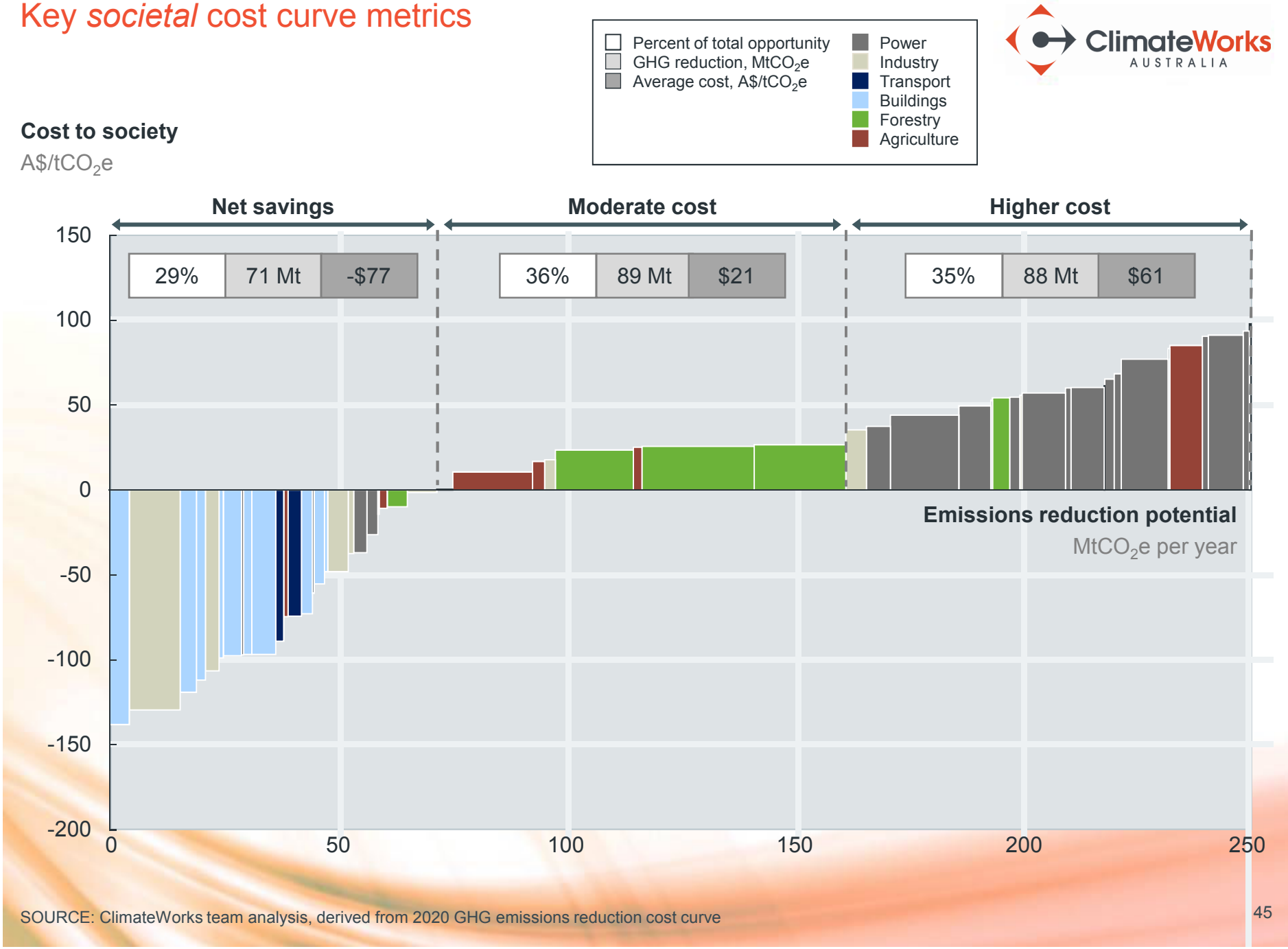
Lowest cost opportunities to reduce emissions by 249 Mt CO_2e[1]



