# Socio-economic modelling of Sectoral Emissions Target allocations in South Africa

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forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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clarity from complexity

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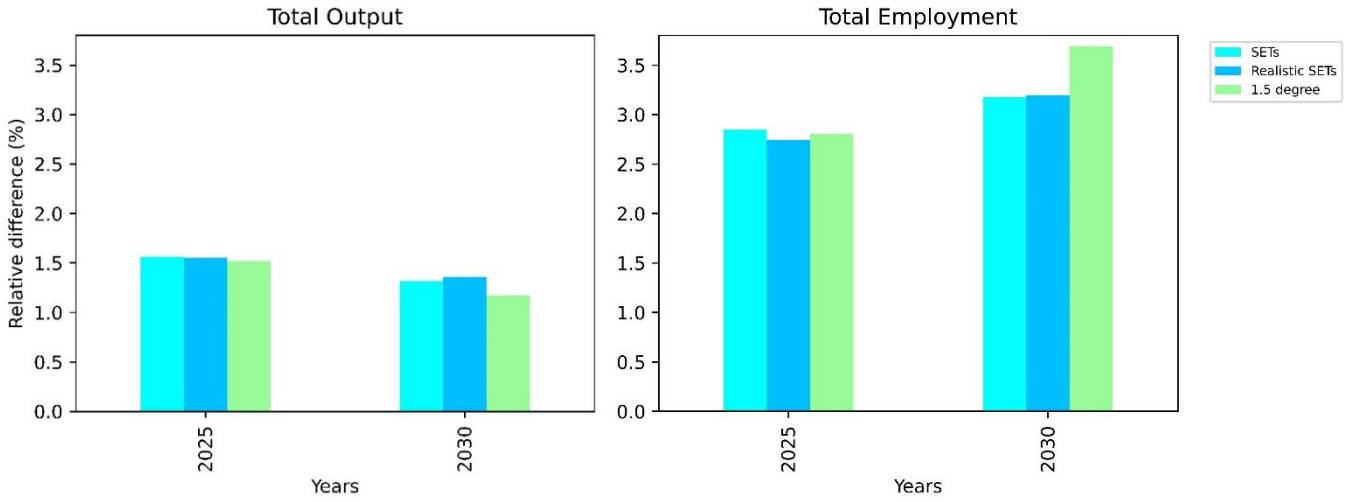
# Executive Summary

This report gives a short overview of the socio-economic outcomes of a baseline scenario and three decarbonisation scenarios until 2030 in South Africa. The results are calculated using the new socio-economic model created for the Department of Forestry, Fisheries and the Environment of South Africa. The four scenarios analysed in this report are: (1) Baseline; (2) Sectoral Emission Targets (SETs); (3) Realistic SETs; and (4) 1.5 degree.

The results show that decarbonisation has a positive net effect on the economy. Decarbonisation triggers investment that boosts output across the economy through intersectoral links. While some sectors see a drop in output during the transition period, the overall effect on output and employment is positive in all scenarios. However, household consumption grows at a slightly slower pace in the decarbonisation scenarios than in the baseline as these scenarios need more investment.

Figure 1 Total output and employment by scenario, relative difference from baseline




Note(s): Charts show relative differences compared to the Baseline scenario.
Source(s): Based on own modelling.

**+1.5%**
**Higher output in all decarbonisation scenarios in 2025**

**+R137B**
**Higher output by 2030 in the SETs scenarios**

**+3%**
**More jobs in the decarbonisation scenarios by 2030**

**+0.5m**
**Higher employment in all decarbonisation scenarios in 2030**

# Economic results

## The new socio-economic model

The model seeks to enhance the integrated model of the Department of Forestry, Fisheries and the Environment of South Africa (DFFE) by giving economic feedback on the effects of the investments in the energy system. The model increases the complexity of the integrated model by measuring the economic impacts of the pathways at the national, industry and household levels. The model is customized to the integrated model and faithfully reflects the South African economy.

