DFFE Integrated model

Socio-economic analysis

Overview

- South African Socio-economic model
- Limitations of approach
- Results
  - Key messages

Socio-economic model

- New model was developed specifically for this project – **South African Socio-economic model**
- Original intention was to use E3ME as it is one of the leading models for comprehensive economic modelling of policy and technology scenarios and one of the most advanced (non-CGE) economic models
- However, E3ME cannot be directly connected with the integrated model due to the structure of the model (written in Fortan and it is very complicated to connect)
- In addition, not fit for purpose:
  - Multi-regional with lots of data and unnecessary level of detail
  - Very complex and difficult to update, with a long running time

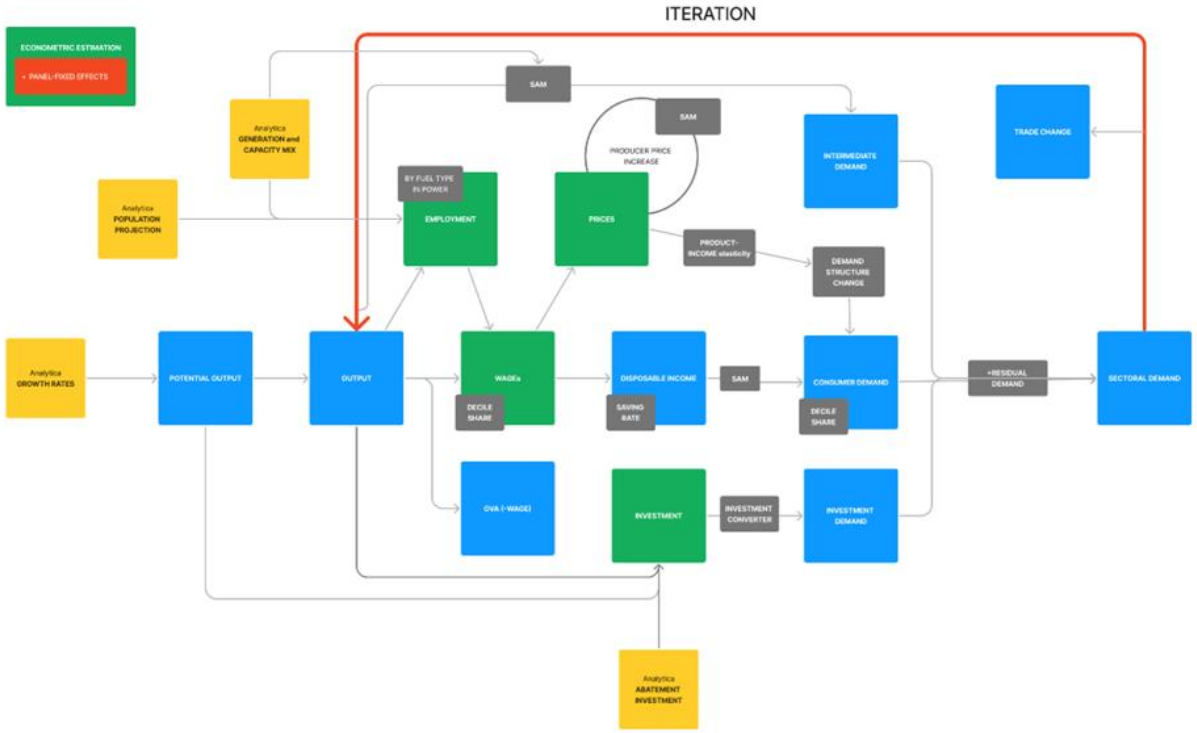
South African socio-economic model

- Seeks to enhance the integrated model by giving economic feedback on the effects of the investments in the energy system
- Increases the complexity of the integrated model by measuring the economic impacts of the PAMs at the national, industry and household level
- Customised to the integrated model and reflects the SA economy

South African socio-economic model

- Easily connected to the Integrated model
  - Model written in Python
- Follows a hybrid approach – potential output growth is received from the integrated model
- Core of the model is a Social Accounting Matrix (SAM)
- Focuses on South Africa (other regions not modelled)
- Since it only uses South Africa macro- and micro-data it simplifies updates and has a much shorter running time

Overview of socio-economic model



- Model is designed to solve each year of the scenario run
- Exogenous inputs from the Integrated model include:
  - Potential sectoral growth rates
  - Investment
  - Population projection
  - Generation mix
- Yearly solution iteratively estimates the socio-economic indicators

Socio-economic indicators

- Output per sector
- GVA per sector
- Employment/unemployment per sector
- Green employment – share of employment in green industries
- Wage - per aggregate sector industry wages
- Disposable income – portion available
- Investment – per sector
- Consumption – by products/income decile/sectors

Limitations

- Simplified version of reality (as with all economic models)
- The model's behavioural assumptions are based on **historical data –** doesn't account for the development of new, disruptive technologies/different behavioural responses
- Despite the relatively high level of sectoral disaggregation, the structure is fixed
- As such, the model cannot estimate the impacts of changes within sectors and it cannot predict the emergence of new sectors

Limitations

- Does not forecast economic growth
- Does not predict or model where investment comes from or how investment is used (particularly not investment in new industries)
- Does not predict number of jobs by skill level (impact is on wages)