1 Includes only opportunities required to reach emission reduction target of 249 Mtpa (25% reduction on 2000 emissions); excludes opportunities involving a significant lifestyle element or consumption decision, changes in business/activity mix, and opportunities with a high degree of speculation or technological uncertainty

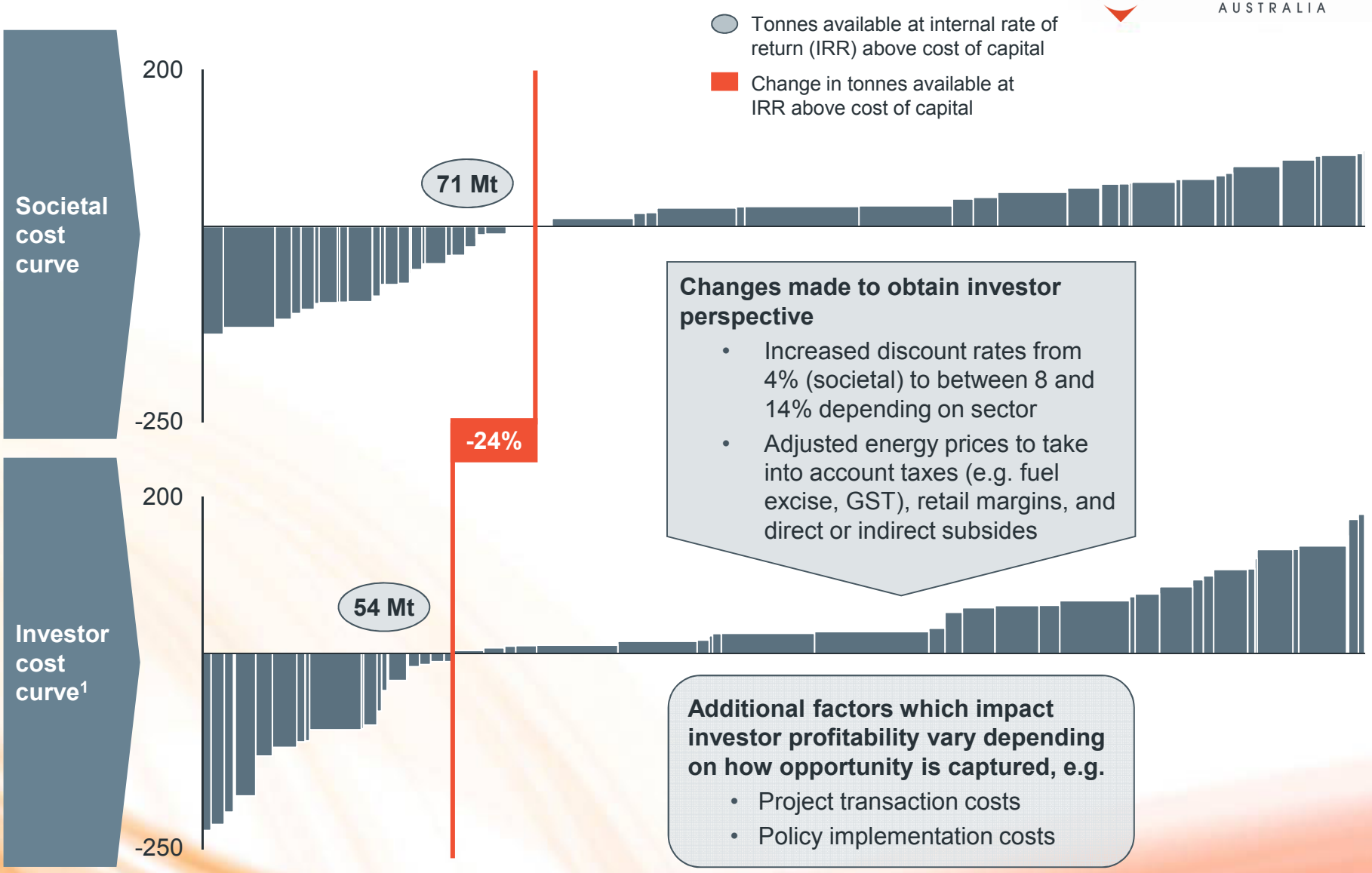
SOURCE: ClimateWorks team analysis (refer to bibliography)

