NSW Treasury

Carbon value in cost-benefit analysis

Yisheng Ho
Principal Economist

Angus Woods
Senior Economist

1

Acknowledgement of Country

We acknowledge that Aboriginal and Torres Strait Islander peoples are the First Peoples and Traditional Custodians of Australia, and the oldest continuing culture in human history. We pay respect to Elders past and present and commit to respecting the lands we walk on, and the communities
we walk with.

Artwork:
Regeneration by Josie Rose

2

2

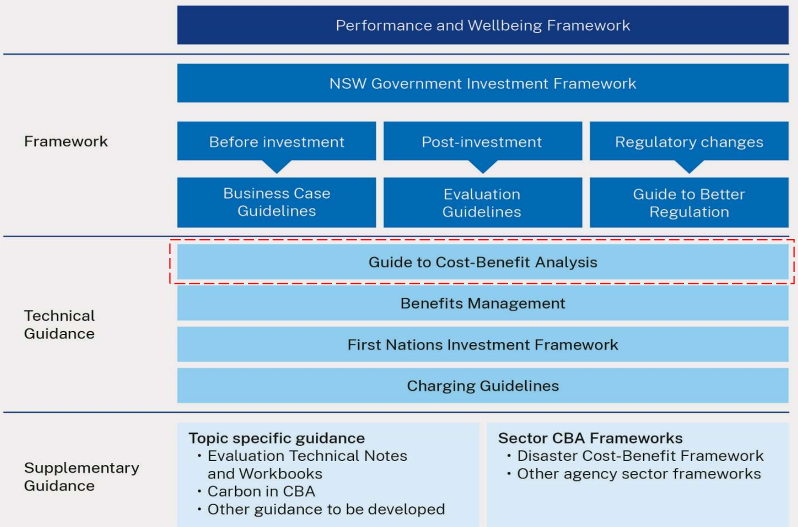
NSW Treasury

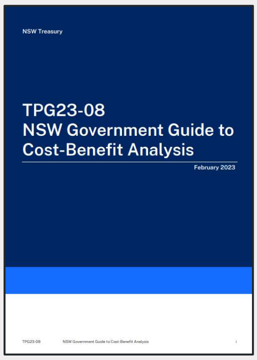
1

Application in cost-benefit analysis

3

NSW Government Investment Framework





Guide to CBA (TPG23-08)

Guidance on completing a cost-benefit analysis (CBA)

4

4

Requirements to value emissions

Guide to CBA (TPG23-08) requires the cost of CO_2 emissions be included in CBA where the cost or benefit is likely to materially affect the NPV and BCR.

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
State the objectives	Define the base case and develop options	Identify and describe all costs and benefits	Forecast all quantifiable costs and benefits	Value quantified costs and benefits	Assess net benefit (NPV and BCR) with sensitivity analysis	Assess distributional and equity impacts	Report results and key findings in executive summary format

5

5

Approaches to price carbon emissions

The two main approaches

Adopted by NSW Treasury

Target consistent approach	Social cost of carbon
Estimates the marginal costs of reducing emissions along a trajectory necessary to reach a defined emissions reduction target in future.	Quantifies the amount of damage caused by marginal additional emissions.

6

6

Target consistent approach

Why did Treasury adopt the target consistent approach?

NSW's 2030, 2035 and 2050 targets are legislated – the carbon price under a target consistent approach reflects the cost to meet these targets.

- Targets are set, but not pathway.

There is no agreement on the modelling assumptions for a social cost approach and estimates produced in jurisdictions vary widely.

Internationally, jurisdictions appear to be moving to a target consistent approach.

✓ Examples include New Zealand, Canada, the UK, and various European jurisdictions.

7

7

Principles to guide the quantification

Cost of carbon emissions under a target consistent approach

Preferred approach	Comprehensive Australian emissions market
Second preference	Cost modelled consistently with targets
Third preference	Existing market prices from the market that most comprehensively prices emissions (EU Emissions Trading Scheme)

Recently developed with Deloitte

Adopted at CBA guide publication

8

8

Project plan

Team and scope

- Project team included representatives from Treasury, DCCEEW & TfNSW.
- Decarbonisation experts from across government reviewed key inputs and assumptions.
- Iteration between government stakeholders and modelling consultants to develop realistic abatement pathway
- Review of methodology by external expert.

