THE UNIVERSITY of ADELAIDE

OSAPC Inquiry into South Australia's Renewable Energy Competitiveness

Potential economic impact of transitioning South Australia's heavy industry and mineral sectors

Final Report

May 2022

Jim Hancock, Suraya Abdul Halim

make history.

Authors:
- Jim Hancock, Deputy Director, SACES
- Suraya Abdul Halim, Research Economist, SACES

Published by: South Australian Centre for Economic Studies (SACES)
The University of Adelaide
North Terrace Campus
SA 5005, Australia
Email: saces@adelaide.edu.au

Contents

1. Executive Summary

This report presents an assessment of the economic impacts arising from the transitioning of South Australia's heavy industrial and mineral sectors to renewable energy sources. The Office of the South Australian Productivity Commission (OSAPC) asked the South Australian Centre for Economic Studies (SACES) in collaboration with the Institute for Sustainability, Energy and Resources (ISER) to estimate the potential net economic impacts on the South Australian economy of two scenarios:

- Scenario 1: An export orientated new green hydrogen generation facility; and
- Scenario 2: An existing mining operation expanding the scale of its operations using renewable energy to undertake additional processing of ore and then exporting the refined product (e.g., copper).

OSAPC specified the two scenarios in broad terms and discussed key assumptions and the approach to modelling with SACES during the conduct of the project.

We have used the information provided as an input to economic modelling work that estimates the broader impacts on the South Australian economy through to 2029/30. The modelling has been carried out using the Victorian University Regional Model (VURM). VURM is a multi-regional dynamic computer general equilibrium (CGE) model of the Australian economy developed by the Centre of Policy Studies (COPS).

1.1. Green Hydrogen

We considered the impact of a green hydrogen plant with exports growing to $1,014 million by 2026/27 and continuing at that volume relative to a baseline with no green hydrogen production. The key macroeconomic net impacts in 2029/30 relative to the base case are:

- gross state product is 1.4 percent higher ($1.9 billion);
- capital investment is 1.4 percent higher ($380 million) after having, in the project development phase, reached a level 8.0 percent higher in 2025/26;
- overseas export volumes are 5.9 percent higher ($900 million);
- employment (employed persons basis) is 0.5 percent higher (4,600 persons);
- the increase in employment is largely met from net migration to South Australia, so that population is 0.5 percent higher – about 9,800 extra people in 2029/30; and
- real wages in South Australia are unchanged (as they are nationwide, since by assumption labour and population move to restore real wage differentials after an initial shock).

1.2. Mineral processing

We considered the impact of an increase in the fraction of South Australia's non-ferrous ores processed locally. As a consequence, exports of non-ferrous metals are increased by $889 million by 2026/27 and thereafter relative to the base case. Non-ferrous ore production remains unchanged. The key macroeconomic net impacts in 2029/30 relative to the base case are:

- gross state product is 0.3 percent higher ($410 million);

- capital investment is 0.4 percent higher ($180 million) after having reached a level 1.2 percent higher in 2026/27;
- overseas export volumes are 4.9 percent higher ($800 million);
- employment (employed persons basis) is 0.3 percent higher (2,400 persons);
- the increase in employment is largely met from net migration to South Australia, so that population is 0.3 percent higher – about 5,000 extra people in 2029/30;
- real wages in South Australia are virtually unchanged (as they are nationwide, since by assumption labour and population move to restore real wage differentials after an initial shock).

2. Background

This report presents an assessment of the potential economic impacts arising from the transitioning of South Australia's heavy industrial and mineral sectors to renewable energy sources.

The Office of the SA Productivity Commission (OSAPC) engaged the University of Adelaide to carry out work on the implications of renewable energy and their potential role in South Australian heavy industry. The University of Adelaide team was led by the Institute for Sustainability, Energy and Resources (ISER). This report conveys the results of economic modelling work that was carried out by the South Australian Centre for Economic Studies (SACES).

OSAPC asked us to consider estimating the potential net economic impacts on the South Australian economy of two scenarios:

- Scenario 1: An export orientated new green hydrogen generation facility; and
- Scenario 2: An existing mining operation expanding the scale of its operations using renewable energy to undertake additional processing of ore and then exporting the refined product (e.g., copper).

OSAPC specified the two scenarios in broad terms and discussed key assumptions and the approach to modelling with SACES during the conduct of the project.

We have used the information provided as an input to economic modelling work that estimates the broader impacts on the South Australian economy through to 2029/30. The modelling has been carried out using the Victorian University Regional Model (VURM). VURM is a multi-regional dynamic computer general equilibrium (CGE) model of the Australian economy developed by the Centre of Policy Studies.

Section 2 outlines the modelling approach that we have taken using the VURM. Section 3 discusses the modelling of Scenario 1 and its results. Section 4 discusses the modelling of Scenario 2 and its results.

3. Modelling approach

This economic impact assessment has been carried out using the Victorian University Regional Model (VURM). VURM is a multi-regional dynamic computable general equilibrium (CGE) model of the Australian economy developed by the Centre of Policy Studies (CoPS) at Victoria University (Adams et al, 2015). VURM and its ancestors – most recently the Monash Multi-Regional Forecasting Model – have been used extensively in the analysis of public policy around Australia over many years. The latest available VURM model provided to us by COPS has been updated to 2017/18. For this study we have rolled the VURM databases forward to 2020/21 in line with key macroeconomic aggregates.

VURM is a Computable General Equilibrium (CGE) model which is developed and provided by Victoria University’s Centre of Policy Studies (CoPS). CGE models are designed to keep track of economy-wide interactions and to help people understand the effects of a policy change or innovation taking into account not just the directly impacted sectors and regions but also other sectors, other regions and the economy as a whole (See Box 1).

VURM is a dynamic multi-regional CGE model of the Australian economy based on neoclassical behavioural assumptions. Producers optimise output levels and minimise production costs by adjusting their input mixes in light of their production technologies and the prices of inputs. Consumers choose an optimal consumption bundle in light of their incomes and the prices of consumption commodities. VURM has 8 sub-national regions (the States, the NT and the ACT) and 88 industries each producing a single distinct output. Output is sold as an intermediate input to industries for production and for investment, to households for consumption, as exports, to national and state/local government, to inventories and to a separated National Electricity Market (generation industries only). Optimal allocations are determined by solving behavioural equations subject to budget and other resource constraints. When operated in dynamic mode, VURM produces a sequence of economic equilibria which are linked by equations which provide laws-of-motion for capital, employment, foreign debt and population.

A major advantage of the CGE approach is that it allows for the price adjustments that occur as a consequence of fundamental resource constraints in the economy. These price adjustments in turn prompt adjustments to the input mix in production processes and the composition of household consumption. In this respect the CGE approach provides a significant enhancement to the more simplistic input-output approach which estimates economic impacts on the assumption that there are no resource constraints. To illustrate, consider the case when there is a boost to the demand for skilled labour when there is a limited supply of skilled labour. In the CGE approach this pushes up wages and causes labour to be reallocated across industries and regions. In contrast, it is implicit in the input-output approach that the boost in demand for skilled labour will be met from a pool of unutilised labour without impacts on other industries.

CGE estimates are calculated by comparing “baseline” and “policy” scenarios. The baseline scenario is a forward-looking reference point which is used as a point of comparison for policy scenarios. To construct it, we rolled forward our 2020/21 starting point to 2029/30 using GDP and national population projections from the 2021

Intergenerational Report (Commonwealth of Australia, 2021) and State population growth differentials from the ABS population projections.

As GDP and population projections are imposed on the model, some other variables must be allowed to support this. We allowed the model to determine changes in multifactor productivity and real wages to be consistent with the imposed GDP and population scenarios. We assumed that the current account balance will remain unchanged as a proportion of GDP and that the terms of trade will remain unchanged. We ran the model with zero change in the CPI, meaning that all value aggregates can be interpreted as real terms series (in the CPI-adjusted sense).

The baseline scenario that we produce is of limited interest in its own right. Its main role is as a reference point from which to determine the consequences of the renewable transition. There are two separate policy change scenarios of interest. The first relates to Scenario 1, which models the growth of exports from the new hydrogen facility (all production will be exported), along with downstream activity. The second relates to Scenario 2, where ore that was produced and exported overseas or to other States is now refined within South Australia using renewable energy and exported.

Box 1 Overview of VURM's key characteristics

VURM is structured to allow the examination of information at the regional level. Within each region,

1. Economic agents take the form of representative industries and households;
2. Each industry minimises costs and faces constant returns to scale;
3. Industries face fixed and variable costs, and both can be reduced through time as technology improves and costs reduced;
4. Representative households maximise utility; and
5. Investors allocate capital to regional industries on the basis of expected rates of return.

