



Ministerial Submission
MS23-000540

FOR ACTION - Treasury's climate modelling forward plan

TO: Treasurer - The Hon Jim Chalmers MP

TIMING: By 6th April

RECOMMENDATION

- That you note the multi-staged approach to restore Treasury’s role in modelling climate risks and opportunities over the next three years, ensuring alignment with planned major modelling exercises and the need to develop a modelling and analytical capability that is flexible, sustainable and credible.

Noted/Please discuss

- s 47C [redacted] That you look to discuss Treasury’s role (and its role more broadly) with your colleague, the Minister for Climate Change and Energy.

Noted / Please discuss

- That you note Treasury’s capability uplift plan, which will develop an economic modelling framework that is flexible, sustainable and credible. This will provide support to the government’s on-going commitment to climate change and managing the increasing complexity of climate change modelling.

Noted / Please discuss

Signature	Date: / /2023
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KEY POINTS

The Net Zero transition task

- Decarbonisation of the globe will require one of the most significant structural changes since the industrial revolution, as world economies transition away from a heavy carbon reliance in an effort to keep global warming to a minimum.
- Australia has legislated more ambitious emissions reduction targets to support an orderly net zero transition. Reforming the Safeguard Mechanism and transformation of the electricity sector to 82 per cent renewables by 2030 are key policy pathways to help achieve this goal.
- Further development of existing and future policies will be needed in order for Australia to reach net zero by 2050. Australia’s Net Zero Plan and Nationally Determined Contributions (currently in train) will be critical to this task.
- The global transition will have significant implications for Australia’s economic outlook, as the world moves away from carbon heavy commodities and towards those which will support the renewable transition. Global policies such as the EU’s Carbon Boarder Adjustment Mechanism will also have an impact on the Australian economy.
- Treasury has an important role to play in supporting government policy by providing advice on the most efficient policy pathways, the impact of policies (both domestic and global) on industries, regions and households, and in designing and implementing sustainable finance strategies.
- The climate transition will create structural economic change that is not straightforward to model. This landscape has changed significantly in the last decade, becoming more complex as a multitude of policies and behavioural responses by economic agents come into play.
 - Significant uncertainty around the timing and sequencing of actions to reduce greenhouse gas emissions also make it difficult to estimate the national and domestic implications for households, industries and regions.
 - There is uncertainty around climate impacts and the “best” policy tools that should be employed to mitigate impacts. To capture the full extent of uncertainty associated with climate transition, will require a certain level of consistency on scenarios that present different, plausible visions of climate risks and opportunities
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Supporting government policy through a staged approach

- To support government decision making and re-establish Treasury’s role as an authority on climate change, a staged approach will be employed over the next three years.

- Treasury is building an economic modelling framework that is flexible, sustainable and credible, to support the government’s on-going commitment to climate change. The framework will be aligned with key analytical outputs, ensuring consistency, and credibility.
- The staged approach and intended outcomes are outlined below, and an illustrative timeline in **Attachment A**.
- **Stage 1: Build (2023)** will restore Treasury’s role in climate modelling; position Treasury as experts in the quantification of physical damages on the economy and provide a strong cost of inaction narrative through the Intergenerational Report; establish enduring modelling capabilities with whole-of-government buy-in; and ensure consistency of climate modelling through co-ordination efforts.
- Modelling of reforms to the Safeguard Mechanism in collaboration with the Department of Climate Change, Energy, the Environment and Water and external providers has lifted Treasury’s knowledge of carbon markets and expertise in abatement technologies.
 - Treasury can continue to draw on this expertise to play a role in providing advice on the continued evolution of the Safeguard Mechanism.
 - The knowledge gained will also be leveraged to support the provision of advice s 47C
- The 2023 IGR will be the first major step in whole-of economy modelling, by providing in-house Treasury analysis of the various channels through which climate change will impact the economy. This is a substantial expansion of climate analysis compared to past IGRs, and brings Australia in line with leading work of our international peers.
 - The IGR will position Treasury as experts in the quantification of the physical impacts of climate change on the Australian economy and provide a strong underlying narrative in support of climate action.
 - s 47C
 - The IGR will also contain estimates of selected potential fiscal implications of climate change, and the various revenue and expenditure pathways through which this will occur. This builds on the framework for considering transition and physical impacts, introduced in the October 2023 Budget.

Coordination of climate modelling

- There is a large volume of climate policy and modelling activity occurring across government (**see Attachment B**). Many of these processes are key priorities for government and will be subject to a high degree of scrutiny.