- Relative differences between scenarios help understand system behaviour and likely outcomes rather than absolute numbers

Results

Key messages

- Net positive effect on the economy, on both output and employment in all scenarios
  - Some sectors see a drop in output
- Decarbonisation triggers investment that boosts output
- Household consumption grows at a slightly slower pace

+1.9%
Higher output in all PAMs scenarios in 2025

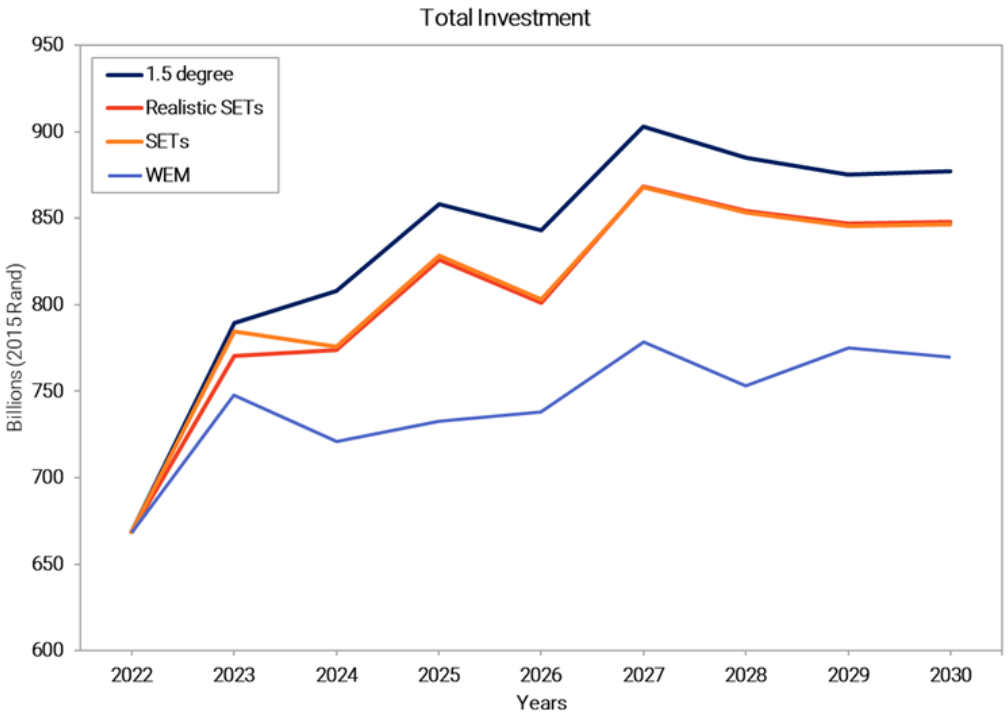
+R144B
Higher output by 2030 in the SETs scenario

+1%
More jobs in all PAMs scenarios by 2030

+0.06m
Higher employment in all PAMs scenarios by 2030

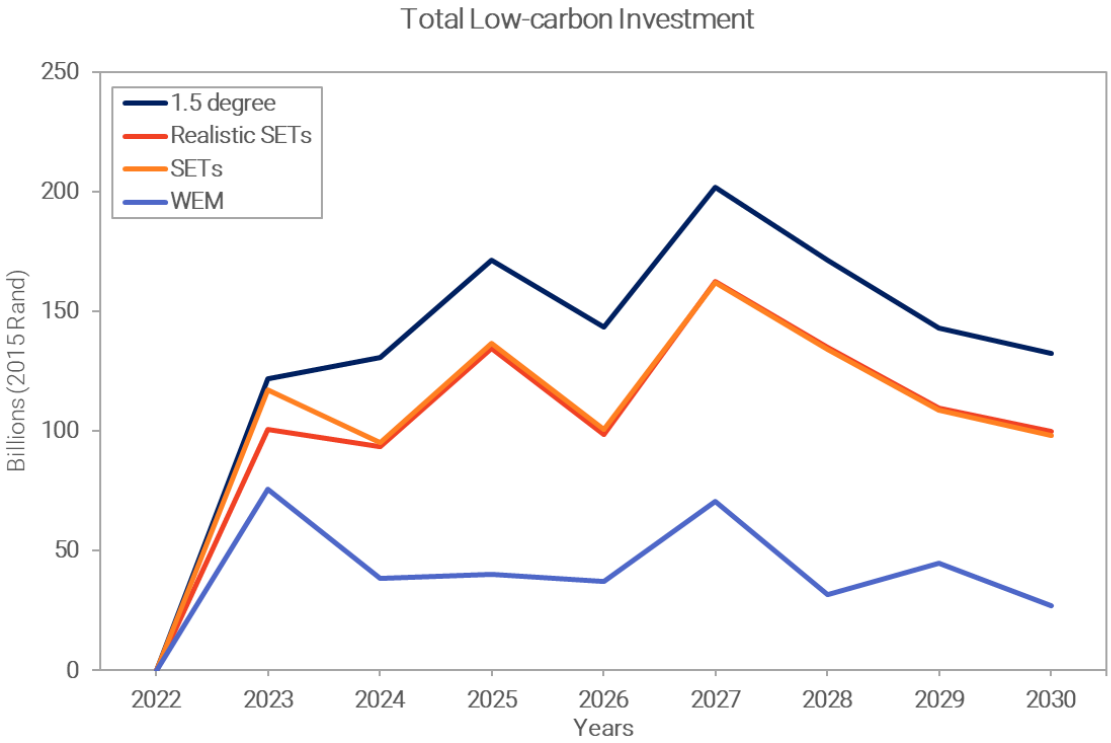
Total investments
(including low carbon investment)