While Australia's population is determined exogenously, the migration of people from one region to another is determined by the level of economic activity in each region and its capacity to compete with other regions.

The rest of the world is treated as a single nation that trades goods and services with each region at prices that are determined exogenously. That is, Australia's behaviour has no influence on cost and prices in other parts of the world.

International demand for each commodity goes up as the real exchange rate goes down. In general, markets are assumed to clear and to be competitive.

Purchase prices differ from basic prices by the value of indirect taxes and margin services.

Taxes and profit margins can differ by commodity, user, region of source and region of destination.

Dynamic equations describe stock-flow relationships, such as the relationship between regional industry stocks of capital and investment in regional industries.

Dynamic adjustment equations allow for the gradual movement of key variables, such as labour, towards their long-run values. In this regard, VURM allows region-specific unemployment rates to temporarily depart from baseline values under an assumption of short-run regional wage stickiness. Over time, regional wage adjustment gradually returns region-specific unemployment rates to baseline values.

Regional per capita real disposable income relativities can depart temporarily from baseline values, under an assumption that there is stickiness in rates of inter-regional migration. Over time, adjustment of rates of inter-regional migration gradually returns inter-regional per capita real disposable income relativities back to an exogenously defined baseline.

Regional economic linkages arise from inter-regional trade, factor mobility, the taxing and spending activities of governments and, also, long-run economy-wide employment and balance of trade constraints.

A full set of national and regional income accounts is created with associated deflators.

Source: Adapted from www.vu.edu.au/CoPS. For more information, see Adams; Dixon and Horridge (2015).

4. Modelling the impact of a new Green Hydrogen Facility (Scenario 1)

4.1. Overview

The first scenario considers the hypothetical development of a new green hydrogen production facility at Port Bonython in the Upper Spencer Gulf. The new facility will sell all of its output overseas. It entails a substantial increase in capital expenditure and exports relative to what can be expected in a base case "no policy change" scenario.

4.2. Modelling the policy shocks

After consultation with OSAPC, we considered the case of a 1,500 MW hydrogen electrolyser located at Port Bonython and focussed on servicing export markets. Parameters for a project of this scale and location were calculated using the Department of Energy and Mining's, South Australia Hydrogen Export Modelling Tool (DEM, 2022). The plant would produce 130,000 tonnes of H_2 when fully operational, all of which would be exported. Capital and operating costs are as shown in Table 4.1.[1]

Table 4.1 - Capital and operating costs for a green hydrogen plant at Port Bonython

	Total CAPEX (a) ($m)	Annual OPEX (a) ($m)	Electricity consumption (GWh/annum)
Electricity transmission	414	8	0
Electrolyser operation	1,612	339	6,837
H2 liquefaction	1,681	298	1,219
Port infrastructure	390	12	0
Total	**4,097**	**656**	**8,056**

Source: DEM (2022), data extracted by OSAPC

We model the economic impact of the development using estimated output and cost elements in Table 4.1. We consider a scenario in which construction of the new green hydrogen plant and associated infrastructure takes place over the triennium 2023/24 to 2025/26. Hydrogen production ramps up in line with capital expenditures but with a 1-year lag. The plant is fully operational in 2026/27.

The green hydrogen plant needs a substantial electricity supply. We assume that incremental electricity demands in the National Electricity Market are met from increased renewable electricity generation in South Australia.

[1] South Australia Hydrogen Export Modelling Tool available at: https://hydrogenexport.sa.gov.au.

Table 4.2 shows capital expenditures, operating expenditures and output/exports for the years 2023/24 to 2029/30. Replacement capital expenditures are based on depreciation at 7.4 percent.[2]

Table 4.2 - Green hydrogen plant: capital expenditures, operating expenditures and LH2 output/export sales

Financial Year	Expansion CAPEX ($m)	Increment to Capital Stock ($m)	OPEX ($m)	LH2 exports / output ($m)
2023/24	1,366	0	0	0
2024/25	1,366	1,366	219	338
2025/26	1,366	2,731	437	676
2026/27	0	4,097	656	1,014
2027/28	0	4,097	656	1,014
2028/29	0	4,097	656	1,014
2029/30	0	4,097	656	1,014

Source: SACES calculations

Our modelling approach compares a policy scenario in which there is a substantial demand for green hydrogen from South Australia and a regulatory and planning environment that accommodates meeting that demand. In the base case scenario South Australia is not accommodative of the development and the boost to export demand then does not materialise.

Our key closures are as follows. We fix the change in green hydrogen exports and output from South Australia so that in the policy scenario they exceed the base case scenario by the amounts shown in "LH2 exports" in Table 4.2. We fix the change in the capital stock for green hydrogen production so that the differences between policy and base case scenarios are in line with the amounts in "Expansion CAPEX" in Table 4.2.This in turn fixes investments in green hydrogen capital stock. We fix output levels for all NEM generation sectors other than South Australian renewables so that they are unchanged between base and policy. This means that changes in NEM generation are met entirely by South Australian renewables.

The broad macroeconomic environment is one in which national employment levels are fixed in the long run. In the short run national employment levels in the policy scenario may depart from the base case but over a period of years real wages adjust to return employment to the base case levels. This approach is standard in CGE modelling. Although national employment levels are fixed in the long run, State employment levels are not, meaning that employment in one State may grow at the expense of employment in others. Changes in State employment growth are assumed

[2] Based on the depreciation rate average of the renewable energy industry 'Other Electricity' in the VURM.

to be accompanied by changes in State population, with labour force participation rates and unemployment rates stable in the long run.

4.3. Results

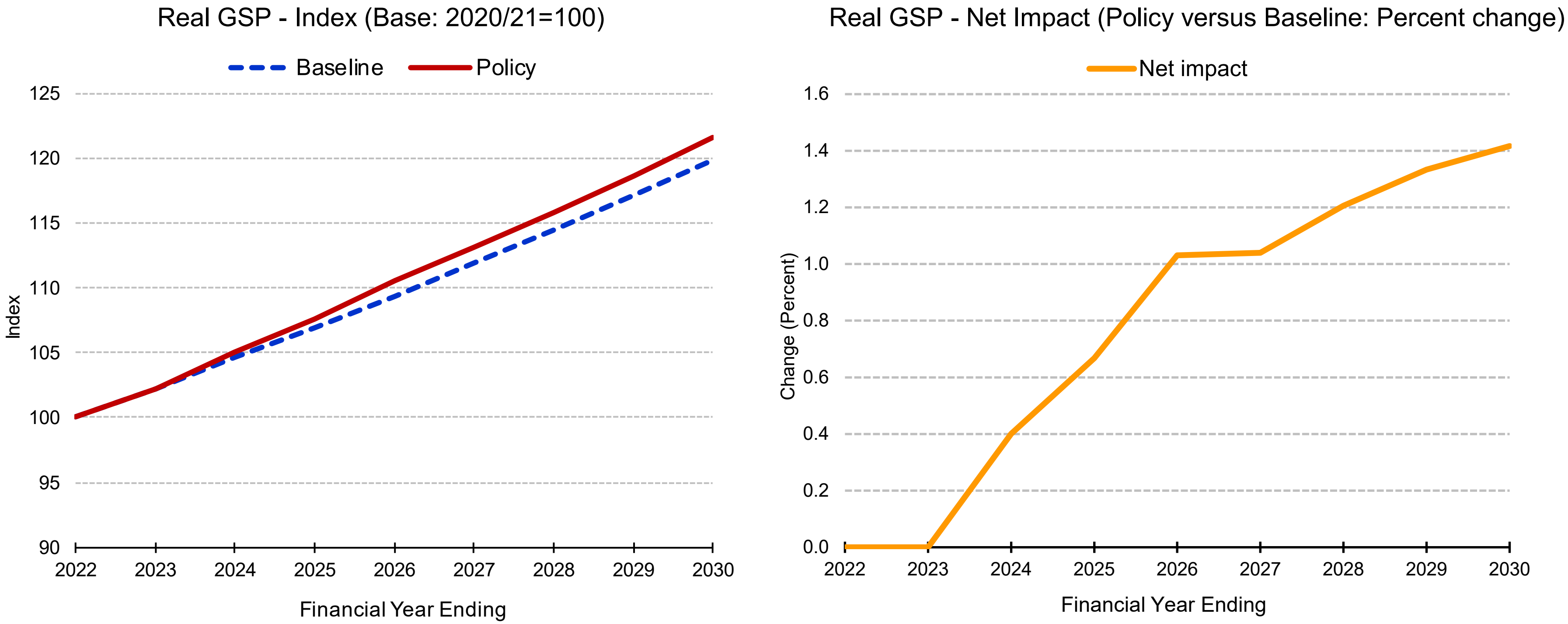
Figure 4.1 to Figure 4.6 and the accompanying tables show the impacts of the policy shocks on key macroeconomic variables.

