MODELLING BEHAVIOURAL FACTORS TO SUPPORT POLICY DESIGN

OVERVIEW OF AUSTRALIAN EXPERIENCE

ClimateWorks Australia

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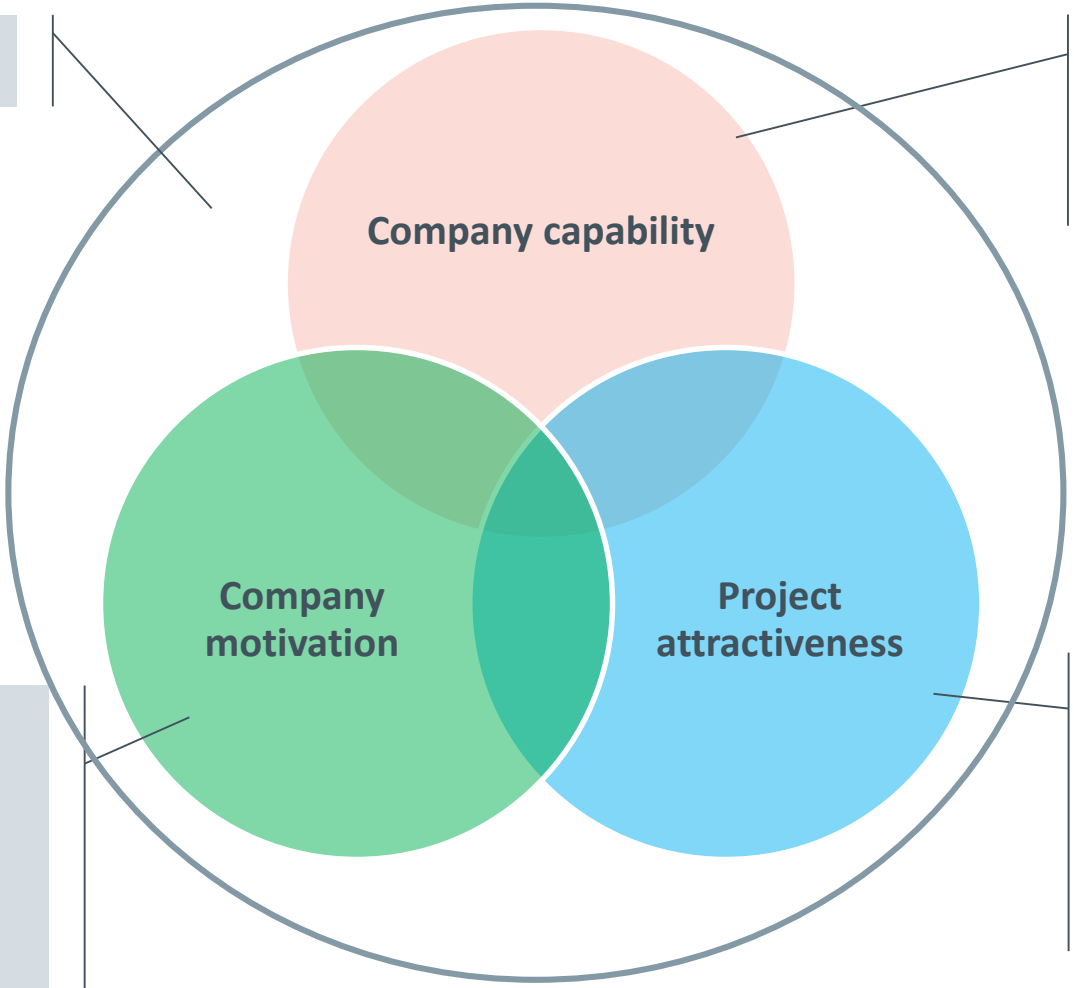
Through our work with the Department of Industry in Australia we have created tools to better understand and model industrial companies decisions