Key *societal* cost curve metrics



SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

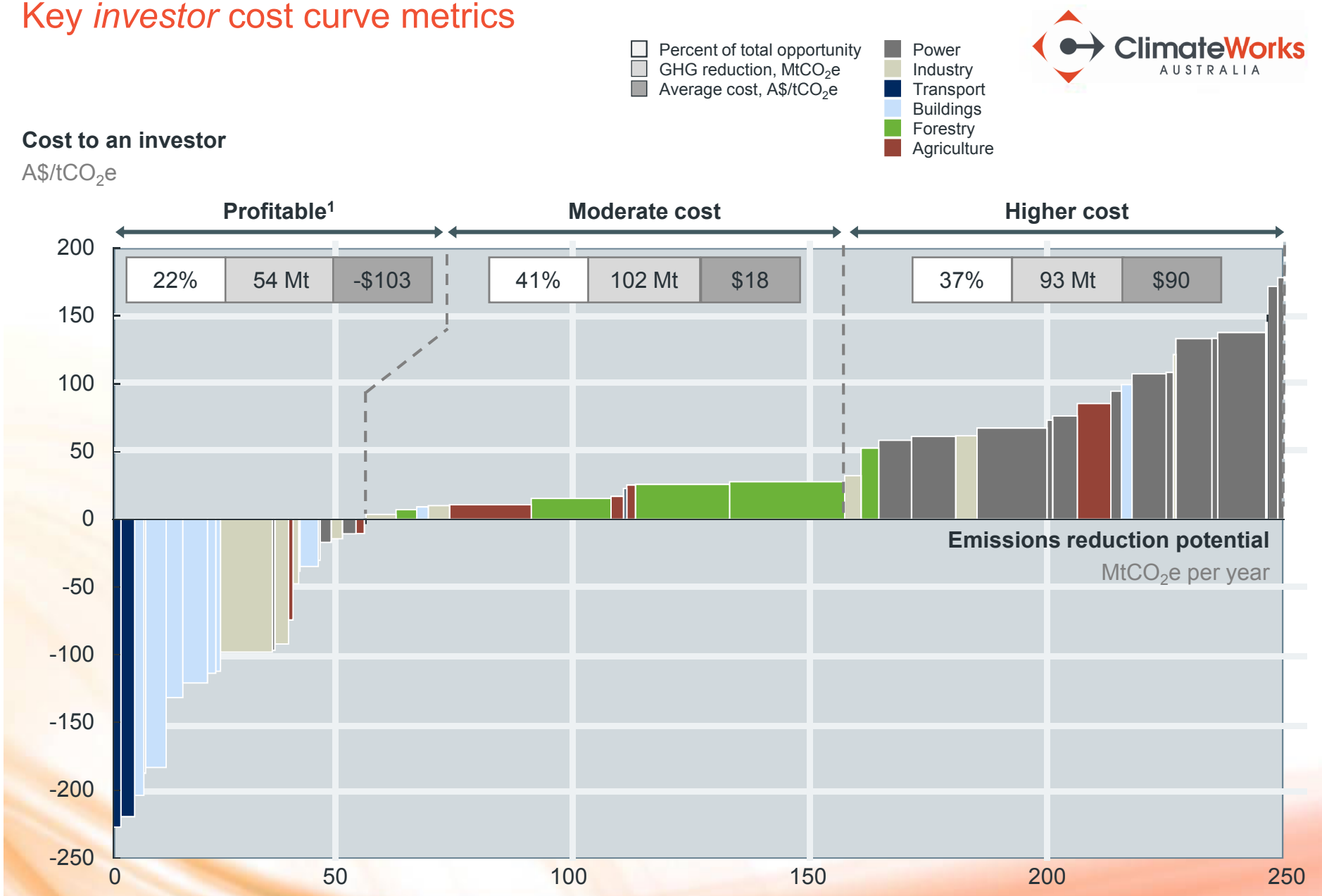
Comparison of societal and investor cost curves