- PAMS scenarios have higher investment than WEM from 2023
- The WEM scenario largely sees investment in the electricity sector



Low carbon investments

- Electricity infrastructure investment
- Investment in mitigation technologies
- ± 15% of total investment



Investment vs JET-IP

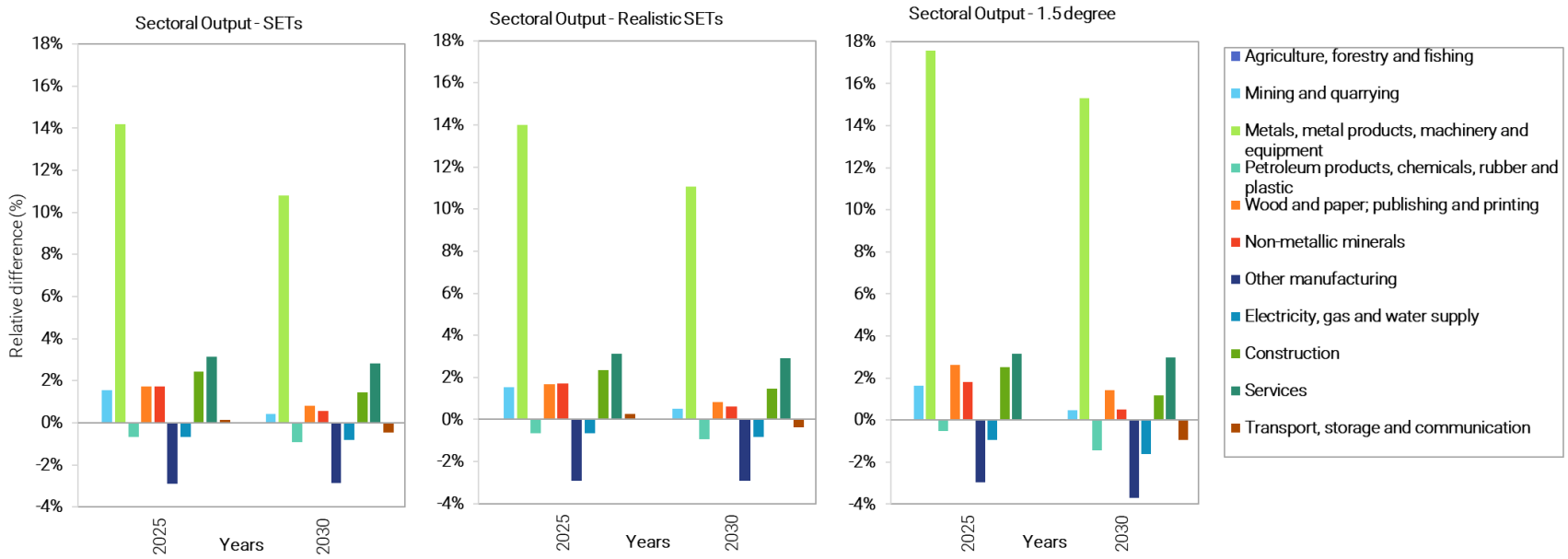
- Difficult to compare directly – timeframes and model purpose
- JET-IP funding (annualized)
  - ±140 billion electricity sector (model lower)
  - ± 300 billion overall (lower than model)