- We have developed a **comprehensive framework** for the factors impeding energy efficiency in industrial companies, including behavioural factors
- We have created a methodology to link those factors to the untapped energy efficiency opportunities and **quantify their impact**
- Thanks to this methodology, we have been able to **model the potential impact of given policies** on those factors, and therefore get estimates of companies' uptake
- In subsequent work, we have been able to refine our tool based on results from **companies interviews**
- We have also developed a **simplified barriers modelling tool** which can be used by government as a high-level first step to understand what policies might be needed

We worked with experts to develop a comprehensive framework for the factors impeding energy efficiency in industrial companies, including behavioural factors

Industrial energy efficiency opportunity by factor impeding uptake

No barrier – implemented in business-as-usual



- Access to internal capital
- Access to external finance
- Access to information
- Internal skills/capability

- Opportunity cost
- Operational risk
- Internal incentives, practices and habits
- Non-market pricing
- Regulatory barriers (cogeneration, fuel rebates and tax depreciation)

- Payback period
- Project scale
- Decision cycles for long-lasting equipment
- Supply chain barriers
- Innovation effort and cost

We have created a methodology to link those factors to the untapped energy efficiency opportunities, by identifying the project and company-related attributes which influence whether a barrier is impeding an activity or not

Examples

Barrier	Technology/process attributes	Company attributes
Access to external finance	▪ **Project cost** (High, Medium, Low) ▪ **Payback profile** (0-2 years, 2-4 years, 4+ years) ▪ **Type of technology/process** (Standard technology, Other)	▪ **Corporate size** (Large, Medium) ▪ **Profitability / Growth profile** (High, Other)
Supply chain barriers	▪ **Type of technology / process** (Specialised / innovative technology and process redesign, Operational process improvements, Standard technology)	▪ **Site location** (Remote, All other) ▪ **Corporate scale** (Large - with other sites in the same industry, All other)

To quantify the *strength* of the barriers, a scoring system was created

It is based on the concept that some barriers require little effort to work through…….

While others are considerably harder to overcome

	Strength	
Code	***Description***	***% blocked***
5	Very high	100%
4	High	75%
3	Medium	50%
2	Low	25%
1	Very low	0%

These scores are applied to every combination of relevant company and technology attributes

Strength		
Code	*Description*	*% blocked*
5	Very high	100%
4	High	75%
3	Medium	50%
2	Low	25%
1	Very low	0%

Example

Barrier: Capability – Internal skills and capability

		Internal skills and capability	**Sites lack specific skills and knowledge to assess and implement energy efficiency opportunities. This includes technical, business case and financial knowledge as well as understanding of suppliers to assist with implementation. It also includes the availability of systems (e.g. to measure energy usage).**											
			Company attributes											
		Energy Intensity	High						Low/Medium					
		Energy Management Capability	High		Medium		Low		High		Medium		Low	
		Corporate Scale	Large	All other	Large	All other	Large	All other	Large	All other	Large	All other	Large	All other
Technology / process attributes	Type of technology / process	Specialised / innovative technology	2	2	3	4	4	5	2	3	4	5	5	5
		Process redesign	2	2	2	3	4	5	2	3	3	4	5	5
		Operational process improvements	1	1	1	2	3	3	1	1	1	2	3	4
		Standard technology	1	1	1	1	3	3	1	1	1	2	3	4

This analysis enabled a calculation of the expected implementation of energy efficiency opportunities in business-as-usual (BAU, what is not blocked by barriers)

	Company Attributes				Technology / Process Attributes				
Subsector	A	B	C	etc	A	B	C	etc	Total Energy savings potential (TJ)
ANZSIC 1	High	High	High	High	High	High	High	High	10
ANZSIC 1	High	High	High	High	High	High	High	Medium	15
ANZSIC 1	High	High	High	High	High	High	High	Low	100
ANZSIC 1	High	High	High	High	High	High	Medium	High	3
etc	High	High	High	High	High	High	Medium	Medium	5