- Treasury has established a Cross-Government Climate Modelling and Policy Reference Group comprising senior officials from PM&C, Treasury, DCCEEW and DISR, and is working closely with other agencies, providing joint strategic direction of significant climate modelling activities and consistency (as far as feasible) in core assumptions being applied.
 - Treasury is in the process of establishing a Climate Advisory Group with external experts in climate modelling, analysis and policy and has directly engaged leading academics in the field including Professor Frank Jotzo, Professor Tom Kompas and Professor Warwick McKibbin to provide expert advice.
 - **Stage 2: Refine (2023-24)** will see Treasury helping the government to determine transition pathways; establishing Treasury as experts in climate and industry policy analysis through the consolidation and application of key analytical assets to major climate modelling exercises.
 - There is an opportunity for Treasury to play a substantial role in providing global, whole-of-economy, sectoral and regional analysis to inform and influence major policy decisions.
 - Australia's next Nationally Determined Contributions and Net Zero Plan will require significant economic modelling to support decision-making and inform policy pathways.
 - These exercises will be inextricably linked, as a decision on a 2035 target will inform what is possible and/or required during the transition to net zero by 2050. s 47C
- s 47C
- Treasury will also play a role in advising on major structural shifts in the economy and policy adjustments. This will include the government's goal of reaching 82 per cent renewables in the electricity sector by 2030.
 - **Stage 3: Mature (2025+)**: This stage will see Treasury further strengthen its reputation as a provider of expert advice on the economic effects of climate change and policy, and climate change effects and uncertainties will be more comprehensively embedded in Treasury's economic and fiscal frameworks.
 - By 2025, Treasury will have established a flexible, sustainable, and responsive framework for analysing and modelling the effects of climate change and policy. This framework will enable Treasury to provide robust advice on the effects of a range of physical impacts of climate change and policy pathways.
 - Treasury's economic and fiscal forecasting and projections frameworks will have been adapted and extended to incorporate the economic and fiscal effects of climate change. Frameworks are continuously reviewed to ensure they are fit for purpose and further incremental changes will be incorporated as required.

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[Redacted]
- : No major counterpart institution has incorporated a full net zero scenario into their long-term projections and economic baselines. Refer to **MS23-000179**.

Treasury's capability uplift

- The staged approach to restoring Treasury's role reflects the breadth and complexity of work that is required to develop the required modelling and analytical capability. **Attachment B** outlines in more detail Treasury's planned capability development.
 - A number of modelling tools, including global modelling using Warwick McKibbin's G-Cubed, input-output analysis and microdata analysis can be drawn on now.
 - Other models and frameworks will advance over time, with successive versions incorporating new features. This includes the Treasury Industry Model, which will be a key tool for domestic macroeconomic modelling.
 - Treasury's model development is being scheduled to match our understanding of the Government's planned policy timeline, ensuring the department can provide timely and fit-for-purpose advice.
 - Treasury's model development plans have been benchmarked to ensure they align with – and in some cases will exceed – those of international peers.

Clearance Officer
Angelia Grant
First Assistant Secretary
Macroeconomic Analysis and Policy Division
24th March 2023