Purpose

Consultant was engaged to develop:

- A set of target consistent values for NSW that can be used to assess the costs and benefits of projects or policies that impact carbon emissions.
- A tool that can be used to update the carbon values in the future.
- A report of the methodology and results.

9

9

NSW Treasury

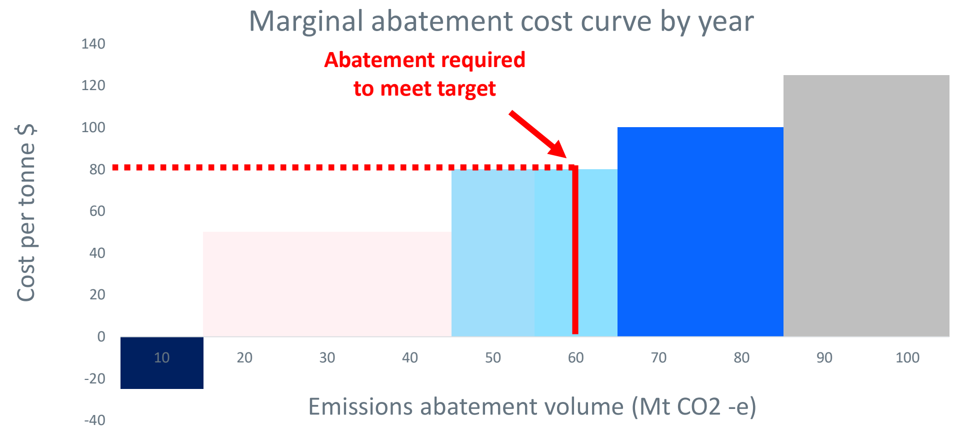
2

Methodology

10

Marginal abatement cost approach

- Carbon value = Marginal abatement cost (MAC).
- MAC = Cost of the most expensive unit of abatement required to meet each emissions target (assuming we utilize the cheapest abatement available).

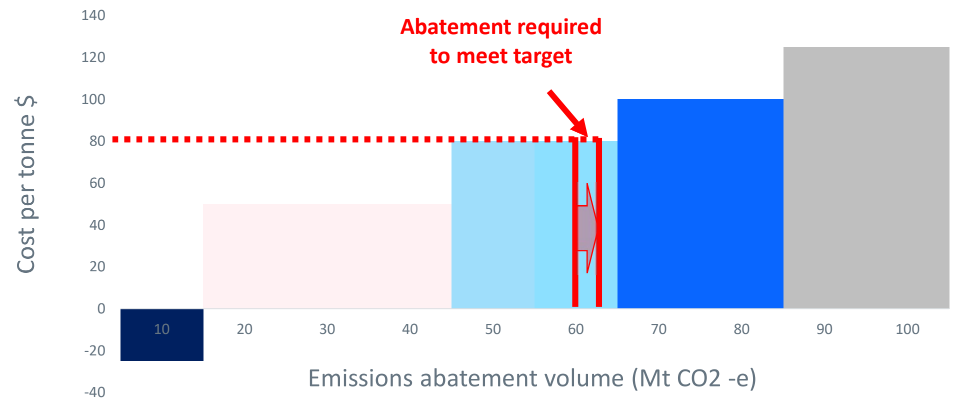


11

11

Why is the MAC used for CBA?

- Consider a hypothetical project that increases emissions by 1 unit.
- Abatement required increases from 60 to 61 units .
- Additional abatement will be delivered at the marginal cost of abatement.

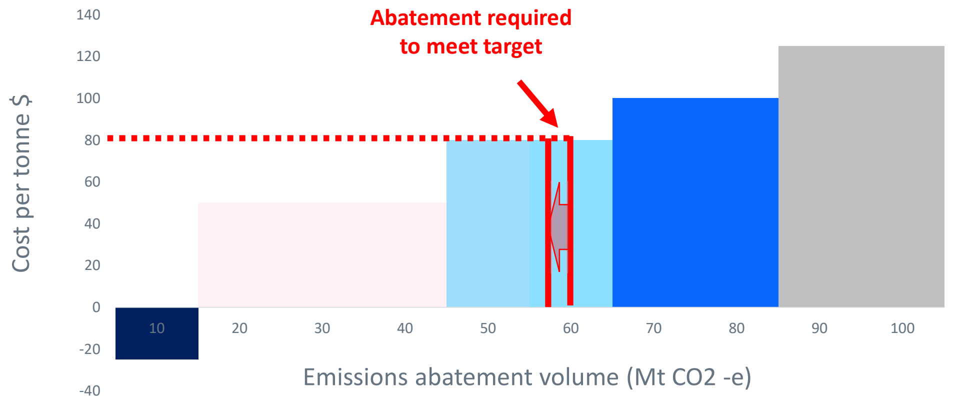


12

12

Why is the MAC used for CBA?