To illustrate the impacts when the expansion of output has been in effect for several years, we consider the difference between outcomes under the policy and base case scenarios for key South Australian economic aggregates in 2029/30:

- gross state product is 1.4 percent higher ($1.9 billion), which in comparison with South Australia's annual average GSP increase of 1.2 percent over the past decade, is about one year of growth;
- capital investment is 1.4 percent higher ($380 million) after having, in the project development phase, reached a level 8.0 percent higher in 2025/26;
- overseas export volumes are 5.9 percent higher ($900 million);
- employment (employed persons basis) is 0.5 percent higher (4,600 persons), which in comparison with South Australia's annual average employment increase of 0.7 percent over the past decade, is almost three quarters of annual growth;
- the increase in employment is largely met from net migration to South Australia, so that population is 0.5 percent higher – about 9,800 extra people in 2029/30, which in comparison to South Australia's annual average population increase over the past decade of 0.8 percent, is over half the annual growth; and
- real wages in South Australia are unchanged (as they are nationwide, since by assumption labour and population move to restore real wage differentials after an initial shock).

The fact that real wage responses are negligible reflects that wages in the long run are determined at national level and the boost to activity is small in the national context.

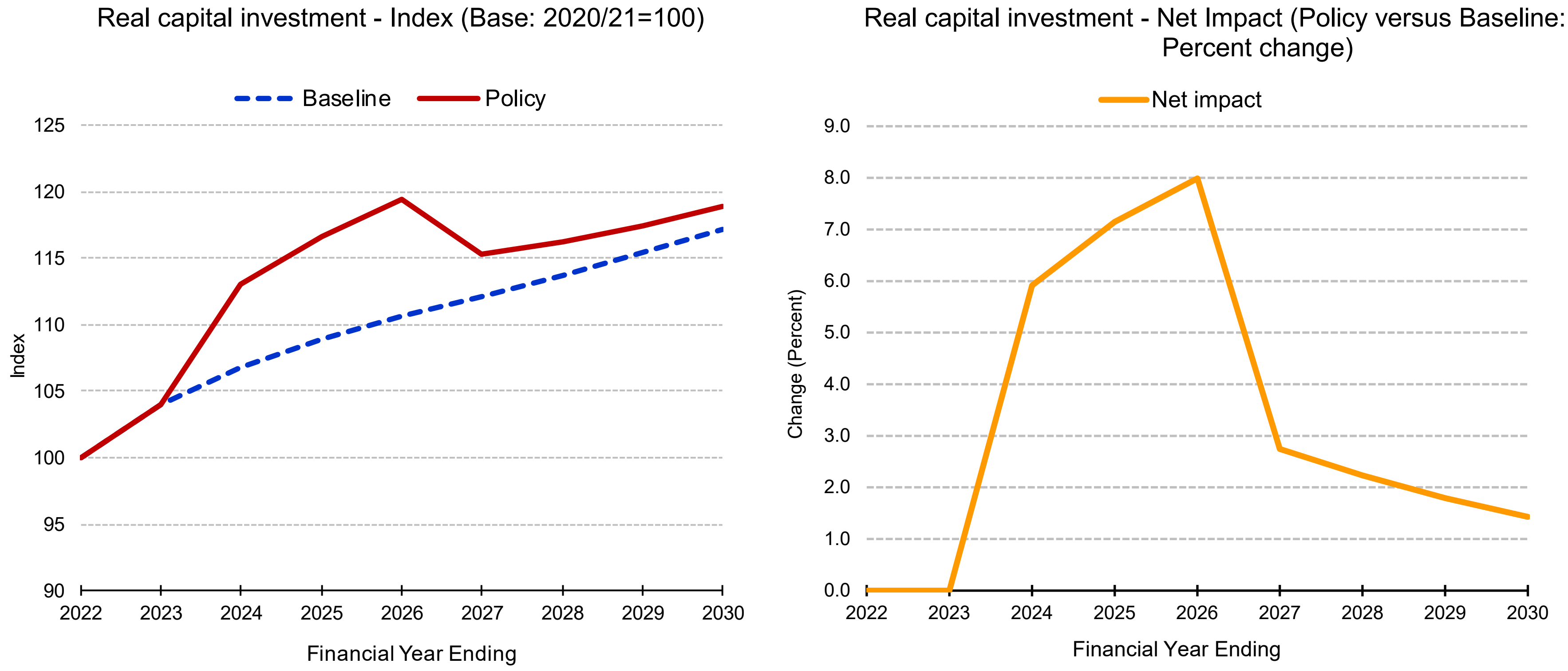
Figure 4.1 - Green Hydrogen Scenario: Real Gross State Product (GSP)



Real GSP		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	102.3	104.6	106.9	109.4	111.9	114.5	117.1	119.8
Policy (Index 2020/21=100)	Policy	100.0	102.3	105.0	107.7	110.5	113.1	115.8	118.7	121.5
Net impact (Percent change from base)	Net impact	0.0	0.0	0.4	0.7	1.0	1.0	1.2	1.3	1.4

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

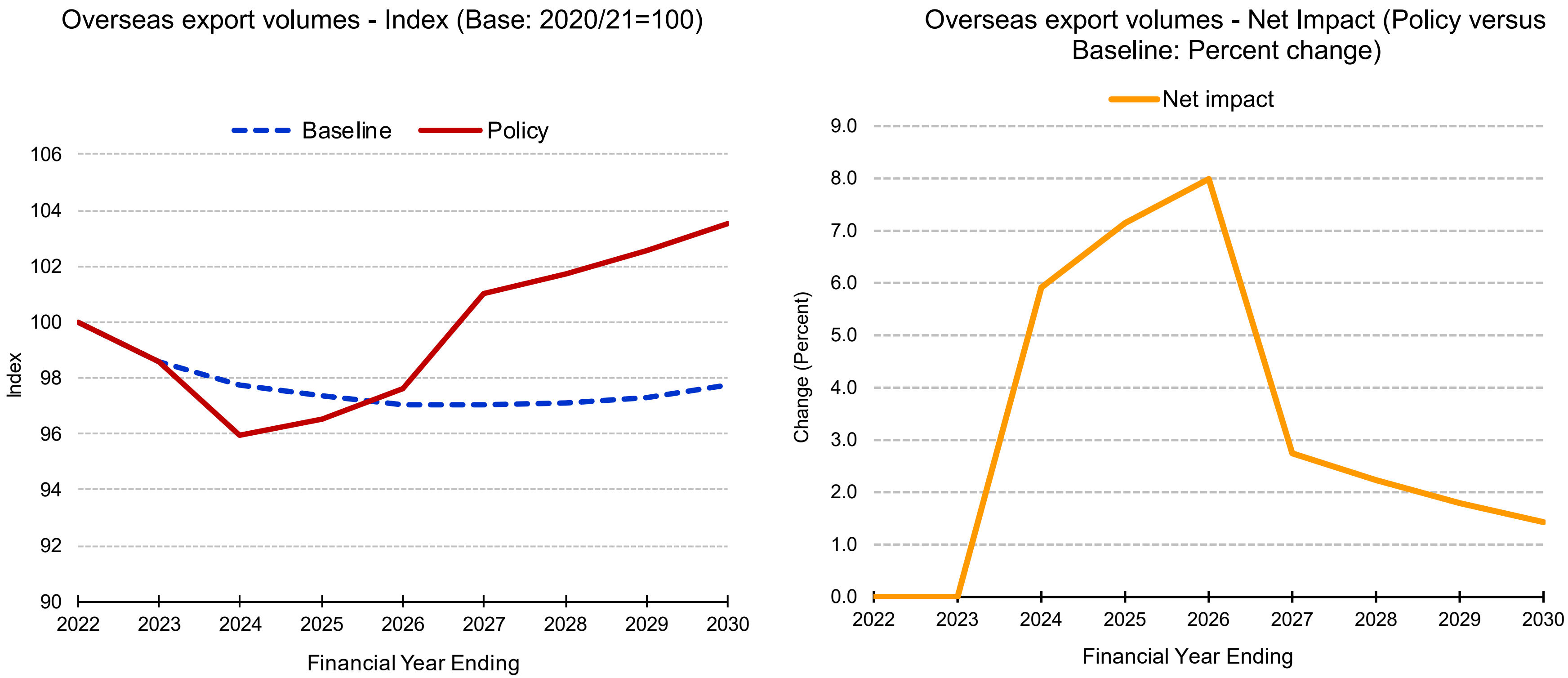
Figure 4.2 - Green Hydrogen Scenario: Real capital investment