The main connections between the integrated model and the new socio-economic model are sectoral output and low-carbon investments. The socio-economic model takes low-carbon investment as exogenous inputs, while the sectoral output growth rates are used as possible output growth rates. The total demand for each sector consists of four parts: consumer demand, intermediate demand, investment demand, and leftover demand.

- The consumer demand calculation is based on the econometric estimation of sectoral estimation, which then translates into disposable income of households and then finally into consumption, incorporating price effects.
- Intermediate demand is calculated from applying South Africa's input-output table, which is derived from a Social Accounting Matrix (SAM).
- Investment demand is given by the estimated econometric relationship between investment and output, plus abatement investment figures received from the Energy model and applying an investment converter between investment and demand.
- Residual demand, which accounts for government spending and international trade.

Once the four components of demand have been calculated, sectoral output is set equal to their aggregated value, ensuring that supply equals demand in an iterative process.

## Low-carbon investments

Low-carbon investment defines the level of decarbonisation ambition across the scenarios, representing the capital requirements of taking necessary steps and action needed to implement mitigation targets. Low-carbon investments represent a key primary exogenous input of the socio-economic model, and these investments affect the economy through supply chain links, leading to indirect investments in other sectors.

The analysis consists of four scenarios with different ambitions and investment levels. The baseline scenario reflects the policies and measures that are already in place and gives a projection based on them for the time period until 2030. This results in total investment levels of 750 billion Rand in 2023, which remains relatively stable over the years and reaches approximately 760 billion in 2030.

The three additional scenarios have higher total investment levels, already from 2023 onwards, as shown in Figure 2. The SETs and Realistic SETs scenarios follow almost identical investment patterns. Since investment influences other macroeconomic indicators, the two scenarios are also related in the other variables. By 2025, the SETs and 1.5 degree scenarios have a similar trend with a total annual investment

of about 830 billion Rand in 2025. Several policies are estimated to end in 2026, which results in a significant drop in total investment of the SETs scenarios, being slightly higher than the baseline with 750 billion Rand and the 1.5 degree scenario at 800 billion Rand. Afterwards, investment consistently increases in all scenarios, reaching approximately 840 billion Rand in the SETs and 860 billion Rand in the 1.5 degree scenario.

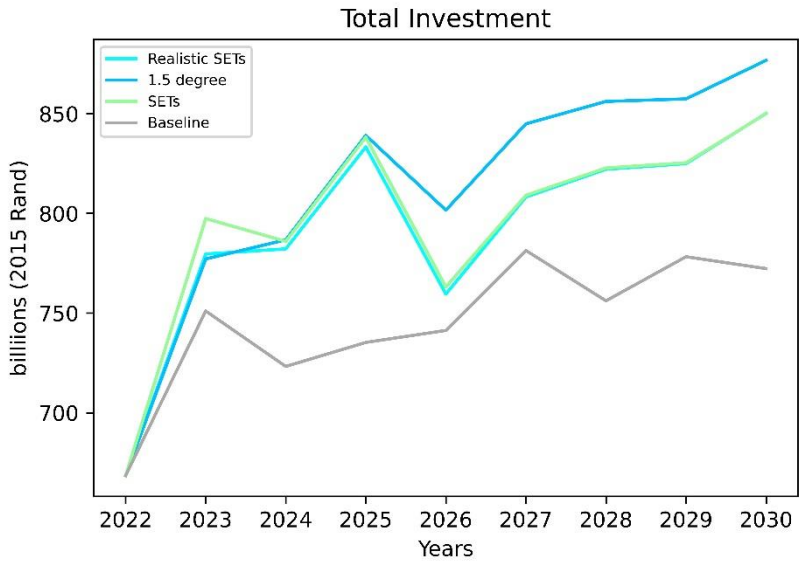



Figure 2 Total investment by scenario, billions, 2015 Rand

The baseline scenario envisages high investment spending in the electricity sector, while in decarbonisation scenarios investments in the electricity sector are lower but investments in other sectors such as agriculture, services and transport are higher. This allocation of investments represents how more ambitious climate policy needs to consider not only the development of the electricity sector as the primary source of clean energy, but also focus heavily on other large emitters to reduce their overall emissions.