1 Does not include the impact of a carbon price

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

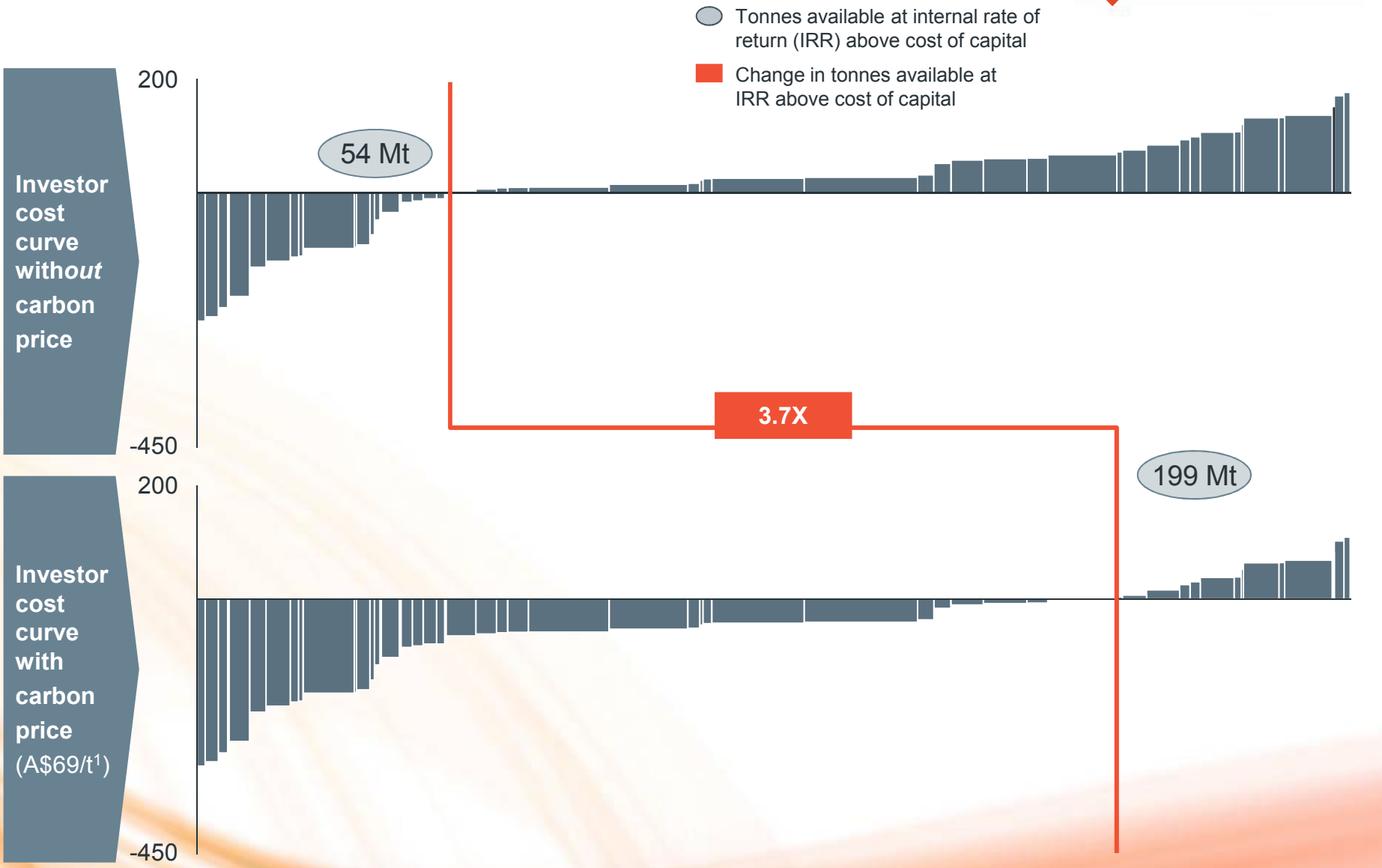
Key *investor* cost curve metrics



1 In this report, profitable is defined as positive return on incremental invested capital and operating expense (excluding transaction or policy implementation costs)