- Consider a hypothetical project that decreases emissions by 1 unit.
- Abatement required decreases from 60 to 59 units .
- Abatement avoided would have been delivered at the marginal cost of abatement.



13

13

Inputs to MAC curve

1 **ABATEMENT VOLUME:** Required to meet the emissions target for each year

2 **IDENTIFY ABATEMENT SOLUTIONS:** Decarbonisation solutions shortlist

3 **ABATEMENT VOLUME:** Provided by each shortlisted solution

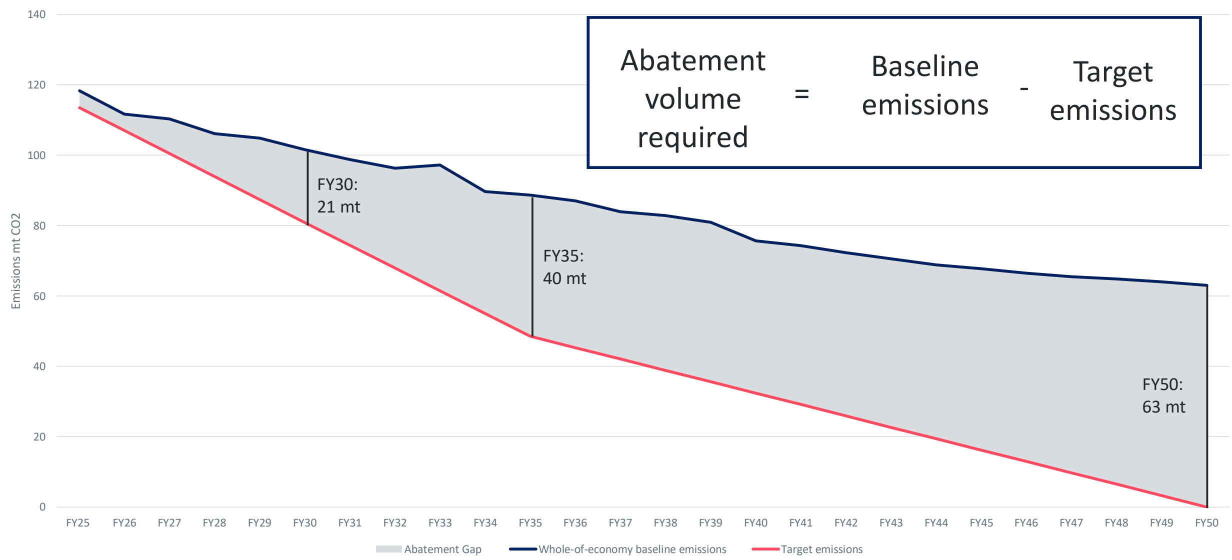
4 **ABATEMENT COST OF EACH SOLUTION**

14

14

1. Abatement volume

Required to meet the emissions target for each year



15

2. Identify decarbonisation solutions

List	Criteria
Long list (>230 solutions)	• Deloitte's proprietary Greenspace Navigator tool • International Energy Agency technology list • Review of NSW Gov documents
Prioritised long list (82 solutions)	• International Energy Agency's classification of importance to reach net zero. • Relevance to NSW
Short list (25 solutions)	• **Strategic alignment** - Reflected in strategy/policy?) • **Desirability** - Abatement potential) • **Viability** – Deployment readiness • **Feasibility** – Enabling infrastructure and capabilities