Total energy savings potential multiplied by a total barrier strength enables us to calculate BAU energy savings

	Company Attributes			Technology / Process			Total Energy savings potential (TJ)	Company Capability			Project Attractiveness			Company Motivation			Barrier strength	Total Energy savings under BAU (TJ)
Subsector	A	B	etc	A	B	etc		A	B	etc	A	B	etc	A	B	etc		
ANZSIC 1	High	High	High	High	High	High	10	1	2	3	1	1	1	2	2	2	50%	5
ANZSIC 1	High	High	High	High	High	Medium	15	1	1	1	2	1	2	1	2	2	25%	11.25
ANZSIC 1	High	High	High	High	High	Low	100	1	1	1	1	1	1	1	1	1	0%	100
ANZSIC 1	High	High	High	High	Medium	High	3	3	4	2	2	1	1	1	3	3	75%	0.75
etc	High	High	High	High	Medium	Medium	50	1	2	1	4	4	3	4	3	2	75%	12.5

To model the potential impact of policies, for each attribute, it was assessed how barriers strength would be changed by each policy option

% blocked	descriptor	Code
100%	Very High	5
75%	High	4
50%	Medium	3
25%	Low	2
0%	Very Low	1

Barrier strength before ESI by attribute/trait

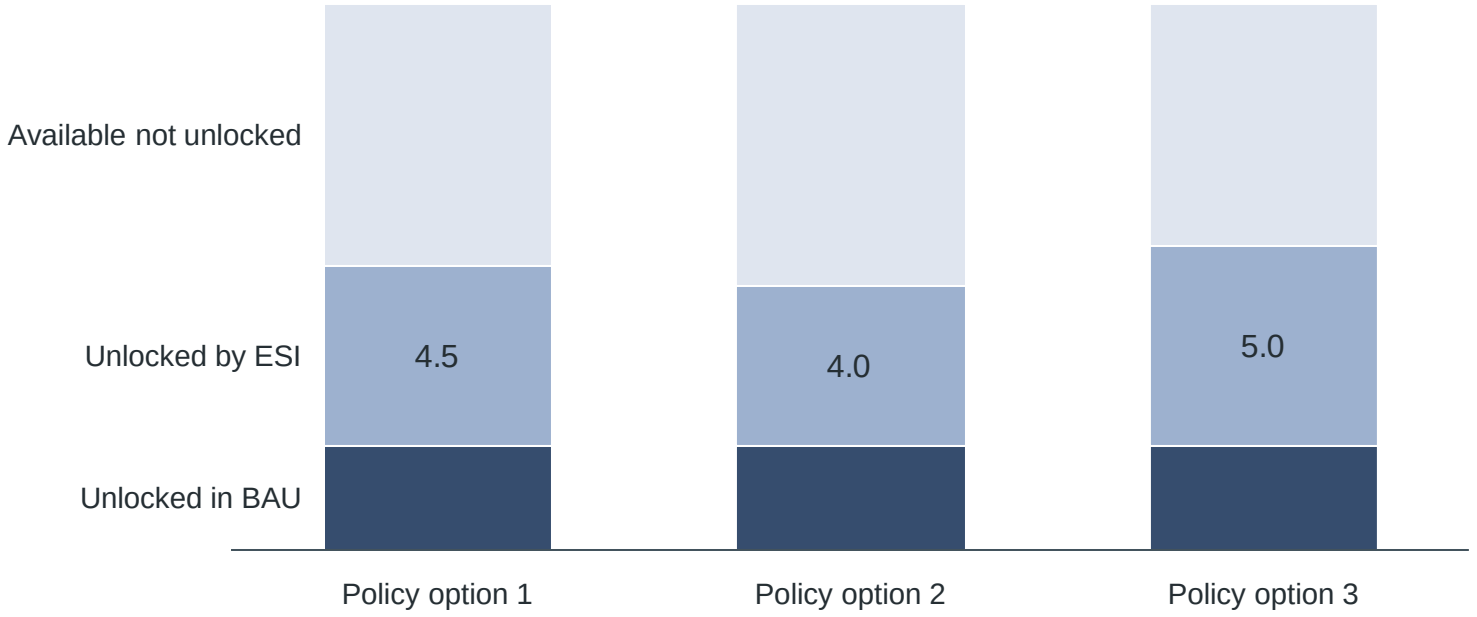
Barrier strength after ESI by attribute/trait