Contact Officer
Rebecca Cassells
Assistant Secretary
Ph: 6263 4768 Mob: s 22

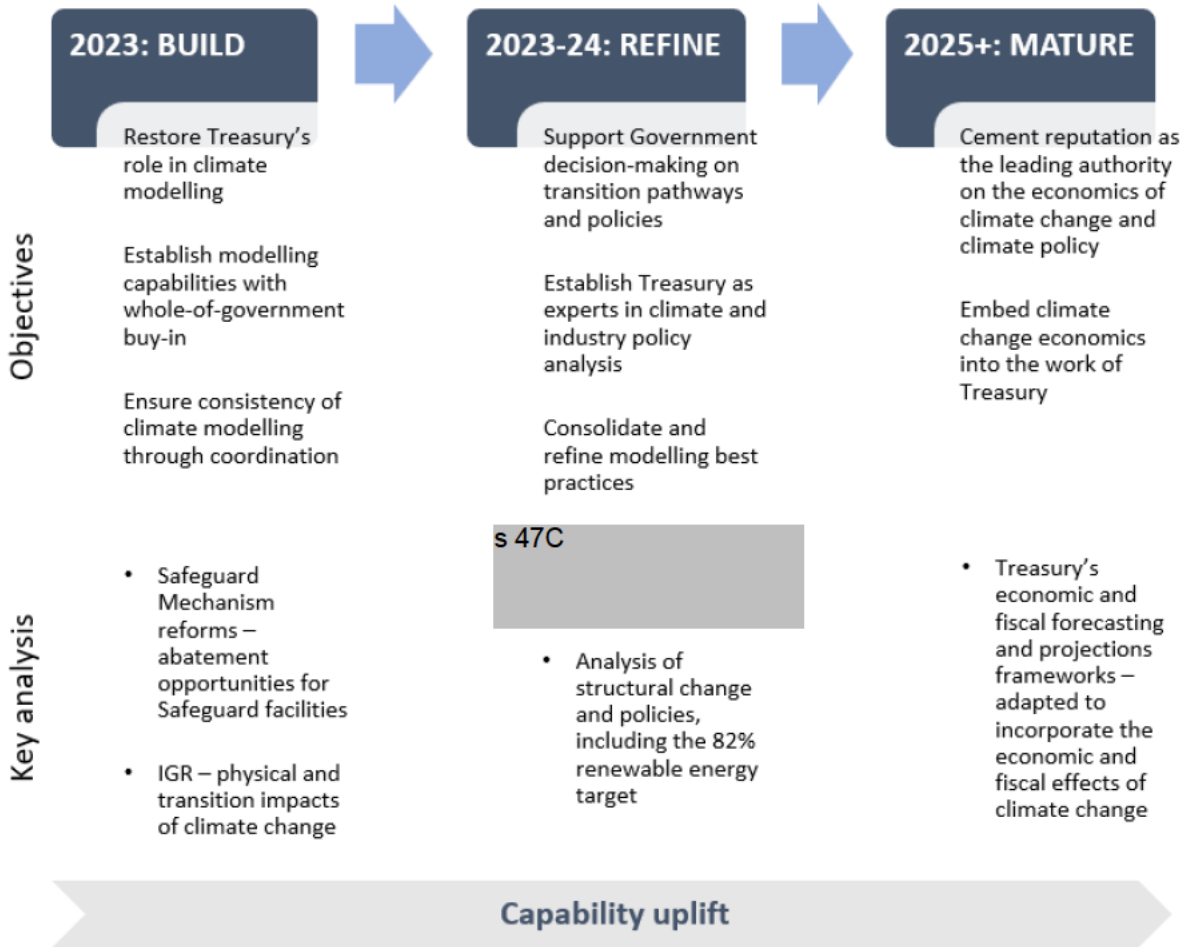
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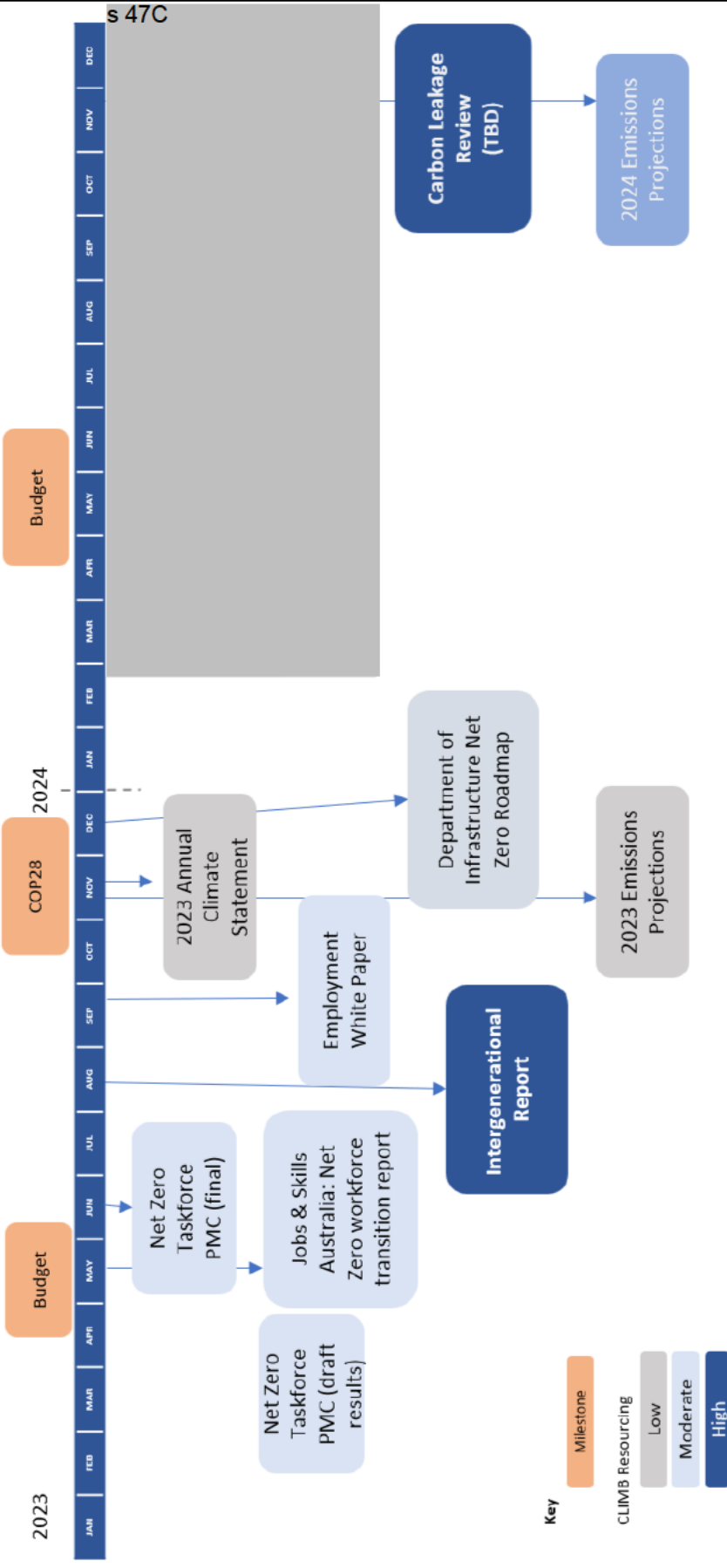
ATTACHMENTS

- A: Climate modelling staged timeline
- B: Key climate modelling exercises
- C: Key modelling assets

ATTACHMENT A – CLIMATE MODELLING STAGED TIMELINE



ATTACHMENT B – KEY CLIMATE MODELLING EXERCISES



ATTACHMENT C – KEY MODELLING ASSETS

- In order to build required capability, Treasury, is developing a comprehensive suite of analytical tools, including models, data assets and infrastructure.
 - The suite of tools is designed provide a practical, fit-for-purpose and well-integrated framework that can be used to provide analysis across the broad range of issues that we expect to be engaging with, as well as analysis at global, national, sectoral and regional levels. Details of these assets are provided below.