## Sectoral output

The results show that decarbonisation has a positive net effect on the economy. The key factor behind the expected economic growth is low-carbon investment, as it boosts demand and creates new possibilities for local suppliers through intersectoral links. Consequently, output is 1.17% above baseline in the 1.5 degree scenario in 2030, and by 1.32% (R137 billion in absolute terms) in the SETs scenarios (see Figure 3). The overall benefits are greater than the costs, while the economy undergoes structural changes. In addition, decarbonisation has an even more positive effect on gross value added (GVA), as sectors with higher value-added, like services, grow more rapidly. In 2025, GVA in all decarbonisation scenarios is 1.7% higher than in the baseline, while in 2030 it is 2% and 1.8% higher in the SETs and 1.5 degree scenarios, respectively.

The SETs scenarios show a significant decline in output in 2026, which is caused by a fall in low-carbon investment. This creates a disturbance in the economy, as some sectors face lower demand and have to adapt their production and employment levels. Output of these sectors improves in the following years, as low-carbon investments starts again, but it stays lower than in the 1.5 degree scenario.

**R137b**
**Increase in total output by 2030**

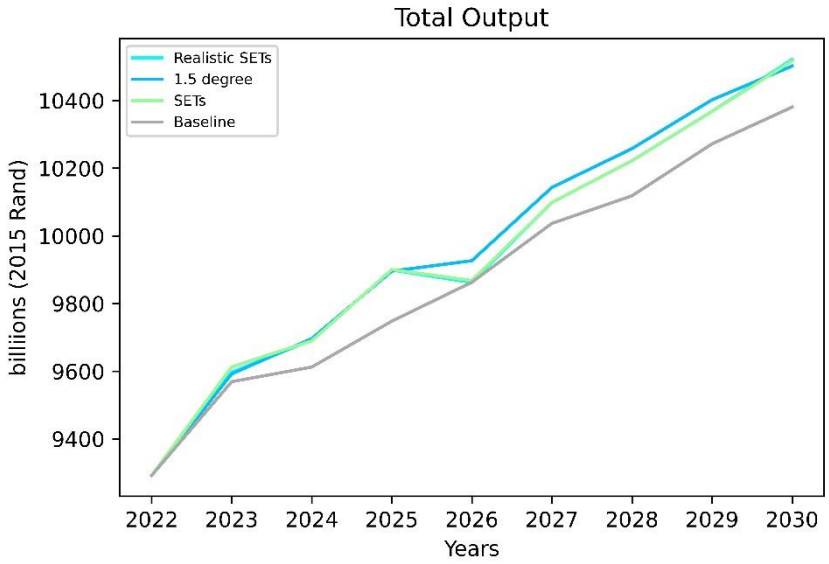



Figure 3 Total output by scenario, billions, 2015 Rand

Figure 4 shows how the output of different sectors changes under the decarbonisation scenarios. In the baseline scenario, the average output growth until 2030 is 1.4%, mainly driven by the services and metals sectors. Construction, mining and non-metallic minerals also benefit from the low-carbon investment, since they supply some of the goods and services needed for the energy transition. The sectors that rely on fossil fuels, such as petroleum, transport and other manufacturing face a drop in output due to the lower demand and higher costs of their products. Electricity also has a lower output, as it undergoes a green transition and produces less energy than in the baseline scenario.