		Project Scale	Some energy efficiency projects are not of sufficient scale to attract required resources (e.g. transaction costs are prohibitive)
Barrier strength before ESI			
Technology / process attributes	Amount of net savings delivered	Internal effort	
	Low (eg <$30,000)	High	5
		Low	3
	Other	High	2
		Low	1
Barrier strength after ESI			
Technology / process attributes	Amount of net savings delivered	Internal effort	
	Low (eg <$30,000)	High	2
		Low	1
	Other	High	1
		Low	1

This methodology allowed us to compare the potential outcome results show how much opportunity could be unlocked by the various policy options

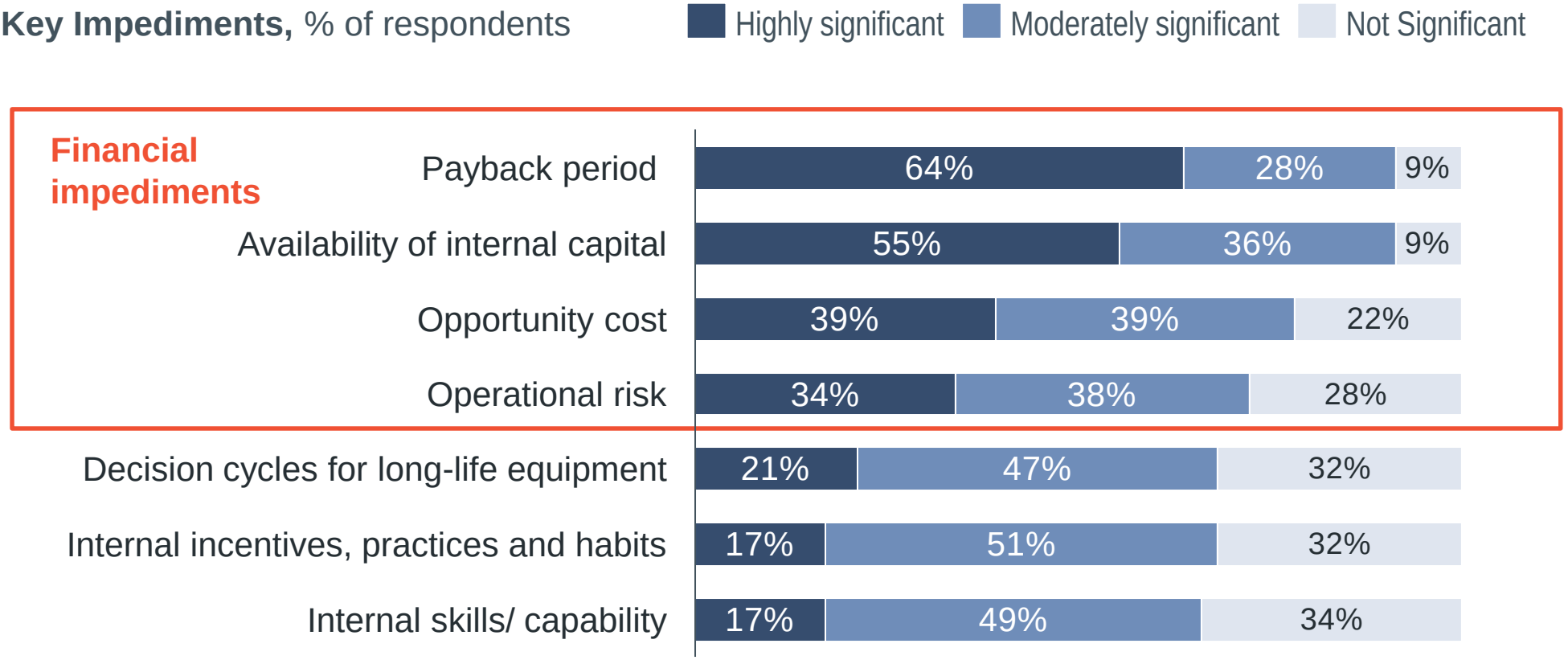
DISGUISED DATA

Energy savings in the industrial sector
% of energy use



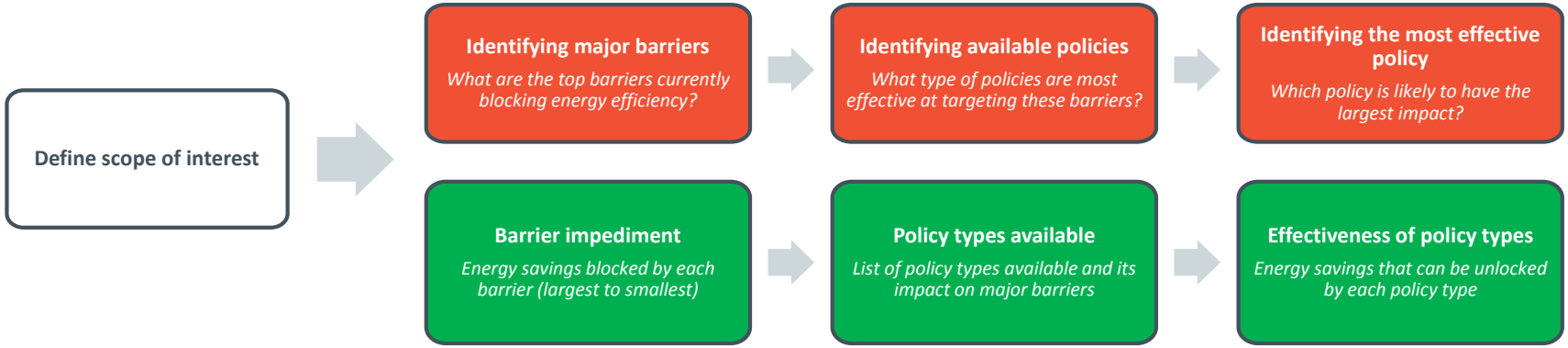
We were later able to refine our parameters based on company survey results

Key Impediments, % of respondents

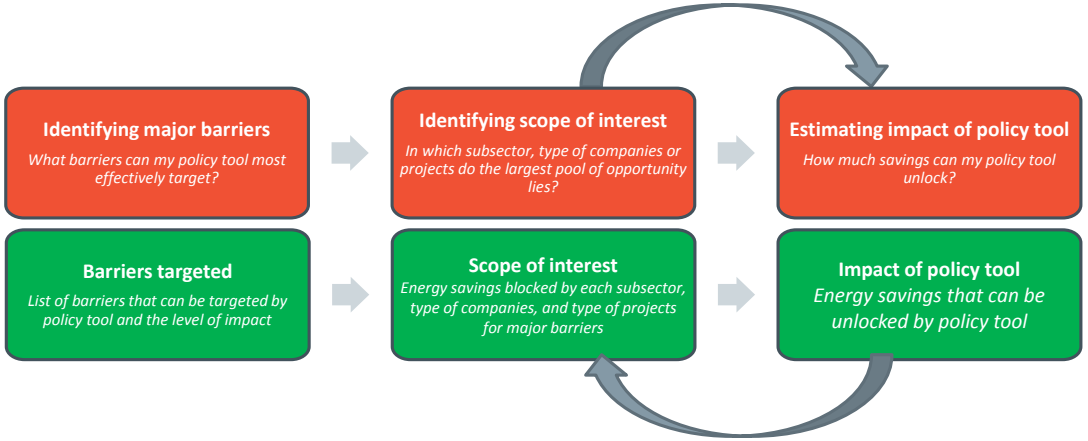


We also developed a simplified version of the tool to support high-level policy analysis