Table 2. JET IP funding requirements per sector, 2023–2027

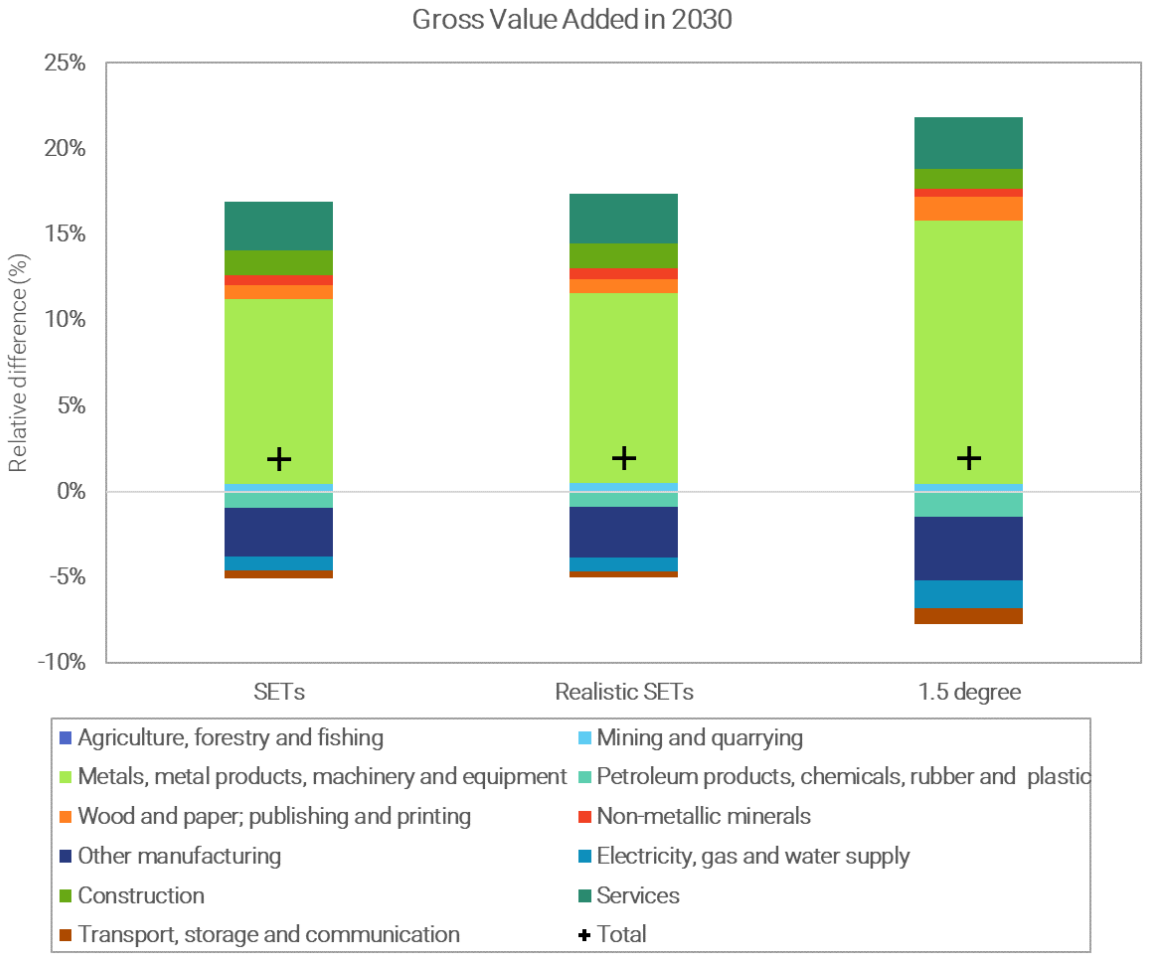
Funding requirements 2023–2027	ZAR billion (US$ billion)
Electricity Sector	711.4 (47.2)
New Energy Vehicle (NEV) Sector	128.1 (8.5)
Green Hydrogen (GH_2) Sector	319 (21.2)
Skills development	2.7 (0.18)
Municipal capacity	319.1 (21.3)
TOTAL	**1 480 (98.7)**

Sectoral output

- Relative difference to WEM



Sectoral output - GVA

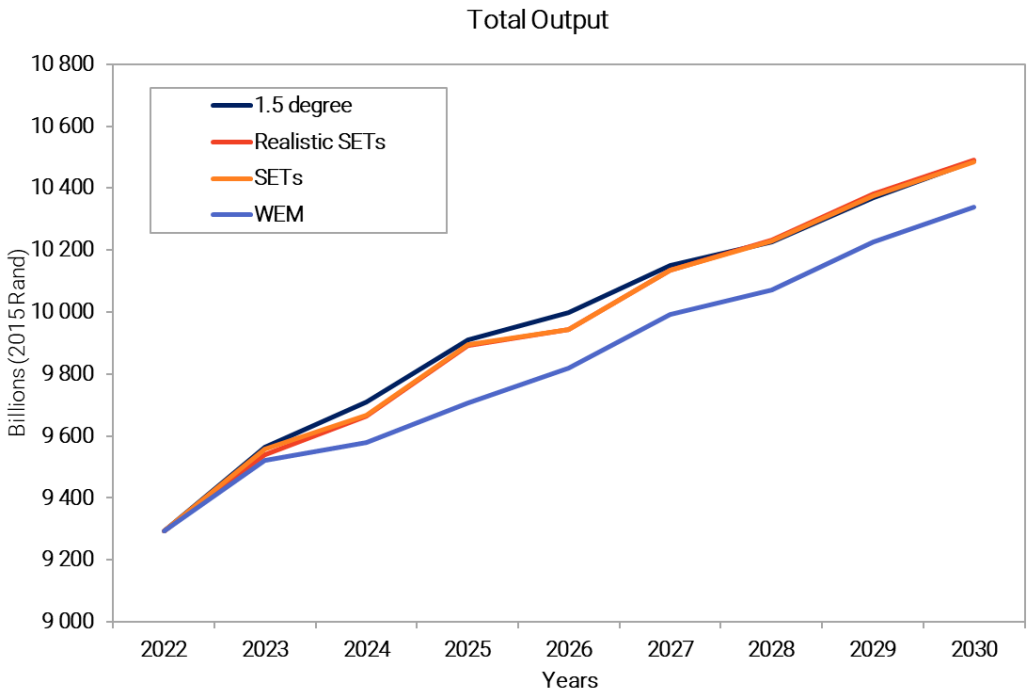


Sectoral output

- Growth is mainly driven by the services and metals sector
  - Construction, non-metallic minerals and wood and paper also benefit
- Sectors that rely on fossil fuels see a decrease in output due to lower demand and higher costs
- Electricity output also decreases as it undergoes a green transition and produces less energy