Real capital investment		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	103.9	106.8	108.9	110.6	112.2	113.7	115.4	117.2
Policy (Index 2020/21=100)	Policy	100.0	103.9	113.1	116.6	119.4	115.2	116.3	117.5	118.8
Net impact (Percent change from base)	Net impact	0.0	0.0	5.9	7.1	8.0	2.7	2.2	1.8	1.4

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

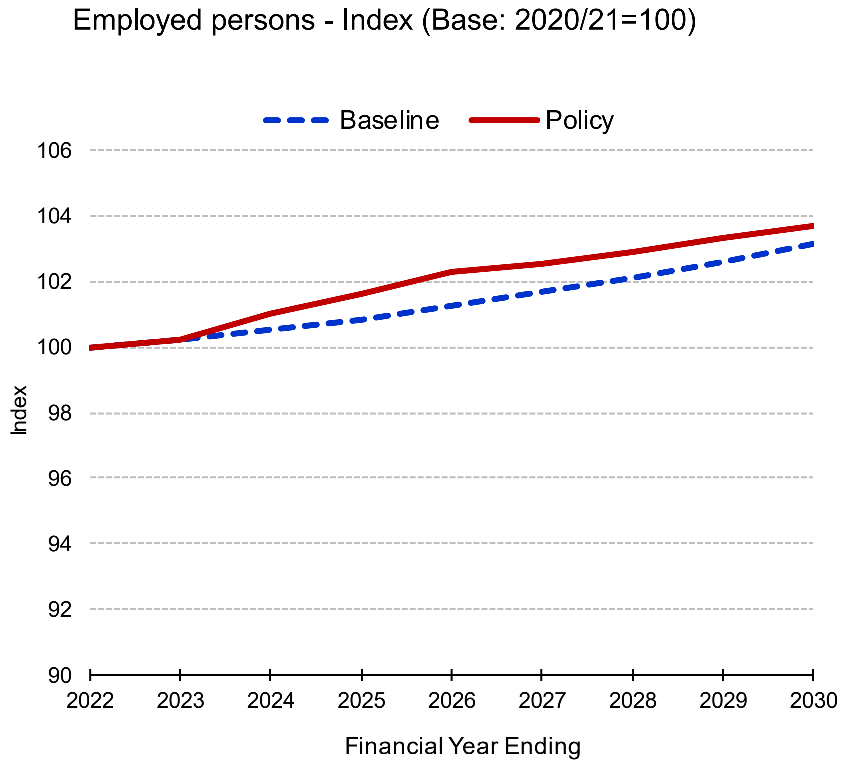
Figure 4.3 - Green Hydrogen Scenario: Overseas export volumes

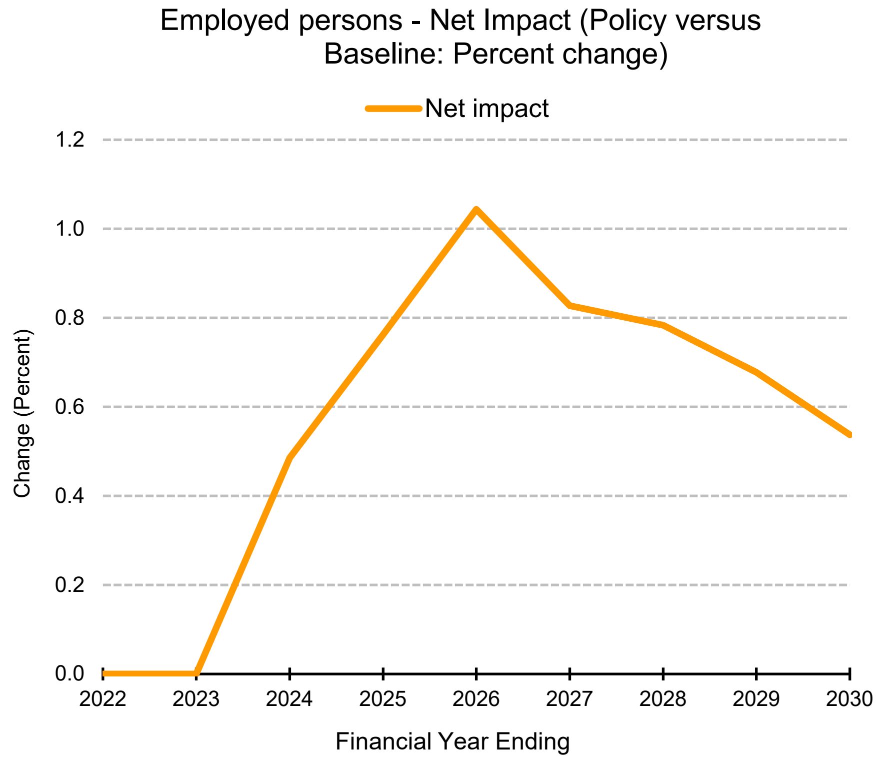


Overseas export volumes		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	98.6	97.8	97.3	97.1	97.0	97.1	97.3	97.7
Policy (Index 2020/21=100)	Policy	100.0	98.6	96.0	96.5	97.6	101.0	101.7	102.6	103.5
Net impact (Percent change from base)	Net impact	0.0	0.0	-1.9	-0.8	0.6	4.1	4.8	5.4	5.9

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

Figure 4.4 - Green Hydrogen Scenario: Employed persons

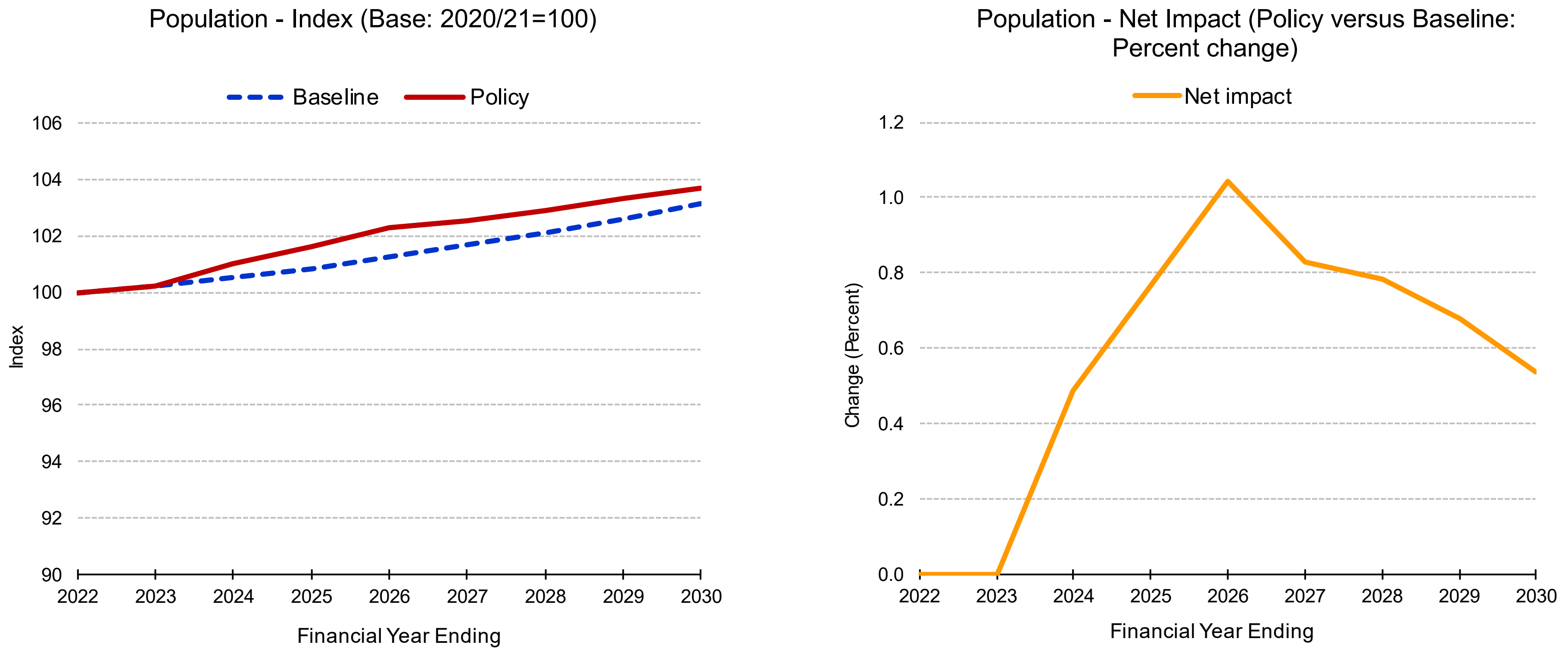




Employed persons		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	100.2	100.5	100.9	101.2	101.7	102.1	102.6	103.2
Policy (Index 2020/21=100)	Policy	100.0	100.2	101.0	101.6	102.3	102.5	102.9	103.3	103.7
Net impact (Percent change from base)	Net impact	0.0	0.0	0.5	0.8	1.0	0.8	0.8	0.7	0.5