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Impact of carbon price on investor economics

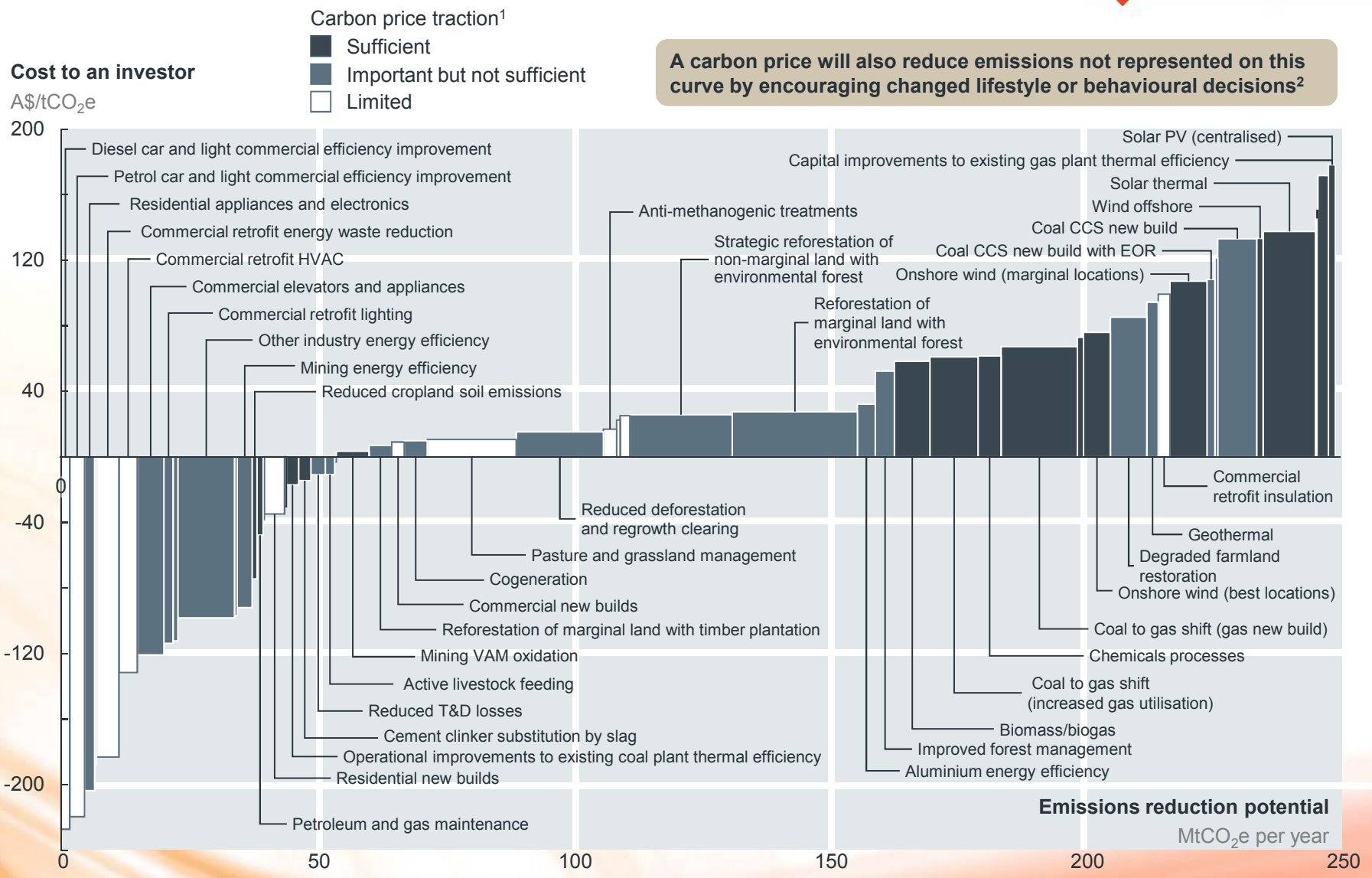


1 Carbon price in 2020 of A$69 per tonne based on Treasury Garnaut -25% estimate (*Australia's Low Pollution Future)* converted to 2010 dollars