Global Economic Models and Projections

- Global economic models will be used to assess the impact of global mitigation policies, and the global climate, trade and regulatory driven market shifts on the Australian economy. The analysis from the global models will also feed into domestic modelling exercises. The global economic modelling capability will be supported by a suite of general equilibrium models such as G-Cubed and Global Trade and Environment Model (GTEM).
- We have purchased Professor Warwick McKibbin’s general equilibrium model G-Cubed, which has been extensively used in Australia and internationally to analyse the effects of climate change. We are engaging with Professor McKibbin to incorporate the latest emissions and energy data into G-Cubed and ensure it captures key behavioural responses critical for climate change analysis. G-Cubed is being set up to assess how major global structural changes and policy developments could spill over to the Australian economy.
- We are also exploring options to develop a framework for long term foreign demand analysis alongside DISR which will provide the capability for assessing changes in the demand for Australian exports due to shifts in the global demand and supply curves for bulk and critical mineral commodities.

Domestic Modelling Capabilities

- The Treasury Industry Model (TIM) will provide analysis of the domestic economy-wide effects of exogenous shifts in global transitions, domestic mitigation policy and the physical impacts from climate change. Importantly, TIM provides an internally-consistent framework to analyse the responses of households and firms to changes in the economic environment and policy. The model can also account for how changes to the global demand and supply of different commodities affects Australia.
 - As a general equilibrium model, TIM accounts for how outcomes in one market affect all other markets. This means the interactions between markets can be captured, which facilitates understanding how changes in specific sectors may impact the broader economy.
 - The model is well suited to analysing issues related to climate change and policy as it contains considerable detail on the production side of the Australian economy, including the 114 industries that are identified in the Australian Bureau of Statistics Input-Output tables.

- We are working on extensions to TIM to incorporate detail required for climate-related analysis, including emissions accounting, abatement opportunities across different sectors and a range of emissions-reductions policy instruments.

Sectoral Modelling

- Treasury will build sectoral-level capability to support the Government’s emissions and clean energy targets in 2030 and beyond.
- Assets to support detailed analysis and advice on key sectors, including the costs and technological pathways they have to transition to net zero.
 - Sectoral models provide detailed analysis of the pathways to achieve net zero at a high level of technological detail. Conditional on cost input and supply assumptions, they provide insights into optimal timing and level of investment required to achieve certain emissions targets and, in some cases, policies.
 - Bottom-up modelling is a necessary complement to economy-wide general equilibrium modelling which ensures credible inputs and in turn outputs from TIM, such as the national electricity generation mix over time.
 - Currently, the key sectors of interest are electricity, industrials and transport. We are currently in the process of procuring and building interlinked techno-economic models focussing on these sectors.
 - : These models will be sufficiently flexible to model a range of implemented and potential policy changes that are relevant to each of the sectors, as well as emerging macroeconomic and sectoral conditions.
 - : The models are also intended to be sufficiently detailed so that we can analyse both micro-level effects for households and businesses as relevant.
 - We are investing in both data and research assets (such as Bloomberg New Energy Finance and detailed energy data) and relationships across government agencies and the private sectors to ensure we can provide support across a broad range of sectors.

Regional Analysis

- Regional datasets and analysis for regional level insights that support policy advice across regions impacted by the physical risk of climate change and the transition to reduce emissions.
 - Regional level climate change risk data informs the view of the future risk to people and businesses at the detailed geographic level, based on exposure of households and businesses to risk as well as the likely effects of the changing climate on local conditions.
 - Treasury will also develop tools and data to analyse the impacts of the transition to net zero emissions on regional communities from the perspective of regions that face challenges as well as opportunities to access new industries through the clean energy

transition. Treasury's analysis will build on the work of the Net Zero Taskforce to understand adaptive capacity in regions, as well as the Employment Whitepaper and the Jobs and Skills Australia analysis on the Clean Energy Workforce.

- Treasury is building a comprehensive regional level database that will be used in a range of socio-economic analyses to support policy advice and inform the impacts of future changes (including natural disasters) on regions.



Ministerial Submission
MS23-000179

FOR ACTION – Incorporating climate change modelling and analysis in the Intergenerational Report

TO: Treasurer - The Hon Jim Chalmers MP

TIMING

By 10 February 2023

Recommendation

- That you agree to the proposed approach to incorporate climate change into the 2023 Intergenerational Report (IGR). It is proposed to add substantive analysis on the physical effects of climate change, the outlook for specific commodities, and longer-term revenue and expenditure implications of climate change, including the outlook for electric vehicle uptake.

Agreed / Not agreed

- That you note Treasury’s staged climate modelling capability plan and s 47C [redacted]
[redacted]
[redacted]
[redacted]
[redacted]

Noted / Please Discuss

Signature	Date: / /2023
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KEY POINTS