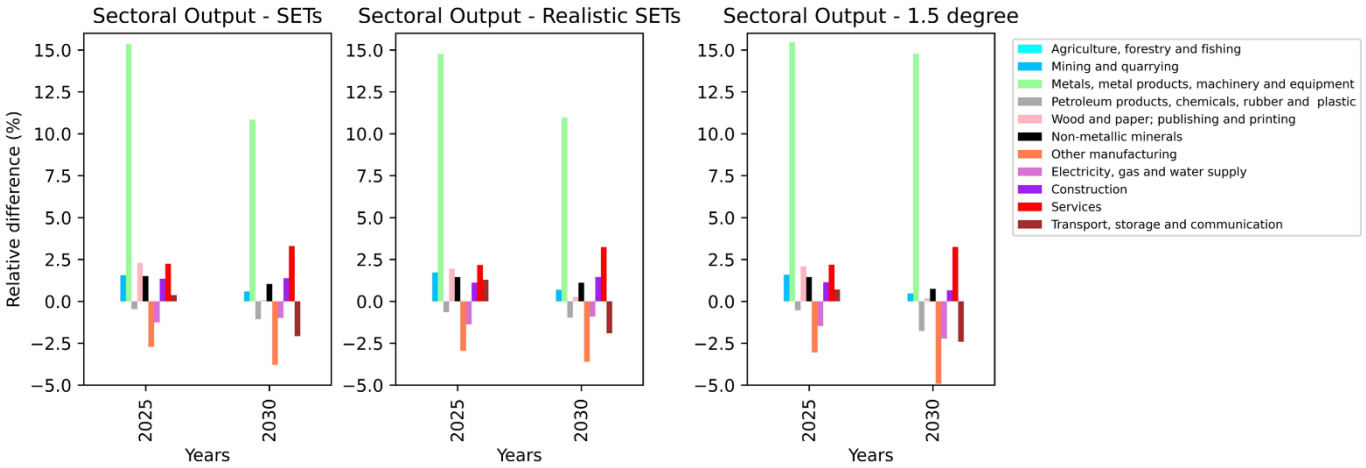



Figure 4 Sectoral output impacts by scenario, relative difference from baseline

Metals production and the services sector are the main beneficiaries of the low-carbon investment, both in absolute and relative terms compared to the baseline. The services sector grows faster than in the baseline scenario because it gains from the higher economic activity and income. By 2030, the sector reaches a 2.5-3% relative increase in its output compared to the baseline. In addition to metals, other mining and construction are also growth sectors in the decarbonisation scenarios, as they supply the goods and

services required for the energy transition. The metals sector increases 10% more than the baseline, while construction has a more modest increase at 1-1.5% relative difference.

The low-carbon investment does not affect all sectors in the same way. The sectors that rely on fossil fuels, such as manufacturing, petroleum, and transport, see a drop in output because of the lower demand and higher costs of their product due to the emissions-intensive production processes. The output of the manufacturing sector is 2.5% lower than the baseline projections in 2030, while the output of the transport sector is only 1% lower in the same year. The transport sector suffers less than other sectors because it can adopt electric vehicles and their related technologies, which is why the sector grows faster than the baseline expectations in 2025. However, this also shows that using only technological solutions to meet emissions targets is not sufficient in the long run.

## Employment

Moving to renewable energy sources is expected to generate new jobs in different parts of the economy. The extra job creation is expected to happen because of the multiplier effects of higher investment levels, which are assumed to help achieve more ambitious mitigation goals. The services sector is the main source of employment growth in all scenarios, as it benefits from the increased demand for low-carbon and energy-efficient services, such as public transport, recycling, education, health care, and tourism.

The changes in employment by sector for each scenario in 2030, compared to the baseline scenario, are shown in Figure 5. All scenarios have significant and positive employment impacts, especially in the services sector, which is the biggest economic sector in South Africa, accounting for nearly half of the total national output. Moreover, the services sector is labour intensive, so the rise in the output of the services sector has a larger effect on employment. In 2025, the total expected employment gains are about 400 thousand more jobs than the baseline in all other scenarios. Of this, 300 thousand are within the services sector and 100 thousand in other sectors.