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Expected traction of carbon price

Based on 2020 GHG emissions reduction *investor* cost curve

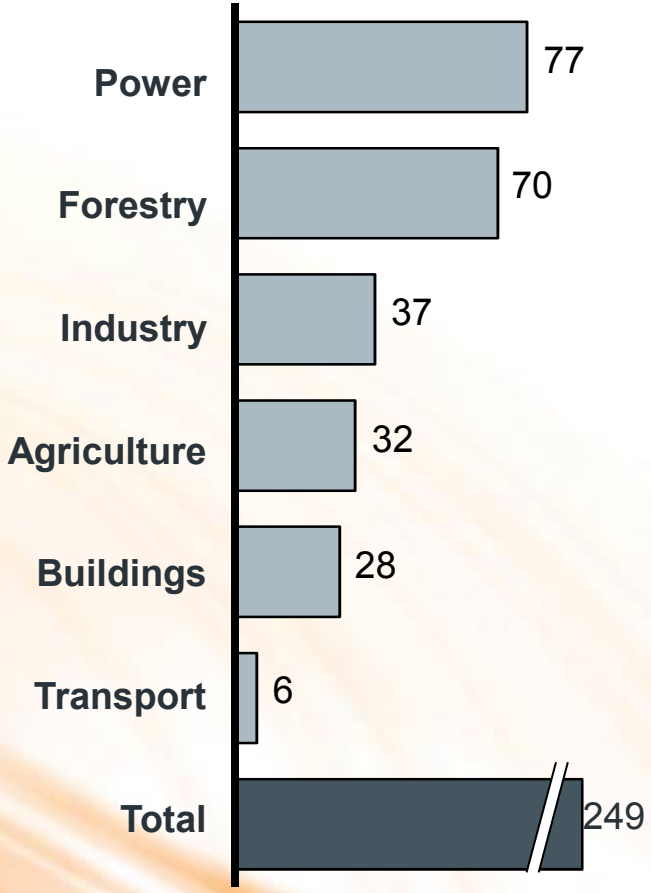


1 Analysis assumes a carbon price large enough to make each opportunity profitable

2 Such as reduced consumption (e.g. turning lights off, driving fewer kms) and switching to less carbon-intensive forms of consumption (e.g. using public transport instead of driving)

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Australian 2020 emissions reduction potential by sector[1]