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

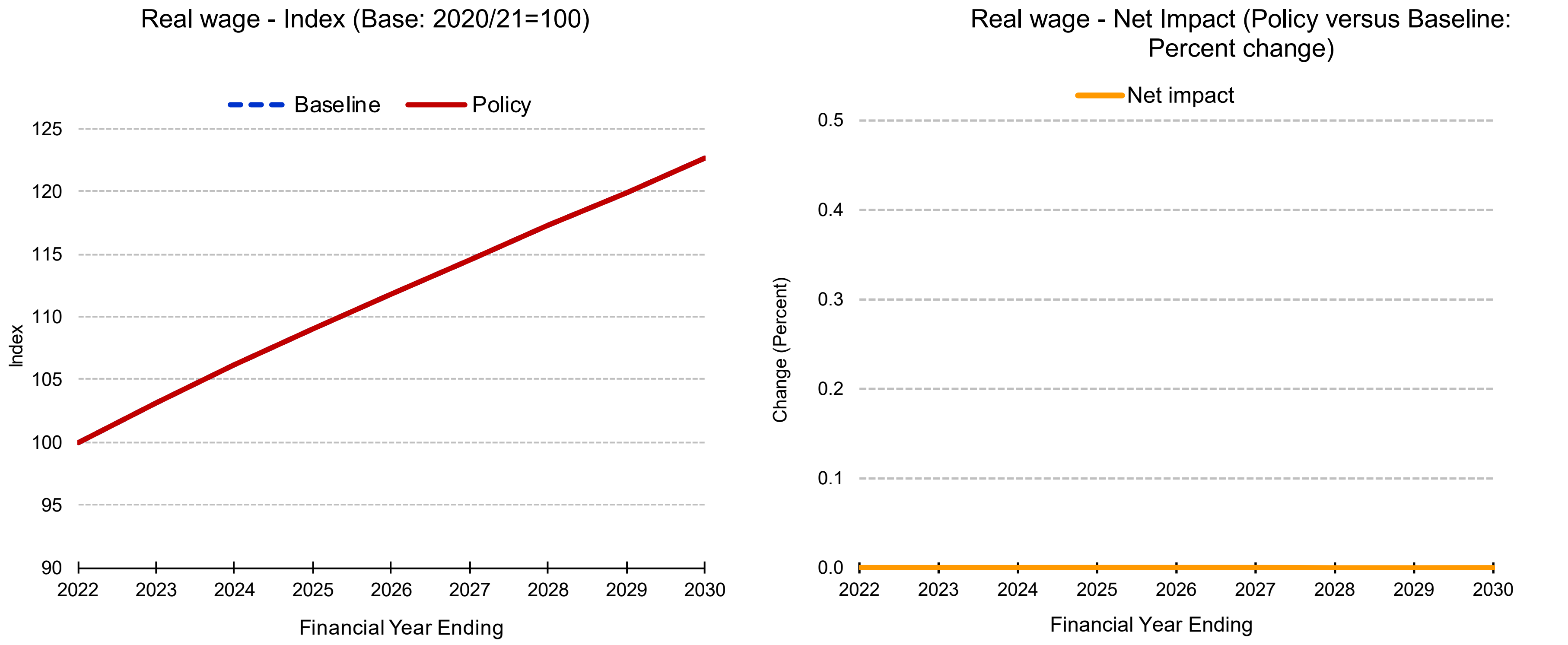
Figure 4.5 - Green Hydrogen Scenario: Population



Population		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	100.2	100.5	100.9	101.2	101.7	102.1	102.6	103.2
Policy (Index 2020/21=100)	Policy	100.0	100.2	101.0	101.6	102.3	102.5	102.9	103.3	103.7
Net impact (Percent change from base)	Net impact	0.0	0.0	0.5	0.8	1.0	0.8	0.8	0.7	0.5

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

Figure 4.6 - Green Hydrogen Scenario: Real wage



Real wage		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	103.1	106.1	109.0	111.8	114.5	117.2	119.9	122.6
Policy (Index 2020/21=100)	Policy	100.0	103.1	106.1	109.0	111.8	114.5	117.2	119.9	122.6
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

5. Modelling the impact of an existing mining operation undertaking additional processing of ore (Scenario 2)

5.1. Overview

The second scenario considers a case in which an increased fraction of South Australia's non-ferrous metal ores are processed in the State instead of being exported. The additional metal that is produced is then exported.

5.2. Modelling the policy shocks

We have considered a scenario in which there is an increase in local processing of copper and gold ores. South Australia presently exports substantial amounts of copper and gold ores. as it is a common ore activity in South Australia. We considered a hypothetical scenario in which South Australia's exports of non-ferrous metals increase by 60kt for copper and 100koz for gold (equivalent to around half of recent exports of copper and gold ores). To give an idea of scale, this is of the same order of size as output from Prominent Hill or Carrapateena, although we neither make any attempt to model either of those operations specifically nor make any judgement about any prospects in relation to those particular mines. We assume a copper price of $10,741/t and a gold price of $2,489/oz (based on average price calculated from DEM, 2021) from 2024/25 onward in CPI-adjusted terms. Thus the increase in non-ferrous metals exports when the expansion is complete is $889 million. We assume that the new in-State processing activity will not change South Australia's ore production but instead will divert it away from export markets (both interstate and overseas).

We assume that incremental electricity demands in the National Electricity Market are met from increased renewable electricity generation in South Australia.

The expansion of output in the metals processing sector requires substantial capital expenditures. We assume that development to support the new processing activity occurs in line with the increases in production over the three years 2024/25 to 2026/27. Table 5.1 shows the year-by-year increments to non-ferrous metals exports.

Table 5.1 - Change in exports of SA-produced non-ferrous metals at constant prices

Financial Year	Change in non-ferrous metals exports ($m)
2023/24	0
2024/25	296
2025/26	593
2026/27	889
2027/28	889
2028/29	889
2029/30	889

Source: SACES calculations based on DEM (2021).

We assigned non-ferrous exports to 'Other metals' and non-ferrous ore production to 'Other non-ferrous ore' industry category in the VURM. Metal processing exports as shown in Table 5.2 are used as a policy 'shock' to exports in 'Other metals' exports. To allow for export diversion in the non-ferrous ore sector, we have assumed no changes in the production of ore (as all of it will be processed within South Australia) and allow the model to determine the changes in sales destinations for ore. Table 5.2 outlines these shocks.

We have allowed the model to determine the capital and labour input requirement of the export shock. Capital investment required by the export shock is determined by the model through fixing the capital rental rate. Additional labour input required at the State level is sourced from regional population migration which is determined by the model by fixing real wage relativity across the states and regional unemployment.

5.3. Results

Table 5.2 show the policy shocks (i.e. imposed changes) and figures 5.1 to 5.6 show their estimated impacts on key macroeconomic variables. In general, the macroeconomic impacts grow fairly steadily when the facility was first built in 2024/25 and begin to ramp up after the completion of the capital works of the facility in 2026/27 over the years to 2029/30 when the production of metal exports are in full production. Unless otherwise stated, the figures cited in this section relate to real values in 2029/30 relative to the base case.