1 I know which companies or projects I want to target, what is the best policy mechanism?



2 I have a policy mechanism, which companies or projects should I target it at?



The tool estimates the amount of savings which can be unlocked if barriers are lowered by a given policy mechanism

Select policy type

Policy type	**Financial support mechanisms**

Select likely impediment reduction to each barrier

The potential impediment reduction (%) is an adjustment factor that will be applied to the BAU strength of relevant barriers.
*The **Default column** specifies standard adjustments based on the policy impact expected.*
*Users should adjust the factors accordingly in the **Manual column** based on details available of a specific type of policy mechanism and expectations of how the policy could impact different barriers.*

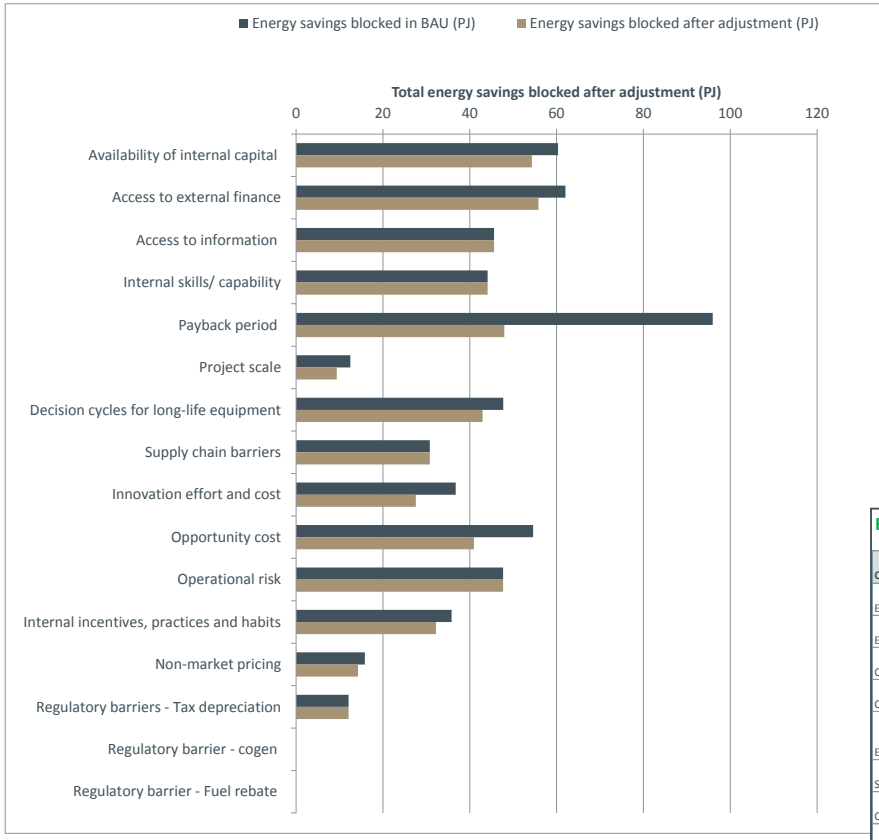
		Potential impediment reduction (%)		
Barriers	**Impact of policy**	**Default** (based on impact of policy)	**Manual** (user defined)	**Final** (assumptions used in calcs)
Availability of internal capital	Strong	-50%	-10%	-10%
Access to external finance	Strong	-50%	-10%	-10%
Access to information		0%		0%
Internal skills/ capability		0%		0%
Payback period	Strong	-50%		-50%
Project scale	Medium	-25%		-25%
Decision cycles for long-life equipment	Weak/Indirect	-10%		-10%
Supply chain barriers		0%		0%
Innovation effort and cost	Medium	-25%		-25%
Opportunity cost	Medium	-25%		-25%
Operational risk		0%		0%
Internal incentives, practices and habits	Weak/Indirect	-10%		-10%
Non-market pricing	Weak/Indirect	-10%		-10%
Regulatory barriers - Tax depreciation		0%		0%
Regulatory barrier - cogen		0%		0%
Regulatory barrier - Fuel rebate		0%		0%