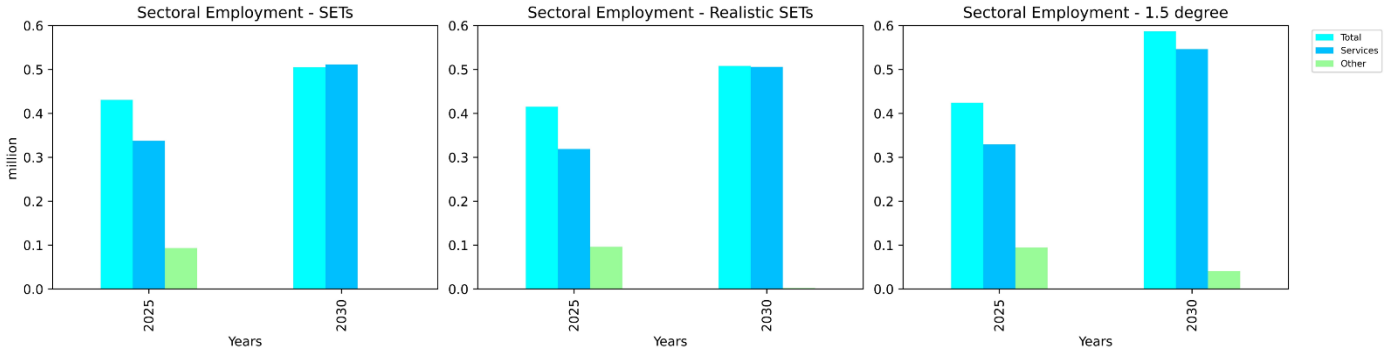



Figure 5 Employment impacts by scenario, absolute difference from baseline

Almost all the new jobs by 2030 will come from the services sector, which will add more than 500 thousand jobs above the current level in the two SETs scenarios. The other sectors will have little change in employment, in the SETs scenarios it is close to zero by 2030, which means either a decrease in demand for that sector, or an increase in productivity if total output is higher. Likewise, in the 1.5 degree scenario, the new jobs are even more than in the SETs scenarios, reaching almost 600 thousand, with 550 thousand of them in the services sector. In all scenarios, the services sector is expected to grow relatively by around 3-

3.5% in 2025 and 5-5.5% compared to the baseline.

The non-services sectors include agriculture, industry, and construction. The non-services sectors include both losing and gaining sub-sectors, but the net impact is still slightly positive in all scenarios, as the gains outweigh the losses. The non-services sectors that benefit the most from the low-carbon transition are the metals, metal products and machinery sector, which create around 75-115 thousand more jobs in all scenarios. The sector is essential for making green technologies that lower carbon emissions, and this increases the demand for it. The two SETs scenarios result in about 75 thousand new jobs each year in 2025 and 2030, while the 1.5 degree scenario raises the 75 thousand estimate to 115 thousand by 2030. Apart from the metals sector, the construction sector, as well as mining and quarrying, are sectors that grow significantly with an extra 15-25 thousand jobs. The metals sector would experience a 20-30% increase in its total employment from the extra jobs, while the other growing sectors would have a 3-7% increase.