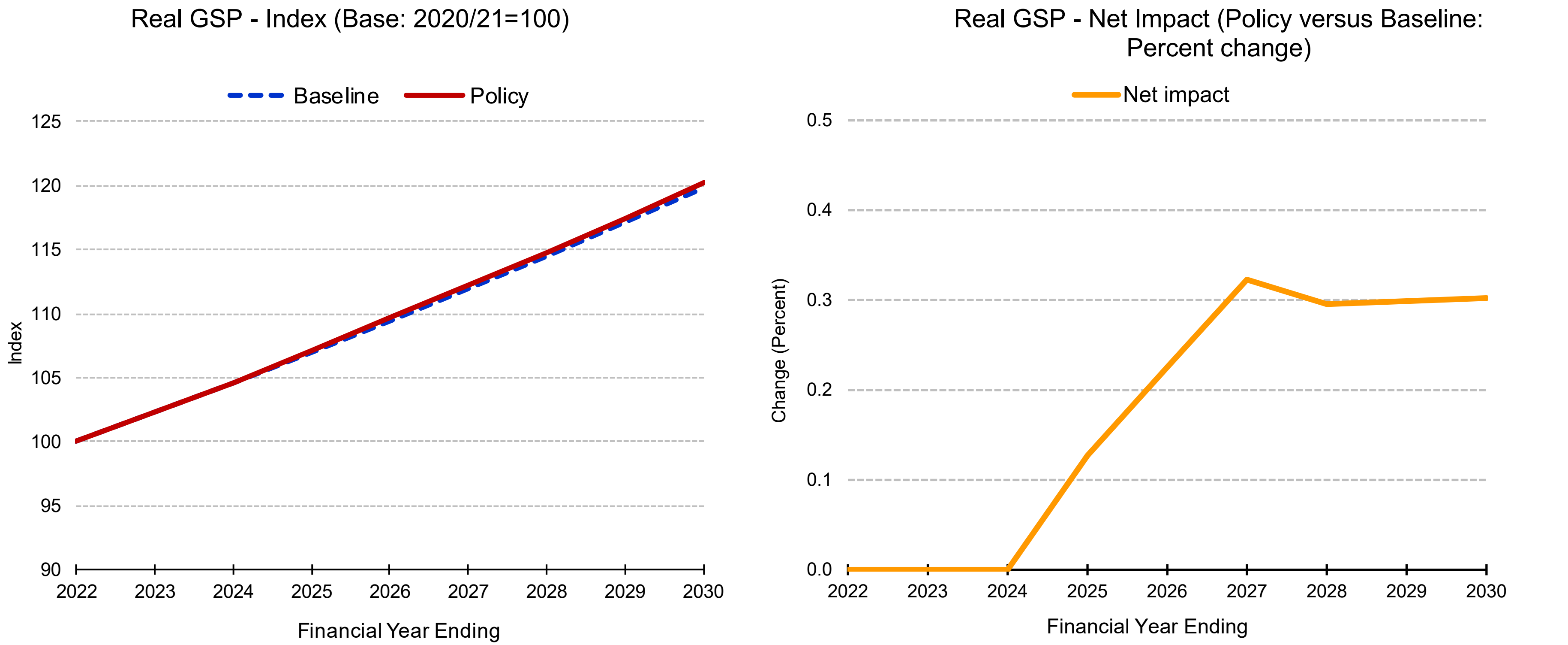
To illustrate the impacts when the expansion of output has been in effect for several years, we consider the difference between outcomes under the policy and baseline scenarios for key South Australian economic aggregates in 2029/30:

- gross state product is 0.3 percent higher ($410 million), which in comparison with South Australia's annual average GSP increase of 1.2 percent over the past decade, is about a quarter of a year of growth;
- capital investment is 0.4 percent higher ($180 million) after having reached a level 1.2 percent higher in 2026/27;
- overseas export volumes are 4.9 percent higher ($800 million);
- employment (employed persons basis) is 0.3 percent higher (2,400 persons) which in comparison with South Australia's annual average employment increase of 0.7 percent over the past decade, is approaching a half of an average year's growth;
- the increase in employment is largely met from net migration to South Australia, so that population is 0.3 percent higher – about 5,000 extra people in 2029/30 which in comparison to South Australia's annual average population increase over the past decade of 0.8 percent, is approaching a half of an average year's growth;
- real wages in South Australia are virtually unchanged (as they are nationwide, since by assumption labour and population move to restore real wage differentials after an initial shock).

Table 5.2 - Mineral Processing Scenario: Imposed changes in production and export levels

		2022	2023	2024	2025	2026	2027	2028	2029	2030
'Other Non-ferrous ores' Production										
Baseline (Index 2021=100)	Baseline	100.0	100.2	100.7	101.5	102.3	103.2	104.1	105.0	106.0
Policy (Index 2021=100)	Policy	100.0	100.2	100.7	101.5	102.3	103.2	104.1	105.0	106.0
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
'Other Metals' Exports										
Baseline (Index 2021=100)	Baseline	100.0	98.7	98.2	98.1	98.4	98.8	99.3	99.9	100.6
Policy (Index 2021=100)	Policy	100.0	98.7	98.2	104.2	110.4	116.8	117.3	117.9	118.7
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	6.1	12.2	18.3	18.2	18.1	17.9

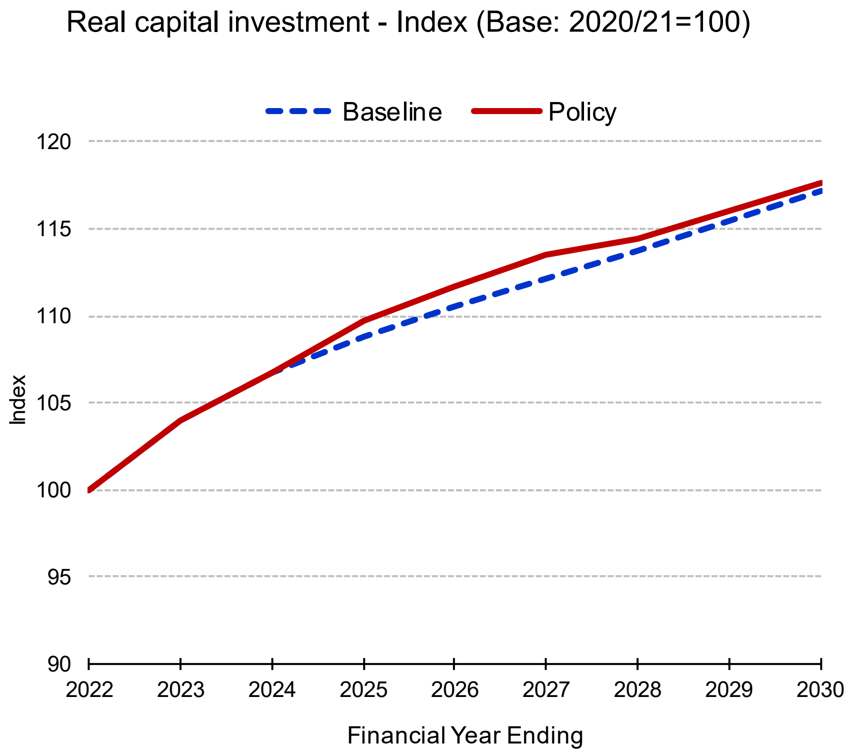
Figure 5.1 - Mineral Processing Scenario: Real Gross State Product (GSP)

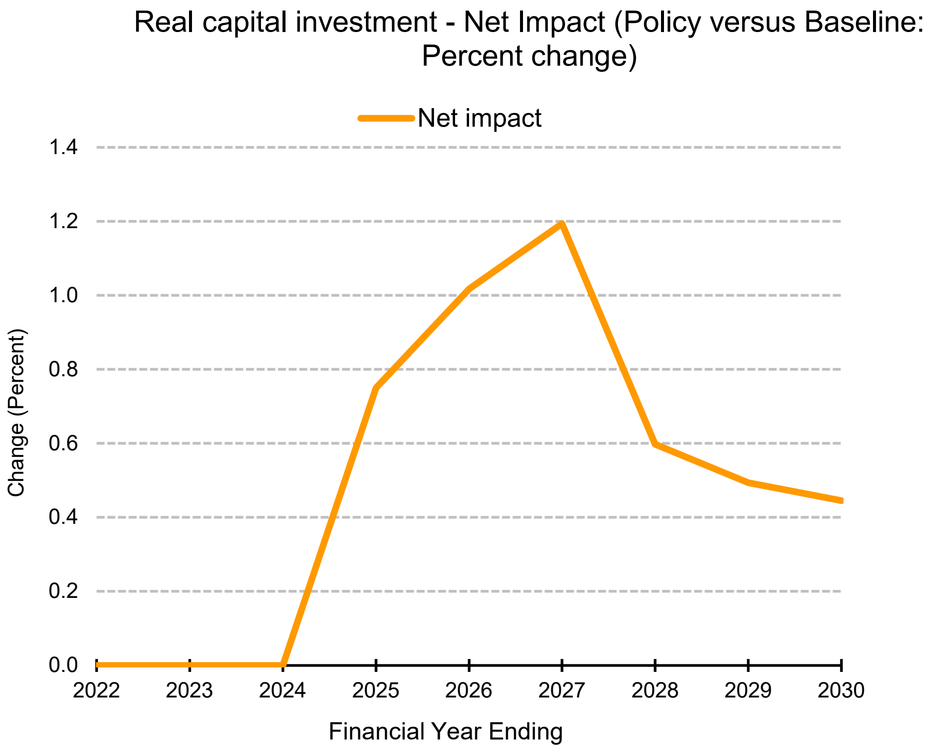


Real GSP		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	102.3	104.6	106.9	109.4	111.9	114.5	117.1	119.8
Policy (Index 2020/21=100)	Policy	100.0	102.3	104.6	107.1	109.6	112.3	114.8	117.5	120.2
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