- You (Treasurer) have committed to greater incorporation of climate change and energy analysis in Budget Statements and Intergenerational Reports (IGRs).
- Reflecting this, it is proposed that the 2023 IGR step up to the frontier of analysis being undertaken by international fiscal agencies. It is intended to illustrate the various channels (both transition and physical impacts) through which climate change can impact the economy and fiscal outlook, providing a strong underlying narrative of climate action.
- It is proposed that four new pieces of climate-related modelling and analysis be included in the 2023 IGR:
 - the potential economic impact of the **physical effects of climate change** (Attachment A)
 - : Building on the broader narrative proposed for the climate change and environment chapter, Treasury will draw on its ongoing climate modelling capability-build to provide a substantive quantitative economic assessment of physical climate effects under different temperature pathways (at the macroeconomic and sectoral level).
 - : This proposed approach will provide an indication of the potential economic and fiscal exposure for government of physical climate effects, as well as a strong underlying narrative in support of climate action (to avoid higher long-term temperatures and therefore greater climate damages).
 - : This approach will be a significant and important step in developing in-house Treasury climate modelling capability. A Working Paper outlining Treasury's modelling approach will be released prior to the IGR to ensure the credibility of the technical analysis.
 - the impact of the global energy transition on the outlook for **Australia's commodity sector** (Attachment B)
 - : The proposed approach will examine Australia's established key commodity and emerging industries, describe the sensitivity of the global demand and supply of commodities to various global transition assumptions and qualitatively assess how the selected transition scenarios shift the outlook for coal and selected critical minerals.
 - : This approach will illustrate that the transition towards net zero greenhouse gas emissions is creating structural shifts in global demand for traditional energy commodities along with opportunities in emerging commodities associated with the technology transition to renewable energy generation globally. In particular, the global demand for thermal coal is expected to fall, while there may be greater demand for critical minerals, including lithium, creating new economic opportunities.

- : The proposed approach will also include standard sensitivity analysis (as presented in the Budget papers) of how changes in commodity prices affect the terms of trade, nominal GDP and tax receipts.
- the impact on the Government’s **climate expenditure** due to rising adaptation costs and increasing rates and intensity of natural disasters (Attachment C)
 - : This will include assessments of climate-related expenditure resulting from adaptation, regional natural disaster impacts and the effect of increased frequency and severity of disasters, disaster relief (domestic and international) and other areas of climate expenditure that are likely to be impacted, such as health systems.
 - : In the context of increasing rates and intensity of natural disasters, early adaptation can partially reduce future impacts, improving outcomes for Australians, lessening the impact of disasters and reducing the costs of disaster recovery.
 - : The proposed approach will add to a growing public narrative on likely increases in climate-related expenditure resulting from adaptation costs and increasing rates and intensity of natural disasters.
- **electric vehicle uptake** and its implications for fuel excise revenue (Attachment D).
 - : The analysis will quantify the effects of a faster or slower EV uptake on fuel excise revenue. Output would include a scenario to an uptake baseline, and an accompanying narrative on the effect of EV uptake on revenue.
 - : The proposed approach will illustrate the sensitivity of revenue collections to electric vehicle uptake, improving the Government’s ability to plan for the energy transition in the transport sector.
 - : The Government has pledged to address declines in fuel excise as part of their 2022 election commitment to the National Electric Vehicle Strategy (NEVS).
- The 2023 IGR will be the first major step in a phased approach to improving in-house Treasury analysis of the channels through which climate change will impact the economy.
- It would be a substantial expansion of our climate analysis compared to past IGRs and Budgets, and brings Australia in line with leading work of our international peers.
 - : While analysis of the fiscal implications of climate change has been undertaken by a number of comparable international institutions, the scope of the analysis has been limited.
 - : No major counterpart institution has incorporated a full net zero scenario into their long-term projections and economic baselines (see Attachment E).

- The proposed approach will also complement and align with other key deliverables across Government over the next two years and major modelling exercises.
 - This includes the Department of Industry, Science and Research new long-term commodity price forecasting,
 - Australia’s next Nationally Determined Contribution: (s 47C [REDACTED]), which will provide a 2035 emissions target;
 - and the Department of Climate Change, Energy, the Environment and Water (DCCEEW)’s Net Zero Long Term Plan: s 47C [REDACTED]
[REDACTED]
 - Planning for the above work programs has already begun and it is expected that the bulk of this work will take place s 47C [REDACTED].
- Future phases of modelling development, for inclusion in Budgets and IGRs, will deepen the analysis on the channels through which climate change will affect the economic and fiscal outlook (with regional analysis being an important extension). It will also broaden the analysis of other channels through which climate change will affect the economic and fiscal outlook.
- Future phases of modelling development will also allow the consideration of ways to incorporate climate change effects and policy into the economic baseline and fiscal projections for future Budgets and IGRs.
- Treasury will continue to use the existing IGR projections framework to provide the economic and fiscal baselines for the 2023 IGR that do not explicitly capture climate impacts. This avoids the risks of generating a misleading aggregate assessment of climate impacts by including some climate effects but not others.
- This staged approach will ensure consistency, credibility and the building of a public narrative for change over many years and across all sectors. It will also reinforce Treasury’s efforts to re-build capability and re-establish itself as an authoritative voice on the economic impacts of climate change.
- This submission follows a high-level overview of the IGR as outlined in MS23-000122.

Clearance Officer
Rebecca Cassells
Assistant Secretary
Climate and Industry Modelling Branch
3 February 2023

Contact Officer
s 22 [REDACTED]
Senior Advisor
Climate and Industry Modelling Branch
Ph s 22 [REDACTED]

CONSULTATION

Budget Policy Division
Labour Market, Environment, Industry and Infrastructure Division
Macroeconomic Conditions Division
Tax Analysis Division

ATTACHMENTS

- A: Physical effects of climate change
- B: Global commodity outlook
- C: Climate expenditure, including adaptation and disaster relief
- D: Electric vehicle uptake and the implications for fuel excise
- E: Comparison with international counterparts

ATTACHMENT A – PHYSICAL EFFECTS OF CLIMATE CHANGE

Objective:

To model the economic impact – at the macroeconomic and sectoral level – of the physical effects of climate change under different global temperature pathways. This section will link closely with the climate expenditure, including adaptation and disaster relief section.