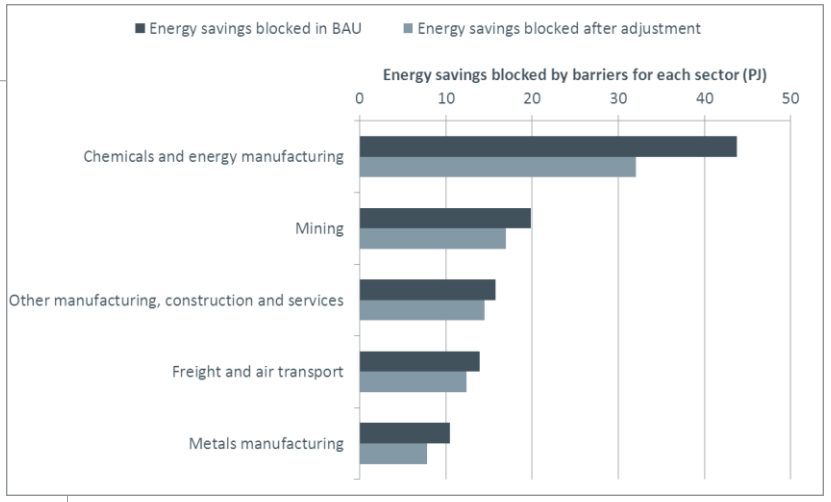
Outputs: Impact of policy mechanism by barrier

Key results of Financial support mechanisms on selected scope of companies and opportunities

Total savings in scope (TJ)	127,952
Total energy savings unlocked (TJ)	20,031
Total abatement unlocked ($MtCO_2e$)	xxx
Total capital corresponding to energy savings unlocked ($m)	xxx
Total fuel cost savings ($m)	xxx
Proportion of energy savings unlocked (% of remaining blocked opportunity)	24%

Graphs and tables allow more granular analysis, by sector, company and project attributes, as well as barrier





Heat map of energy savings unlocked across all company attributes

Company attributes	Traits	Energy savings blocked in BAU (TJ)	Energy savings blocked *after adjustment* (TJ)	Net savings unblocked by (TJ) Financial support mechanisms
Energy intensity	High	90,347	71,184	19,163
	Low	13,384	12,517	867
Electricity consumption	High	100,638	80,954	19,683
	Low	3,094	2,747	347
Corporate scale	Large	59,901	49,457	10,444
	Other	43,831	34,244	9,587
Company size	Large	90,694	71,766	18,928
	Other	13,037	11,935	1,102
Energy management capability	High	41,279	31,381	9,898
	Medium	36,872	27,322	9,549
	Low	25,581	24,998	583
Site location	Remote	13,417	11,555	1,862
	All other	90,315	72,146	18,168
Company energy production	Cheap in-house energy	386	370	16
	Other	103,346	83,332	20,014
Eligibility for fuel rebates	Eligible	21,819	18,719	3,100
	Not eligible	81,913	64,982	16,930
Production profile	Continuous	55,747	42,457	13,290
	Other	47,984	41,244	6,740
Profitibility/Growthprofile	High	42,538	31,332	11,206
	Medium	31,115	26,877	4,239
	Low	30,078	25,493	4,586
Age of facility	Older	35,576	29,190	6,387
	All other	68,155	54,511	13,644

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FOR FURTHER INFORMATION:

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