Figure 5.2 - Mineral Processing Scenario: Real capital investment

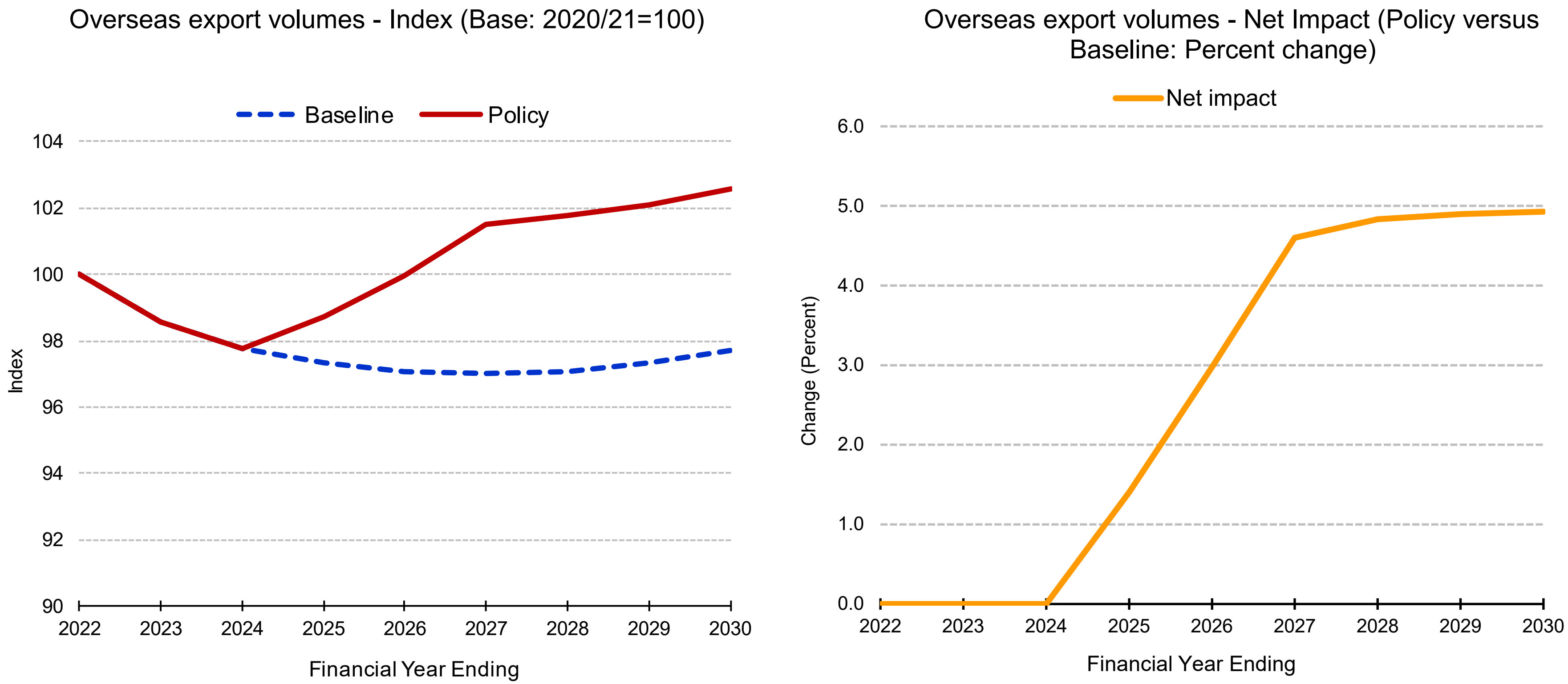




Real capital investment		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	103.9	106.8	108.9	110.6	112.2	113.7	115.4	117.2
Policy (Index 2020/21=100)	Policy	100.0	103.9	106.8	109.7	111.7	113.5	114.4	116.0	117.7
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.8	1.0	1.2	0.6	0.5	0.4

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

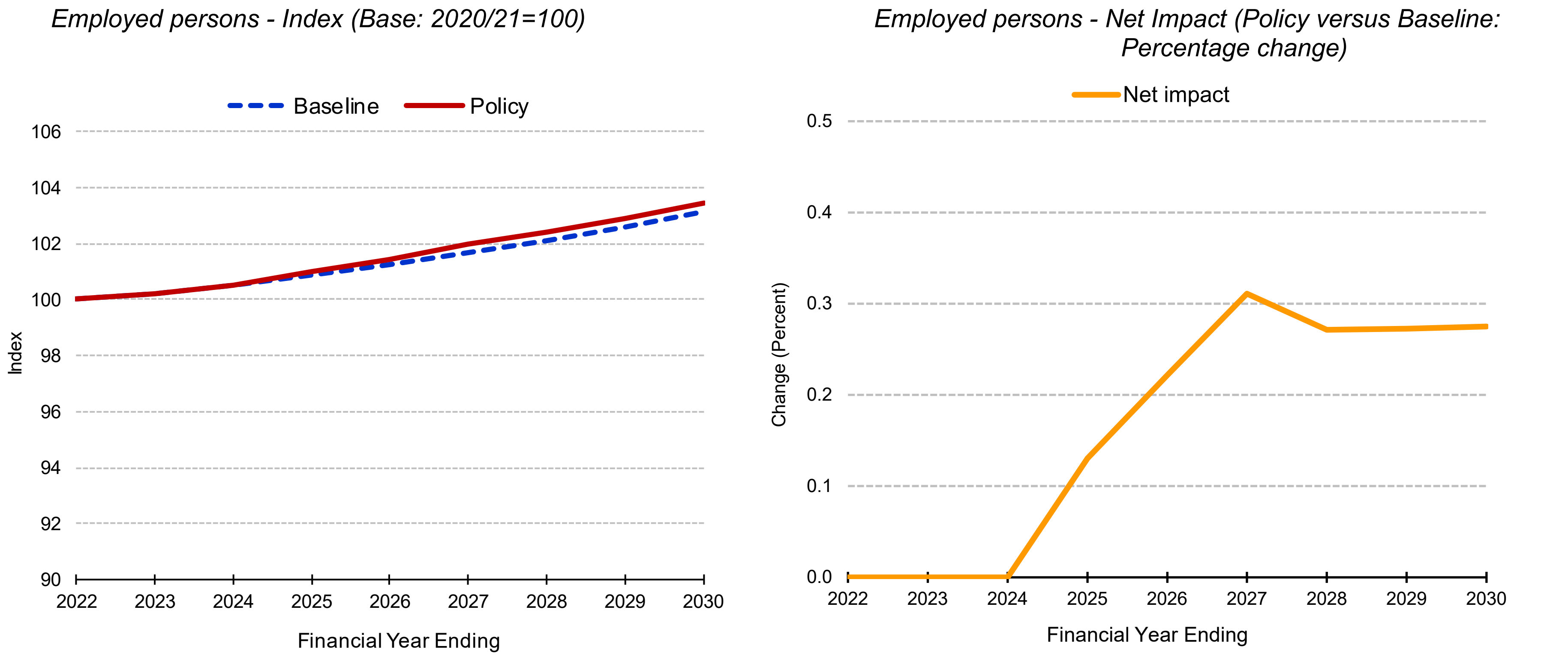
Figure 5.3 - Mineral Processing Scenario: Overseas export volumes



Overseas export volumes		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	98.6	97.8	97.3	97.1	97.0	97.1	97.3	97.7
Policy (Index 2020/21=100)	Policy	100.0	98.6	97.8	98.7	100.0	101.5	101.8	102.1	102.5
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	1.4	3.0	4.6	4.8	4.9	4.9