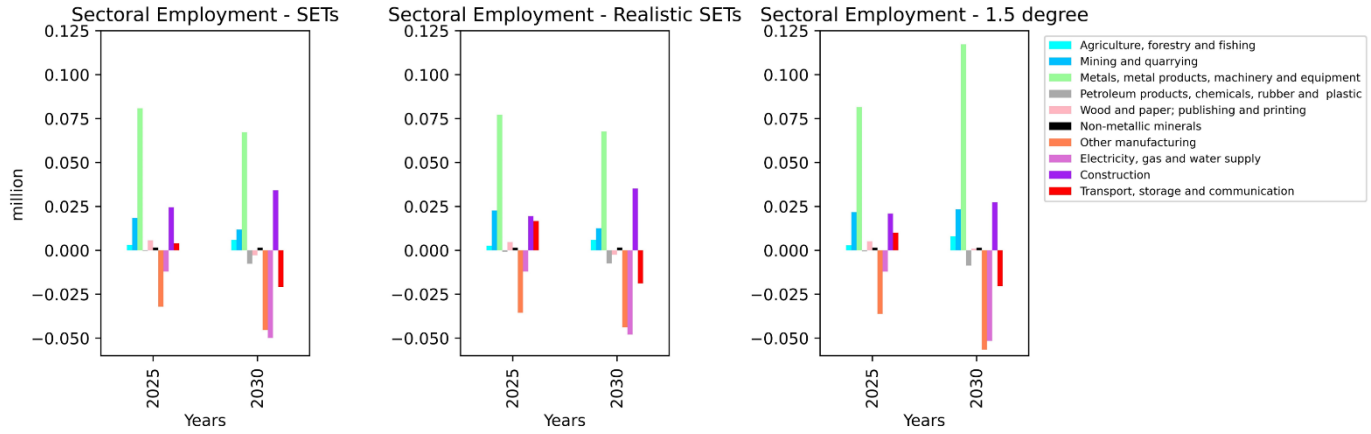



Figure 6 Employment impacts in the non-services sectors by scenario, absolute difference from baseline

The biggest declines are in the sectors of manufacturing and electricity and the sector of transport, storage and communications. Electricity and manufacturing each drop by about 40-50 thousand jobs by 2030, while transport loses around 25 thousand jobs. However, in all decarbonisation scenarios there are more jobs in the transport sector in 2025, due to the higher short-term investment in green technologies.

A key challenge for the shift to a low-carbon economy is to make sure that workers who are displaced from shrinking sectors can access new opportunities in expanding sectors. This requires a high level of labour mobility, both across regions and across occupations. Labour mobility relies on several factors, such as the access to training and education programs, the recognition of skills and qualifications, the provision of social protection and income support, and the elimination of barriers to mobility. Improving labour mobility can help lower the social costs of decarbonisation and increase its benefits, as well as promote innovation and productivity growth.

## Distributional impacts

The shift to a low-carbon economy also poses a challenge of making sure that low-income households are not worse off because of the net zero policies. Low-income households usually use more of their income on goods and services that need a lot of energy, such as heating, electricity, and transport. Besides, low-income households may have less opportunity to use low-carbon technologies, such as renewable energy sources or electric vehicles, and may face more difficulties to adjust to the changing labour market conditions. Therefore, it is important to plan policy actions that consider the distributional effects of the shift and provide enough help and compensation to low-income households. This could involve direct transfers, subsidies, tax credits, or specific social programs that aim to lower energy poverty and increase energy efficiency. By reducing the harmful effects of the shift on low-income households, policy makers can improve the social support and possibility of the net zero policies and ensure a just and inclusive shift.

In the SETs, Realistic SETs, and 1.5 degree scenarios, more investment stimulates the economy, but it also slightly reduces households' disposable income and hence consumption compared to the baseline. Household consumption falls by over 5% in all the decarbonisation scenarios in 2025; however, in the SETs scenarios the difference narrows to around 4% by 2030. Household consumption is the lowest in the 1.5 degree scenario because this scenario has the most investments. Even though household consumption is smaller in the decarbonisation scenarios than in the baseline, it is important to note that consumption levels rise in all four scenarios. In the baseline, consumption grows by an average of 2% per year, while in the SET and 1.5°C scenarios, the rates are 1.6% and 1.3%, respectively. Hence, household consumption only rises at a slower pace in these scenarios than in the baseline.