16

16

2. Decarbonisation solutions shortlist

Sector	Includes	Shortlisted solution	
Electricity generation	N/A	• Utility solar • Rooftop solar	• Wind • Firming
Transport	• Light vehicles • Heavy-Duty vehicles	• Light-Duty – Battery EVs • Heavy-Duty – Battery EVs	• Heavy-Duty – Hydrogen fuel cell • Rail – Hydrogen/bio feedstock/ammonia
Agriculture	• Animals	• Dietary manipulation • Herd management	
Stationary energy	• Energy • Manufacturing • Residential and other	• Mining – Vehicle electrification • Industrial electric heating equipment • Cement produced with alternative raw materials	• Household heat pumps • Household appliance electrification and efficiency • Building efficiency improvements
Industrial processes and product use	• Metals sector • Chemicals Sector	• Aluminium primary smelting – inert anode • Iron and steel – Direct reduced iron produced using green H2	• CCUS across multiple applications • Green ammonia produced using green H2
Fugitive emissions	• Coal mining	• Drainage – Power generation • Air Methane Oxidation	
Waste	• Solid waste disposal	• Drainage – Waste power generation	
Whole-of-economy	N/A	• GHG Removal – DACCS • GHG Removal – Nature-based solutions	

17

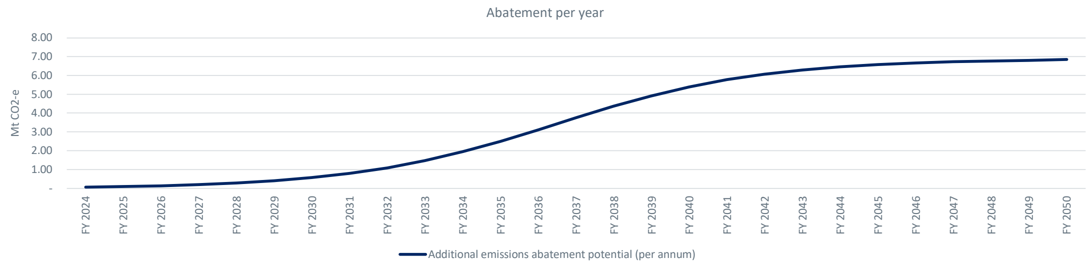
17

3. Abatement volume

Provided by each shortlisted solution

Abatement potential = Emissions from sub-sector (pre deployment) x maximum percentage of emissions addressable (%)

Solution assumed to be deployed over time:



18

18

4. Abatement cost of each solution

$$\text{Abatement cost} = \frac{\text{Present value of CAPEX and OPEX (\$)}}{\text{Lifetime emissions reduced (tonnes of carbon)}}$$