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

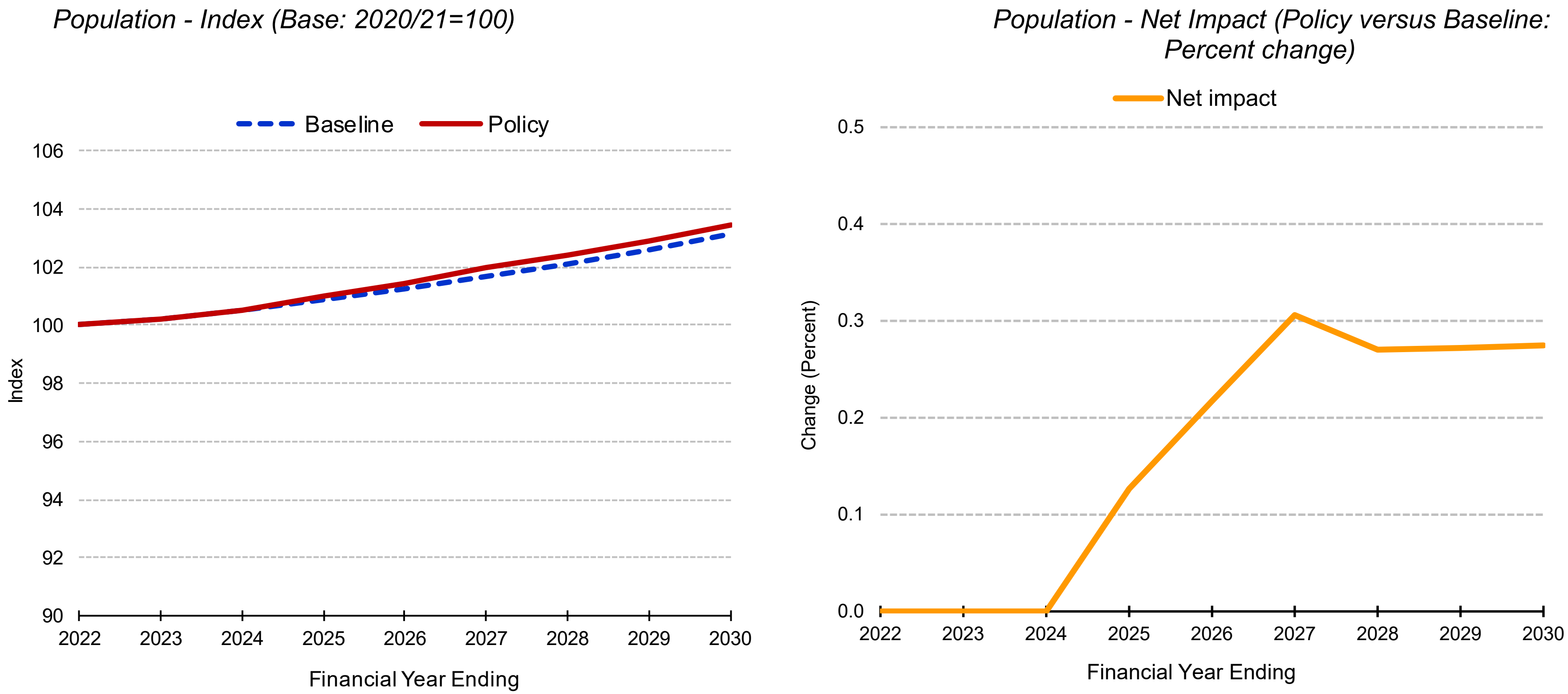
Figure 5.4 - Mineral Processing Scenario: Employed persons



Employed Persons		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	100.2	100.5	100.9	101.2	101.7	102.1	102.6	103.2
Policy (Index 2020/21=100)	Policy	100.0	100.2	100.5	101.0	101.5	102.0	102.4	102.9	103.4
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

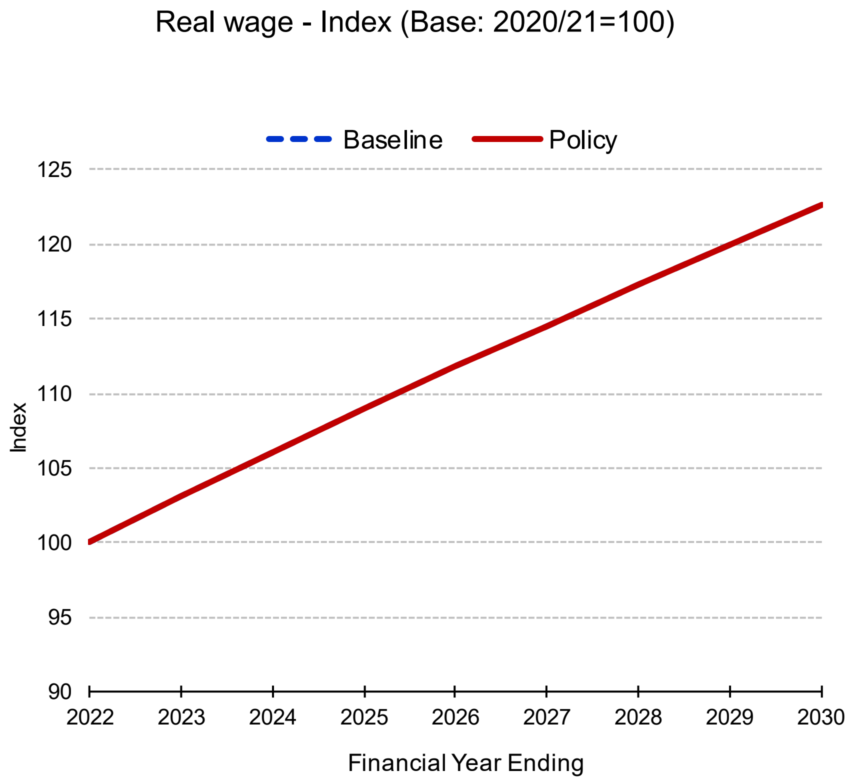
Figure 5.5 - Mineral Processing Scenario: Population

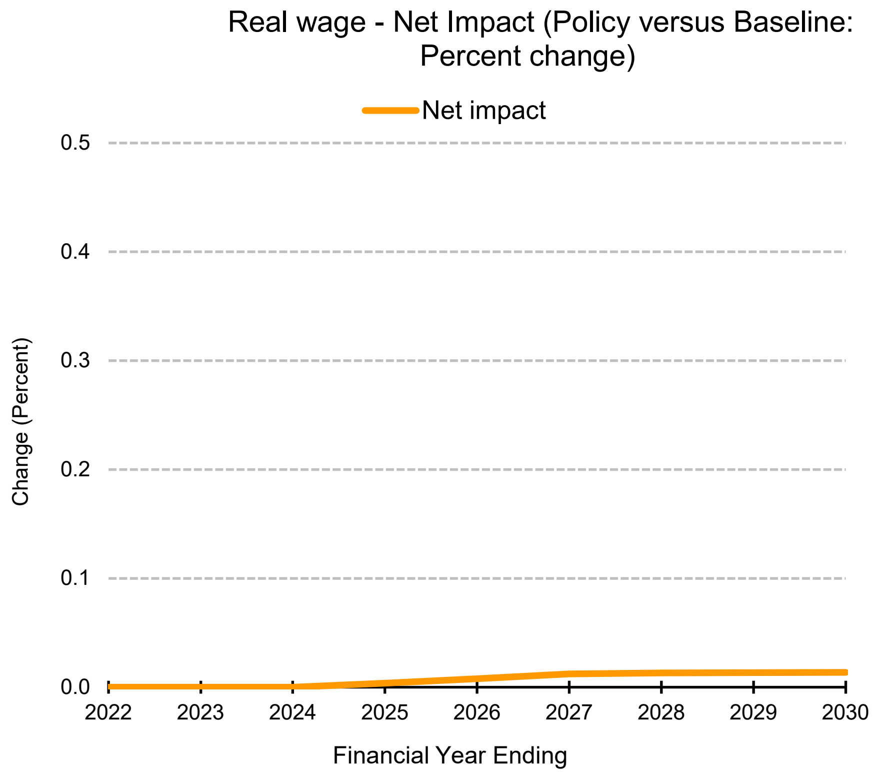


Population		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	100.2	100.5	100.9	101.2	101.7	102.1	102.6	103.2
Policy (Index 2020/21=100)	Policy	100.0	100.2	100.5	101.0	101.5	102.0	102.4	102.9	103.4
Net impact (Percent change from base)	Net impact	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

Figure 5.6 - Mineral Processing Scenario: Real wage





Real wage		2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline (Index 2020/21=100)	Baseline	100.0	103.1	106.1	109.0	111.8	114.5	117.2	119.9	122.6
Policy (Index 2020/21=100)	Policy	100.0	103.1	106.1	109.0	111.8	114.5	117.3	119.9	122.6
Net impact (Percent change from base)	Net impact	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01

Source: SACES calculations using VURM 2017-18 (COPS, 2021) and GEMPACK software (Horridge et al, 2018).

6. References

Adams, P.D., Dixon, J.M. & Horridge, J.M. (2015), *The Victorian University Regional Model (VURM): Technical Documentation*, Version 1.0, Centre of Policy Studies Working Paper G-254.

Australian Bureau of Statistics (ABS). (2021), *State Accounts 2020/21*.

Australian Bureau of Statistics (ABS). (2022), *National, State and Territory Population, September 2021*.

Commonwealth of Australia (2021), *2021 Intergenerational Report*, the Treasury, Canberra.

Department of Energy and Mining (DEM) (2021), *South Australian mineral resource production statistics for the six month ended 30 June 2021*, Report Book 2021/00018, Energy Resources Division, South Australia.

Department of Energy and Mining, Government of South Australia. (2022), *South Australia Hydrogen Export Modelling Tool: Test 3, 31 January 2022*, available at https://hydrogenexport.sa.gov.au/

Horridge J.M., Jerie M., Mustakinov D. & Schiffmann F. (2018), *GEMPACK manual,* GEMPACK Software, ISBN 978-1-921654-34-3.