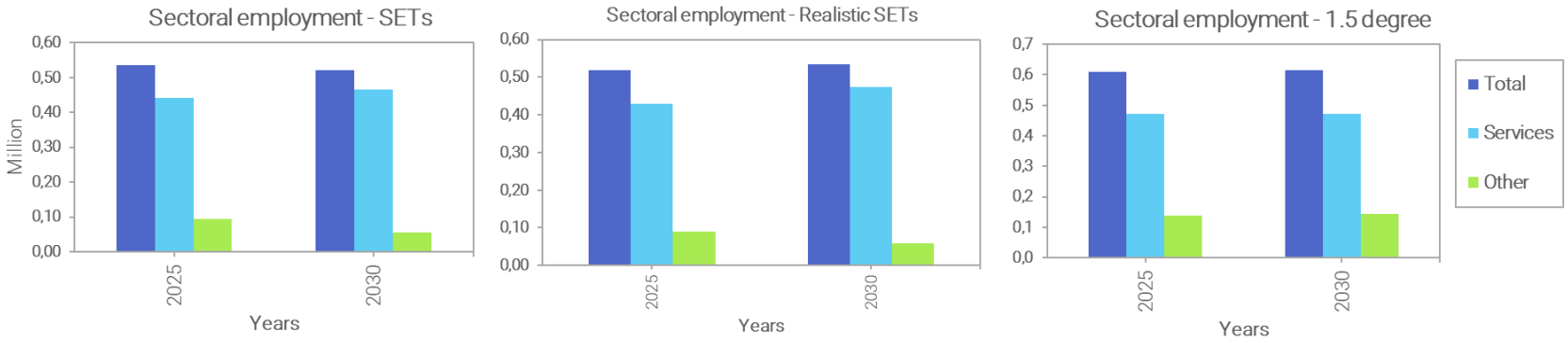
Sectoral output

- Net positive effect on the economy and GVA
- Sectors with higher value-added, like the services sector, growing more rapidly



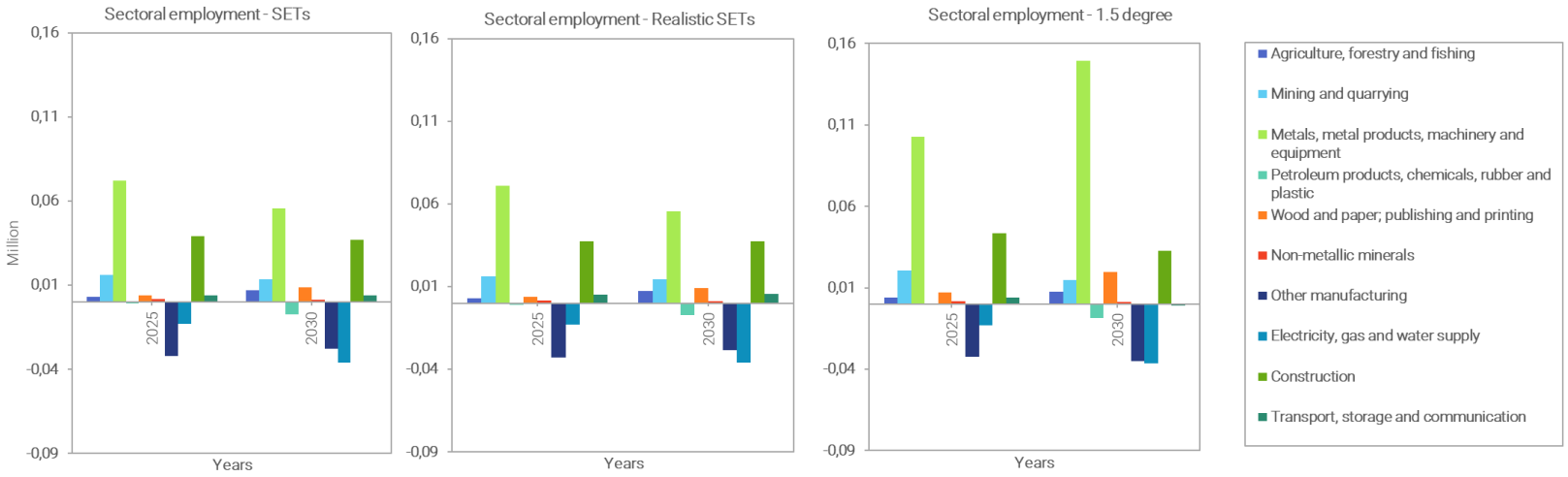
Employment

- Positive effect on employment
- Services sector is the main source of employment growth