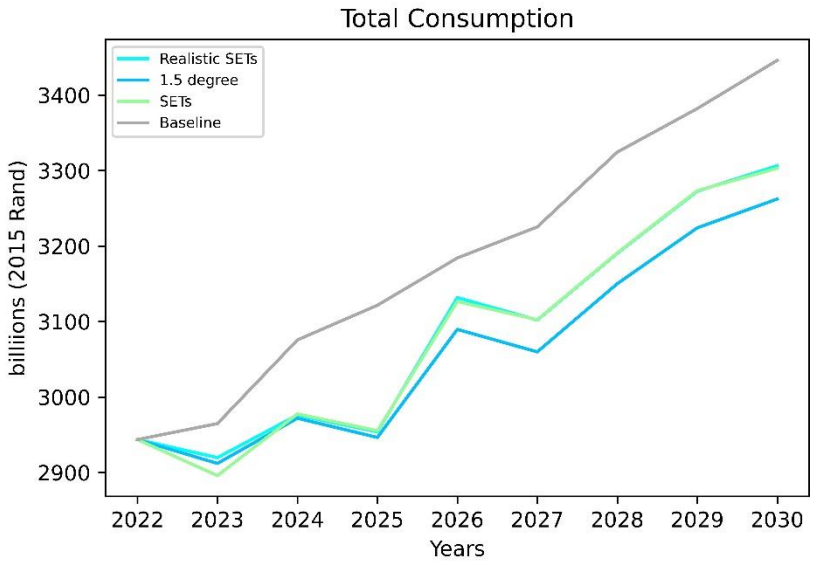



Figure 7 Total household consumption by scenario, relative difference from baseline

The low-carbon investments affect the household deciles in a similar way, but there are minor differences. In 2030, in the SETs and Realistic SETs scenarios the poorest income deciles see the biggest drop in consumption, while in the 1.5 degree it is the richest decile both in 2025 and 2030. This shows that the slightly different distribution of investments across the scenarios can result in different impacts on inequality.

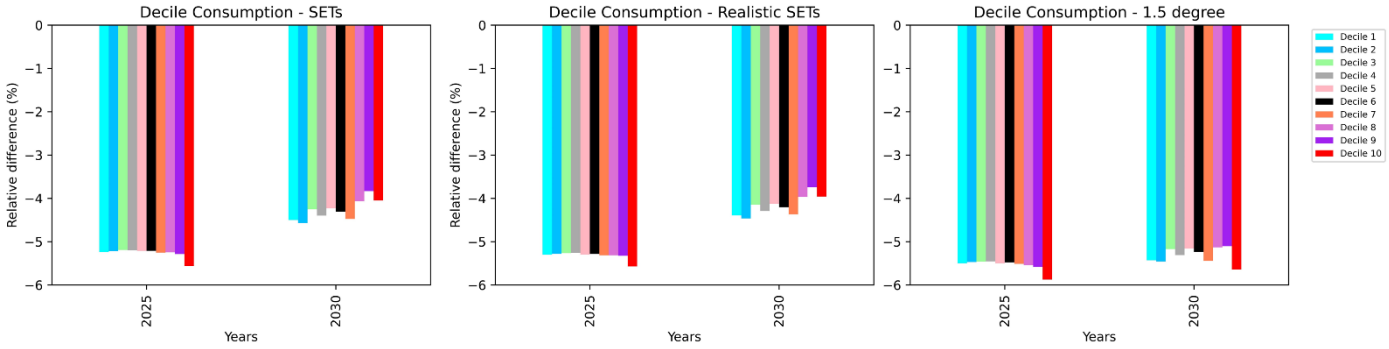



Figure 8 Distributional impacts by scenario, relative difference from baseline

The consumption drop is comparable in percentage terms across the income deciles, but there are big gaps in the absolute amounts. Because the high-income households spend a lot more than the low-income ones, most of the reduction occurs in the top deciles, which implies that the required investment to reach the mitigation targets is mainly paid by the top deciles.