CAPEX and OPEX are net of the technology the solution replaces

A learning rate is applied to reduce CAPEX over time

19

19

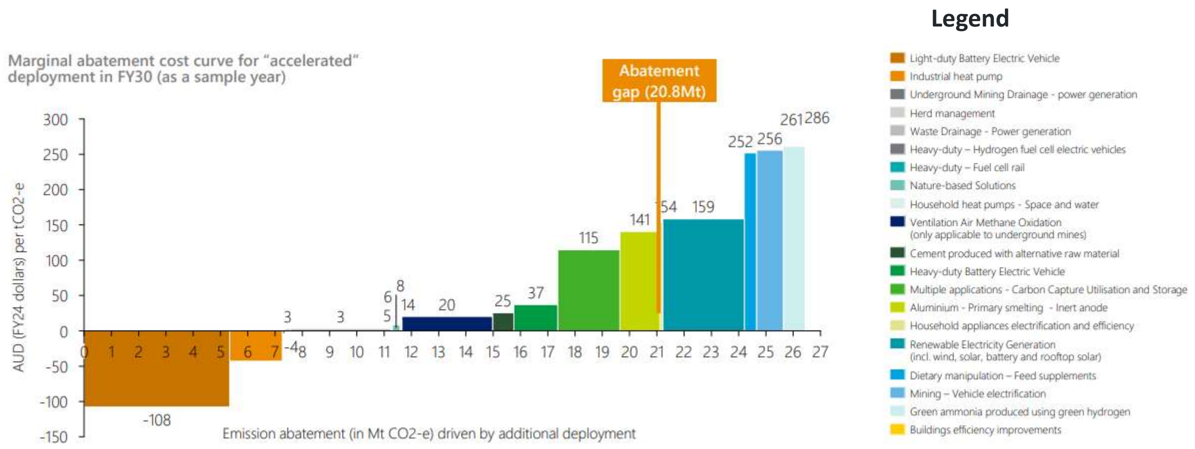
NSW Treasury

3

Results

20

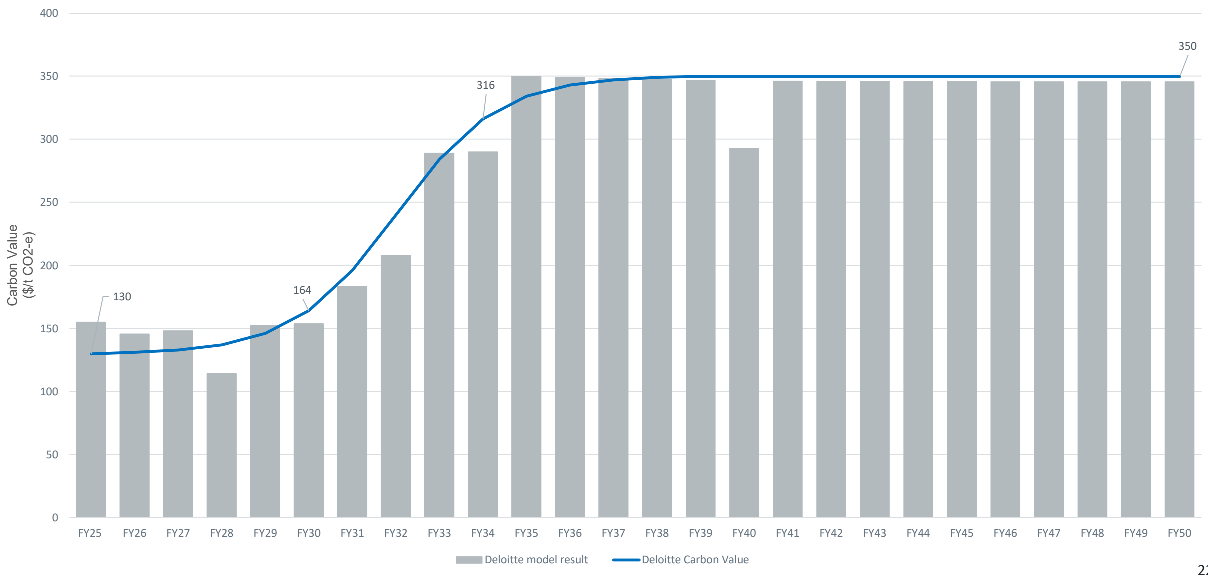
Marginal abatement cost curve for FY30



21

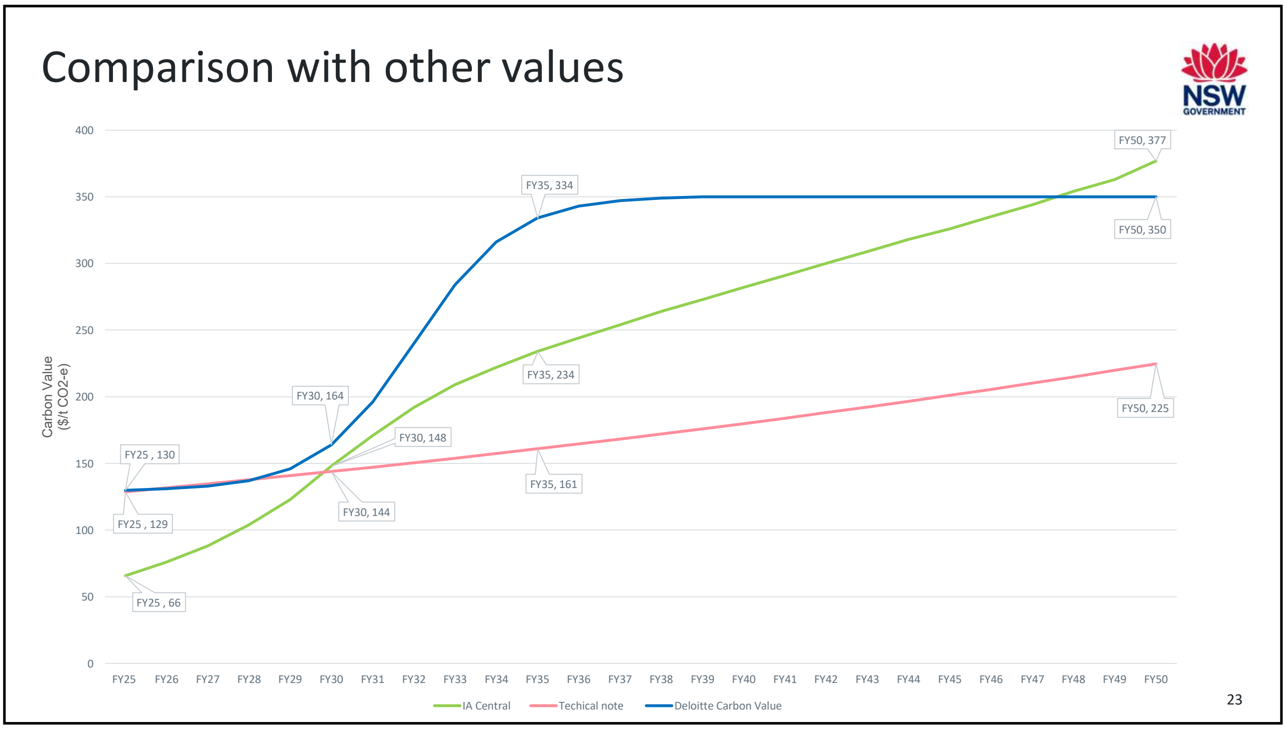
21

Central carbon value

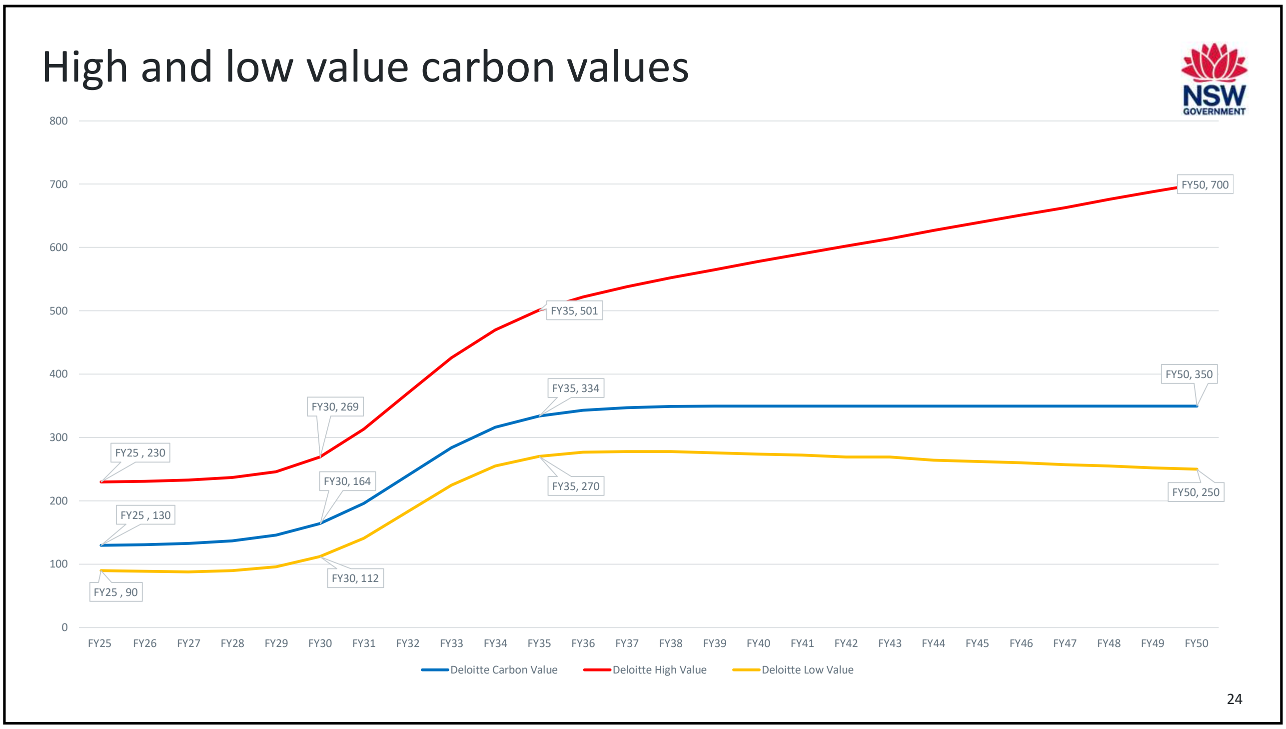


22

22

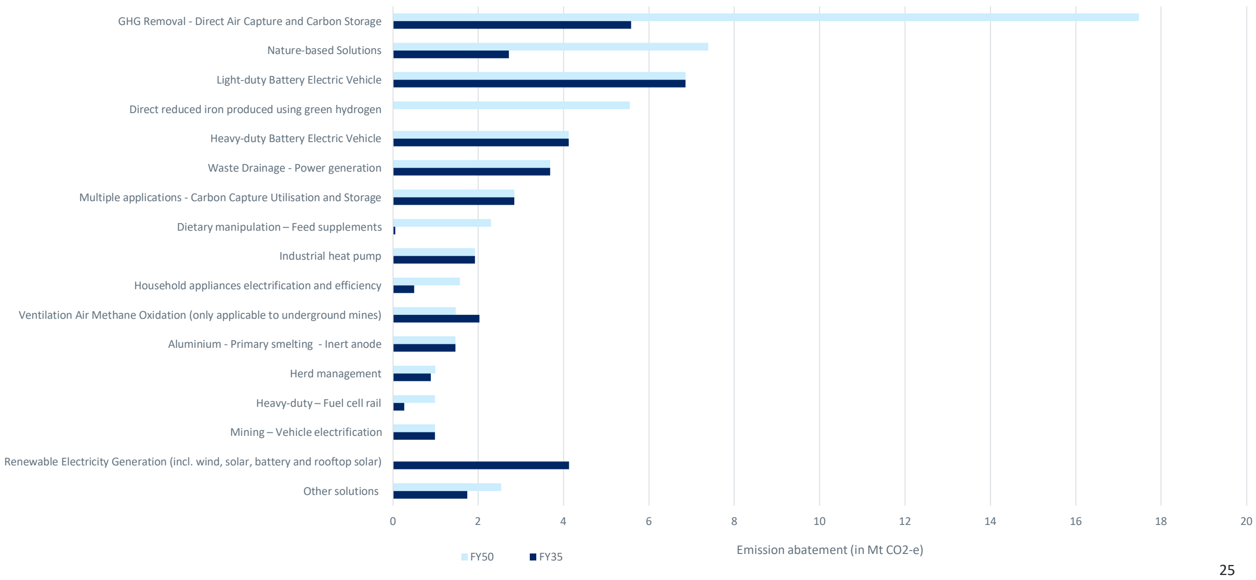

Comparison with other values