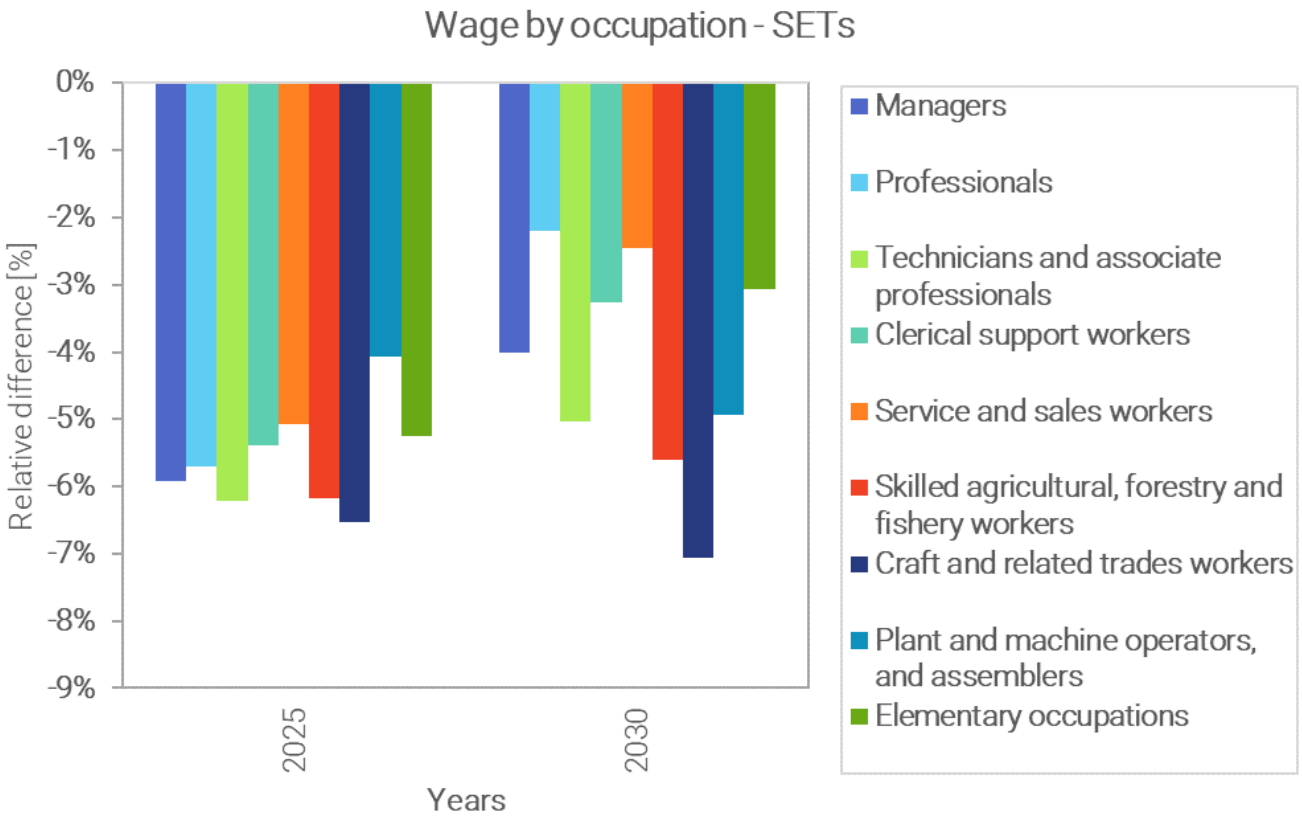


Employment

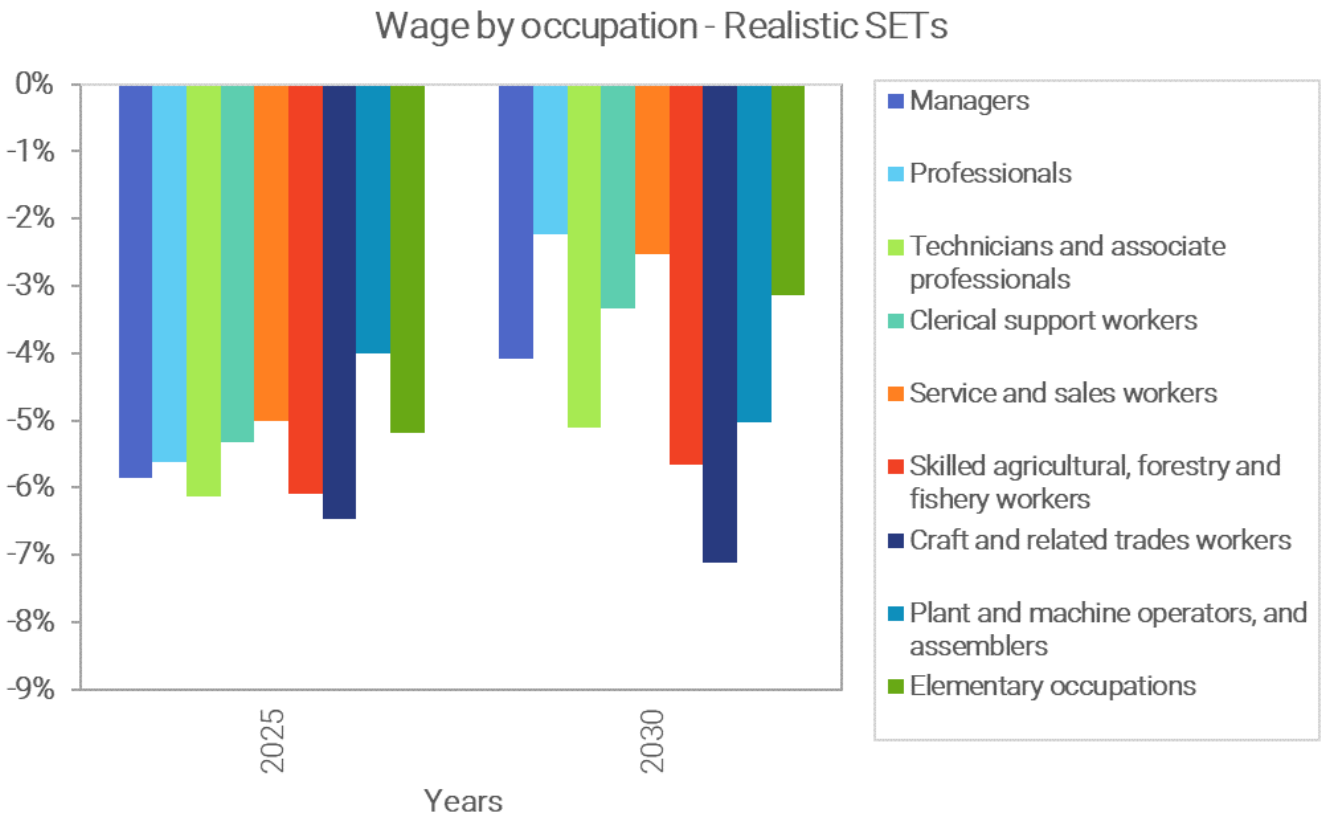
- Non-service sectors see slight growth
  - Mainly in the metals sector, as well as the construction and mining sectors
- Biggest declines are in the manufacturing and electricity sector