Overview of approach:

- The physical effects of climate change (global temperature increases and the increased frequency and severity of extreme weather events) will significantly impact the economy, government revenue and expenditure. Previous IGRs have not incorporated these effects.
 - While these effects are not expected to be material (for Australia or other countries) at a macroeconomic level before 2030, their localised impact, through more extreme weather events such as fire and flood, is already evident.
- Within macroeconomic modelling, damage functions are used to translate physical impacts into economic impacts. They do this by mapping the impact of climate variables (such as temperature increases) on economic variables (such as productivity) via a function that is calibrated using appropriate data. In essence, they calculate losses caused by climate change.
- To date, a limited amount of third-party research has been undertaken using the above approach to estimate the likely economic impact of physical climate effects on the Australian economy. However, these results vary in sophistication and detail.
 - Treasury proposes building on these approaches to develop its internal models to estimate the economic impact over the IGR period of four core physical climate effects:
 - : Agricultural productivity losses from heat stress
 - : Labour productivity losses from heat stress
 - : The impact of natural disasters
 - : Tourism losses
- These damages would be modelled using the Treasury Industry Model (TIM), with results then mapped to the Macroeconometric Model of the Australian Economy (EMMA).
 - This dual-model approach will allow for results to be reported at a macroeconomic (EMMA) and sectoral (TIM) level. This is valuable given climate losses will vary between sectors.
 - These results are expected to show a strong cost-of-inaction narrative within the IGR's climate and environment chapter (as failure to act will result in higher global temperatures and therefore great losses from climate change), supporting the argument for more-ambitious mitigation, adaptation and economic transition support.
- Substantial regional variation is likely, which will be considered and discussed qualitatively and illustratively in the 2023 IGR. Where possible and relevant, analysis will also be drawn from PMC's Net Zero Economy Taskforce.

- Other physical damage channels – human health, biodiversity loss, sea level rise and water stress – will also be discussed qualitatively. They could be modelled in future IGRs or Budgets.
 - Due to their complexity, prior analysis and current understanding of these damages is limited. Data collection is also a significant challenge.
- A peer-reviewed working paper outlining Treasury’s modelling approach will be released prior to the IGR, ensuring credibility in the analysis.
 - Consistent with the schedule outlined in MS23-00122, we anticipate publication of this working paper in June 2023.
- A technical appendix would also be included in the 2023 IGR, summarising key points from the working paper.

Previous related work:

- The US, NZ, the UK, NSW, the IMF and NGFS, have published work on the fiscal implications of climate damages. Others, such as the World Bank, Deloitte and Swiss Re, and academics like the University of Melbourne’s Tom Kompas, have published estimates of climate damages.
 - The above analyses vary in terms of the climate scenarios used, physical damages modelled, and modelling approaches.
 - They have all informed Treasury’s proposed approach and external experts will be engaged during the modelling work.

Risks and sensitivities:

- Work on physical climate effects is complex and uncertain, so underlying assumptions, methods and uncertainties will be clearly communicated.
 - We will also clearly communicate that this analysis is a first stage towards building Treasury’s capability and understanding. It will be expanded on as new data become available, frameworks are developed or understanding of climate damages evolves.
- Physical damages are heterogeneous. As such, we could be criticised for presenting aggregate (macroeconomic) results, rather than regional results.
 - Quantifying regional effects is complex, including due to data difficulties. We would look to build on the qualitative assessment in a 2023 IGR in future IGRs and Budgets, and this could be made clear in the 2023 IGR.
- Data, methods, and results will likely be compared against other work on physical damages. There is no single comprehensive, readily-accessible suite of Australia-specific damage functions. This could result in criticism if results or underlying assumptions differ.
 - The publication of a working paper outlining Treasury’s approach to modelling physical climate damages before the release of the IGR will serve to mitigate this criticism.
 - Treasury also has in place a range of other channels for peer review and consultation, as well as general socialisation of models and methods.

- TIM does not currently include damage functions. Model development will need to be undertaken before analysis can commence, drawing on expert knowledge and external data. It is anticipated this work will take 3 months. Insufficient time may result in delivery risk.
- Developing the analysis, including sourcing appropriate data, will require collaboration across government, and with modelling and climate experts with the private sector and academia.

ATTACHMENT B – GLOBAL COMMODITY OUTLOOK

Objective:

To provide insights into how the global energy transition could influence the outlook for Australia's commodity sector over the next 40 years. This would include standard sensitivity analysis (as used in Budget and previous IGRs) to illustrate the importance of commodity projections to economic and budget projections. It would not at this stage, provide a specific aggregate assessment of the impact of global commodity developments for the fiscal position.

Overview of approach:

The transition towards net zero greenhouse gas emissions is creating structural shifts in global demand for traditional energy commodities along with opportunities in emerging commodities associated with the technology transition to renewable energy generation globally. This creates considerable additional uncertainty about the outlook for the Australian commodities sector. This case study will provide an assessment of how global mitigation pathways generate new export opportunities as well as the impact on current commodity exports.