NSW GOVERNMENT
Carbon Value ($/t CO2-e)
400
350
300
250
200
150
100
50
0
FY50, 377
FY35, 334
FY50, 350
FY35, 234
FY30, 164
FY50, 225
FY30, 148
FY25 , 130
FY35, 161
FY30, 144
FY25 , 129
FY25 , 66
FY25 FY26 FY27 FY28 FY29 FY30 FY31 FY32 FY33 FY34 FY35 FY36 FY37 FY38 FY39 FY40 FY41 FY42 FY43 FY44 FY45 FY46 FY47 FY48 FY49 FY50
IA Central
Techical note
Deloitte Carbon Value
23

23


High and low value carbon values
NSW GOVERNMENT
800
700
600
500
400
300
200
100
0
FY50, 700
FY35, 501
FY50, 350
FY35, 334
FY30, 269
FY25 , 230
FY30, 164
FY35, 270
FY50, 250
FY25 , 130
FY30, 112
FY25 , 90
FY25 FY26 FY27 FY28 FY29 FY30 FY31 FY32 FY33 FY34 FY35 FY36 FY37 FY38 FY39 FY40 FY41 FY42 FY43 FY44 FY45 FY46 FY47 FY48 FY49 FY50
Deloitte Carbon Value
Deloitte High Value
Deloitte Low Value
24

24

Shortlist solutions



25

25

NSW Treasury

4

Next steps

26

Next steps

- Publish the updated carbon values over the coming months
- Update values periodically

27

27

28

28