Employment


Wage by occupation - SETs
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
-8%
-9%
Relative difference [%]
2025
2030
Years
Managers
Professionals
Technicians and associate professionals
Clerical support workers
Service and sales workers
Skilled agricultural, forestry and fishery workers
Craft and related trades workers
Plant and machine operators, and assemblers
Elementary occupations

Employment


Wage by occupation - Realistic SETs
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
-8%
-9%
2025
2030
Years
Managers
Professionals
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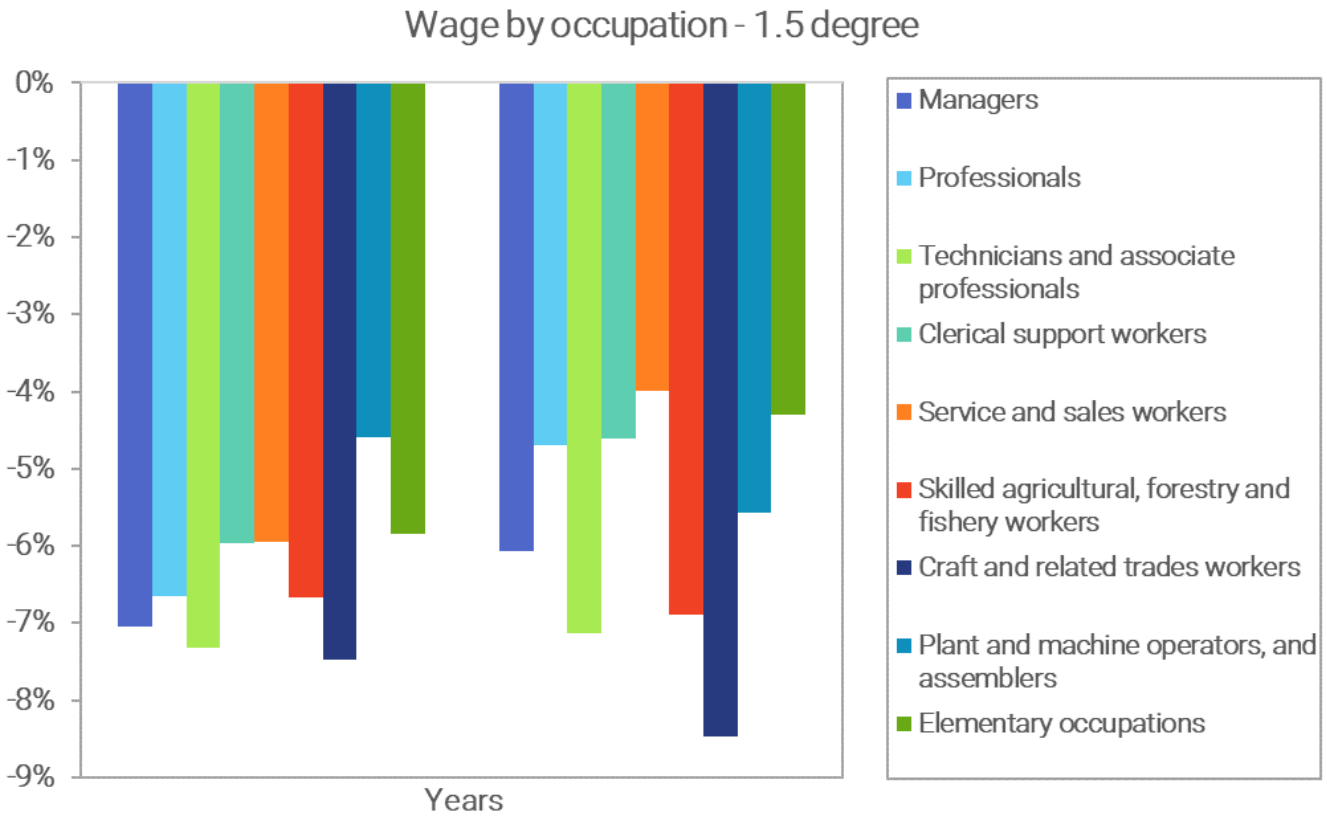
Employment