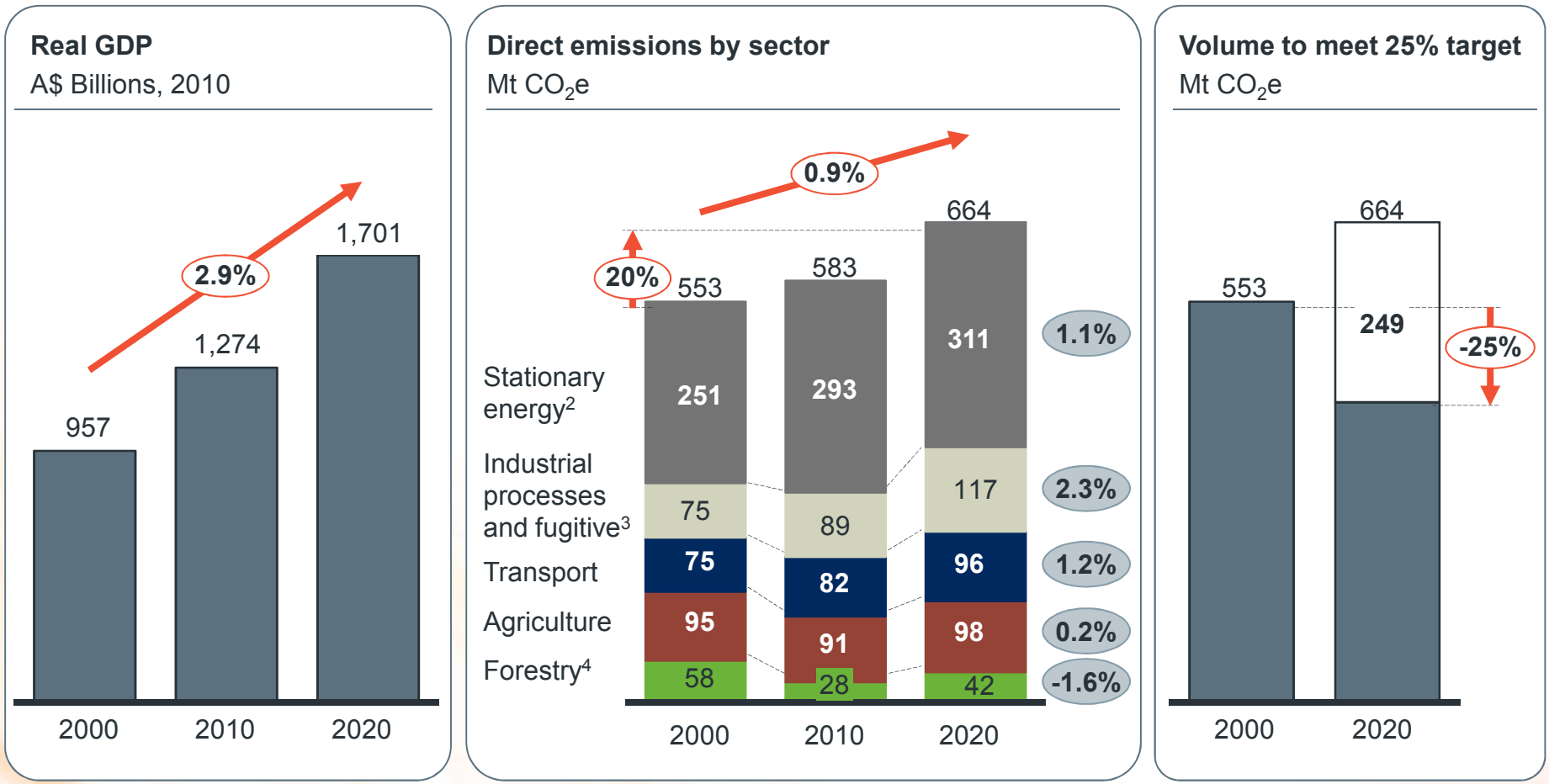


	Volume $MtCO_2e$	Average cost per tonne Real 2010 A$ Societal	Investor	Example opportunities
Power	77	54	87	• Renewables • Coal-to-gas shift
Forestry	70	25	24	• Reforestation • Reduced deforestation
Industry	37	-48	-25	• Industrial energy efficiency • Ventilation air methane oxidation
Agriculture	32	25	25	• Degraded land restoration • Reduced deforestation
Buildings	28	-99	-90	• Commercial retrofits • Residential new builds
Transport	6	-60	-194	• Combustion vehicle efficiency • Hybrids
Total	249	**7**	**19**	

1 Includes all emission reduction opportunities required to achieve 249Mtpa

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Business-as-usual projected economic and emissions growth and relative volume of savings identified in Low Carbon Growth Plan



CAGR[1]

1 Compound Annual Growth Rate per annum, 2000–20
2 Direct emissions from the power sector can also be regarded as indirect emissions from downstream power-consuming activities (e.g. power use in the building and industry sectors)
3 Includes fugitive emissions, industrial process emissions and waste emissions
4 Net emissions after subtracting growth in carbon sinks (e.g. new plantations) from emissions due to land clearing; Kyoto accounting method used

SOURCE: Australian Department of Climate Change (2009); ClimateWorks team analysis

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