- Provide a qualitative snapshot of Australia's established key commodity exports (for example coal) and emerging exports (for example, selected critical mineral exports), including their relative importance to the gross national income.
- Analyse the sensitivity of global demand and supply of selected commodity exports to various global transition assumptions and identify opportunities created from advances in demand for low emission technologies (e.g., greater demand for critical minerals including lithium).
 - In particular, the global demand of thermal coal is expected to fall as the global energy sector transitions towards low emission technologies.
 - The global demand of critical minerals and other raw materials critical for low emissions technologies is expected to increase as more clean energy technologies are deployed, for example in the manufacture of electric vehicle batteries.
 - The magnitude of these positive and negative effects will depend on global and domestic mitigation targets and reactive and planned adaption.
 - This analysis will draw on global mitigation pathways selected from the International Panel on Climate Change's sixth Assessment Report (AR6) released in 2022.
 - Fundamental price and volume projections will be sourced from:
 - : the International Energy Agency World Energy Outlook and prospective technology projections;
 - : the Department of Industry, Science and Resources (DSIR) long-term projections capability (which is currently being developed); and
 - : bespoke commodity and investment forecasting agencies (such as Wood Mackenzie (WM), which are already partially utilised in Treasury's current long-run commodity price anchor methodology).

- The analysis will qualitatively assess how the selected transition scenarios shift the outlook for coal and selected critical minerals. Care will be taken to ensure consistency with the work of other institutions (such as, WM, IEA, DISR and the RBA).
 - This section will highlight the ongoing importance of coal in the energy transition process and other opportunities to decarbonise the industries. It will also highlight the importance of emerging commodities such as lithium in Australia's export markets.
- The analysis will also include standard sensitivity analysis (as presented in the Budget papers) of how changes in commodity prices affect the terms of trade, nominal GDP and tax receipts, all else equal to illustrate the implications of uncertainty around the outlook for commodities for Australia's fiscal position.

Previous related work:

- Reserve Bank of Australia (2021): [Towards Net Zero: Implications for Australia of Energy policies in East Asia](#).

Risks and sensitivities:

- Any long-term assessment anchored to global climate mitigation pathways is subject to high levels of uncertainty.
 - As well as the economic uncertainty, there are a large number of existing alternative possible socio-economic pathways (which underpin global climate scenarios), and structural uncertainties in climate models, and in how different economies adapt.
- Annual budget forecasts are often highly scrutinised by the media, academia, and private sector decision makers.
 - This IGR case study will need to clearly state that it is provided as a stylised review of how climate mitigation pathways may directly influence key export commodities (that is, coal and lithium). It will not look at the subsequent flows to change in investment or other aspects of the economy.
- DISR is in the process of updating their energy and resources projections framework by extending their modelling timeframes and inclusion of mitigation policies. This work will not be ready in time for the IGR. Treasury will work closely with DISR to ensure consistency in approaches and narratives as far as possible.

ATTACHMENT C – CLIMATE EXPENDITURE, INCLUDING ADAPTATION AND DISASTER RELIEF

Objective:

To illustrate some of the likely increases in climate-related expenditure resulting from adaptation costs and increasing rates and intensity of natural disasters. This section will link closely with the physical effects of climate change modelling section of the IGR, demonstrating the fiscal risks associated with climate change.

Overview of approach:

This section will draw on and extend work undertaken for the October 2022-23 Budget (and further work proposed for the May 2023-24 Budget, outlining climate-related government expenditure. It will include the following areas of discussion on climate expenditure:

- Adaptation – enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change is a key pillar of the Paris Agreement on Climate Change, and will likely become a greater share of government expenditure over time. This includes the need to build/retrofit/relocate both public and private assets to higher standards to handle temperature extremes, more volatile weather and prepare for disasters.
 - A qualitative discussion of climate adaptation will be included, accompanied by existing data on government expenditure and likely increased pressures over time.
- Regional natural disaster impacts – increasing frequency and severity of disasters is concentrated in specific regions, and will lead to increased localised cost and economic damage. (e.g. Local governments being unable to sufficiently repair damaged roads after NSW 2022 floods).
 - A qualitative assessment of regional exposure and expenditure pressure will be provided. This would draw on literature on the impacts of natural disaster events in Australia and describe impacts for selected geographical descriptors and how recovery program expenditure has changed over the long term.
- Disaster relief – increasing quantity and severity of disasters will place increasing pressure on disaster relief-related expenditure. This would draw on the budget impact from historical disaster relief expenditure based on assumptions relating to population growth and the amount of increase in damage from disasters. This analysis would be subject to data availability.
- Disaster relief (international) – increasing disasters and severe weather combined with rising sea levels are likely to tax the resources of island nations in the region, increasing the amount of foreign assistance they require. They may also result in migration changes.
- Other areas of climate expenditure that are likely to be affected by more frequent and intense severe weather and natural disasters include health systems due to increased incidence of diseases and environmental health hazards, changes in the prevalence and geographical distribution of disease and threats to mental health. The health sector will also face challenges to reduce emissions.

Early adaptation can help deal with future impacts, improving outcomes for Australians, lessening the impact of disasters and reducing the costs of disaster recovery. This could drive a narrative for future adaptation spending and alternative action, such as preparatory analysis and planning guidance leading to regulatory changes at all levels of government. There are links between adaptation and mitigation that will also be addressed.