Wage by occupation - 1.5 degree
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
-8%
-9%
Years
Managers
Professionals
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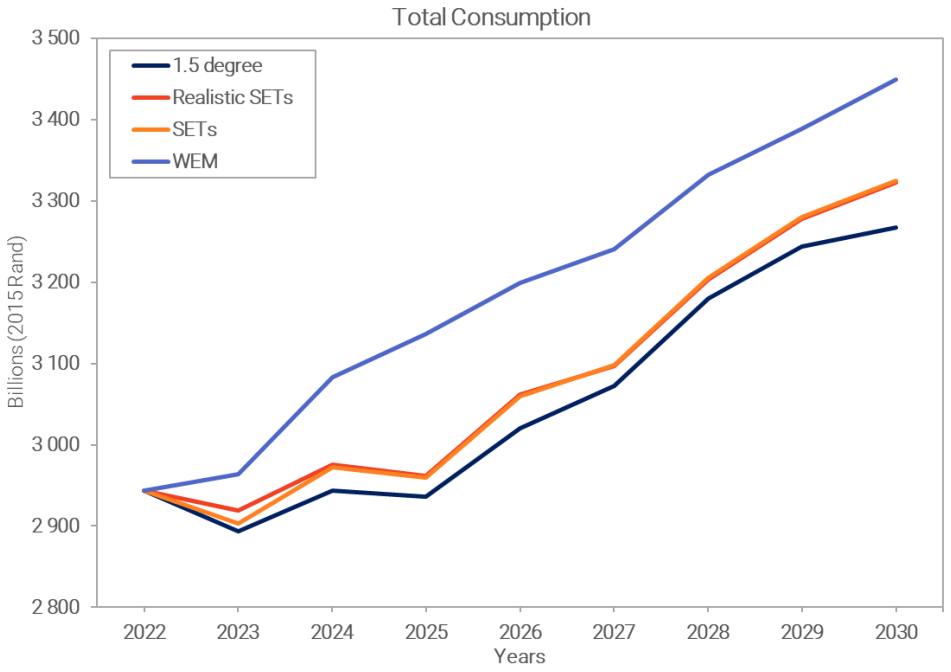
Elementary occupations

Distributional impacts

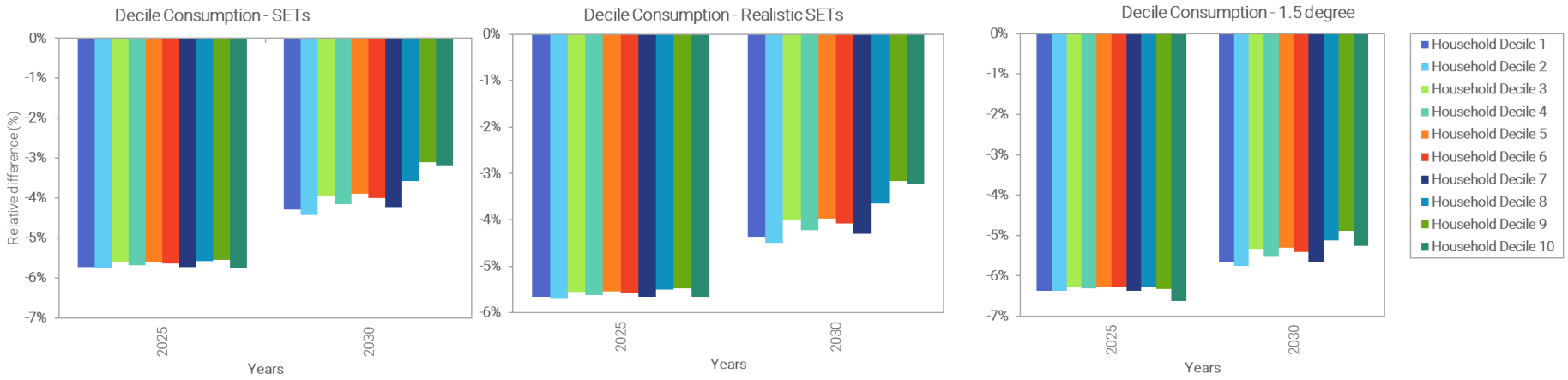
- The PAMs stimulates more investment but slightly reduces rate of increase in households' disposable income and thus consumption
- Although household consumption is lower than the WEM, consumption levels rise in all scenarios



Distributional impacts

- Slightly different distribution of investments across PAMs scenarios can result in different impacts on inequality
- In percentage terms the drop across income deciles is comparable, however there are big gaps in absolute amounts
- Because high-income households spend significantly more than low-income ones, most of the reduction occurs in the top deciles
- This implies that the required investment to reach mitigation targets is mainly paid for by top deciles

Distributional impacts



THANK YOU!

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REPUBLIC OF SOUTH AFRICA

2030 NDP

30 YEARS OF FREEDOM