This could include a separate box discussing impacts on capital assets of climate change such as accelerated degradation and depreciation rates resulting from harsher weather, identifying the impacts on various levels of government and the flow through to fiscal pressures. This could also briefly mention impacts on private capital and insurance implications. It also provides an opportunity to highlight the impact of climate change on the capital stock, offering a broader lens than GDP.

Previous related work:

- Past IGRs, past Budgets, UK's OBR fiscal risks report, NSW 2021-22 IGR

Risks and sensitivities:

- Apportioning impacts of disasters to climate change is not feasible due to underlying uncertainty of causation and would be met with criticism. This risk can be mitigated by avoiding discussion of particular incidents or avoiding attribution to climate change.
- Estimates of funding impacts might create expectations regarding future policy paths e.g. the need for the Commonwealth to increase the amount of funding provided for disaster relief. Clear expression of caveats and assumptions can mitigate that risk.

ATTACHMENT D – ELECTRIC VEHICLE UPTAKE AND THE IMPLICATIONS FOR FUEL EXCISE

Objective:

The Government has pledged to address declines in fuel excise as part of their 2022 election commitment to the National Electric Vehicle Strategy (NEVS). The final NEVS will be released prior to the IGR and will include a narrative based on the fuel excise collections from the October 2022-23 Budget. This case study will build on the NEVS narrative and present a scenario where electric vehicle (EV) uptake is faster or slower than the uptake rate assumed in the IGR baseline. The analysis will illustrate faster (slower) uptake of EVs will lead to a faster (slower) decline in fuel excise revenue. This analysis, together with the other three pieces of analysis, could drive a broader discussion of the pressures on Australia's tax base.

Overview of approach:

- The analysis will quantify the effect of a faster or slower EV uptake rate on fuel excise revenue over the IGR projection period.
- The analysis will not consider any other revenue effects from faster or slower EV uptake. Other impacts may be discussed qualitatively. It will also not consider any potential general equilibrium effects, structural changes or policy decisions beyond those already included in the baseline.

Previous related work:

- Recent Budget updates have taken account of the effect of EV uptake on fuel excise in the medium-term revenue projections.

Risks and sensitivities:

- The impact on fuel excise will be highly uncertain and not just dependent on EV uptake rate, but also on the retirement rate of the existing fleet, distance driven/fuel consumption of different vehicles, fuel consumption by heavy vehicles. The scenarios in the IGR will make this uncertainty clear.
- A range of public and private sector EV uptake projections have been published. This includes DCCEEW's estimates published with emissions projection in December 2022. Any analysis will need to take into account this previous work.
- The Government is expected to consider measures resulting from NEVS consultation before the end of the financial year. NEVS measures could affect EV take up, however this impact may not be able to be incorporated on IGR timeframes.

ATTACHMENT E : COMPARISON WITH INTERNATIONAL COUNTERPARTS

- The proposed approach will ensure that the 2023 IGR is at the leading edge of international counterpart institutions – such as the UK Office for Budget Responsibility, the US Congressional Budget Office and the NZ Treasury.
- Our longer-term climate modelling capability development plans, and approach to comprehensively incorporating climate change effects into the economic baseline using a suite of models, would take us well beyond our peers.
- In their comprehensive April 2022 survey of the state of macroeconomic modelling of climate risks the US Council of Economic Advisers and US Office of Management and Budget declared that while there is now a relatively rich literature on the economic impacts of climate change, producing estimates that are useful in the context of macroeconomic modelling remains a considerable challenge.
 - No major counterpart institution has incorporated a full net zero scenario into their long-term projections and economic baselines (see table below).

Table 1: Comparison with international counterparts

	US CBO 2020, 2021 and 2022 Long-Term Budget Outlook	UK OBR 2021 Fiscal risks report	NZ Treasury 2021 Shocks and Scenarios Analysis Using a Stochastic Neoclassical Growth Model	NSW Treasury 2021 Intergenerational Report	Proposed approach 2023 Intergenerational Report
Scenario analysis or included in projections?	Included in projections	Scenario analysis	Scenario analysis	Scenario analysis	Scenario analysis
Physical damages considered	Temperature, precipitation, hurricane frequency and sea levels	Illustrative, showing potential impact of more frequent 'periodical fiscal shocks'	Earthquakes, storms and droughts	Natural disasters, sea level rise, heatwaves	Temperature, humidity and natural disasters
Approach	Top-down approach, estimating the impacts of climate change on GDP Bottom-up approach, on the impact of hurricane damages on GDP	Top-down approach, estimating the impact on GDP from: <ul style="list-style-type: none"> • Productivity assumptions • Action versus inaction • High versus low public spending shares • Bottom-up approach estimates 'resource costs' of transitioning to net zero 	Top-down approach, estimating the impact on GDP from natural disasters through: <ul style="list-style-type: none"> • Productivity shocks • Capital destruction 	Top down approach, estimating the costs of natural disasters and temperature rises, using damage functions which account for: <ul style="list-style-type: none"> • Selected costs of natural disasters • Capital destruction • Labour productivity • Agricultural productivity 	Bottom-up development of damage functions integrated into CGE model accounting for: <ul style="list-style-type: none"> • Agricultural productivity • Capital destruction • Productivity in affected sectors • Depreciation rates