The development of South Africa's energy emissions path and the implications for our Nationally Determined Contribution

Work currently in progress at UCT on South Africa's NDC and long-term emissions pathway

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SA-TIED
Southern Africa – Towards Inclusive Economic Development

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The Paris Agreement and Nationally Determined Contributions

- The Paris Agreement (December 2015) is based on:

1. A global temperature goal: "..well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C". 1.5°C is new – a recognition, coming out of the science and a "structured expert dialogue" (2013-15) on the adequacy of the long-term 2°C goal.
2. A cycle of action and reflection: countries submit Nationally-Determined Contributions (NDCs) to the global mitigation effort – the collective effect of NDCs (including implementation) is assessed in a "global stocktake" to determine progress against the global goal – countries submit next round of NDCs, taking progress and additional required effort into account.
3. The first round of NDCs were assessed by the UNFCCC Secretariat in a "synthesis report" and found to lead to global warming of 2.7-3.4 °C (unconditional/conditional NDCs).

South Africa's NDC

- South Africa submitted its Intended Nationally Determined Contribution in 2015, and ratified the Paris Agreement in 2016 at which point its INDC became its NDC
- Our NDC consists of a mitigation, an adaptation and a support component – here we will consider only the mitigation component
- The mitigation component consists of a commitment to limit emissions to a range (398-614 Mt CO_2-eq) for 2025 and 2030, based on the "Peak, Plateau and Decline" emissions benchmark range contained in the National Climate Change Response White Paper (2011).
- The PPD is in turn built on a foundation developed in the the Long Term Mitigation Scenarios process, concluding in 2007, in turn based on older data and an assessment of what emissions reductions would be "required by science"

Two key shifts in the last five years, since South Africa's first NDC

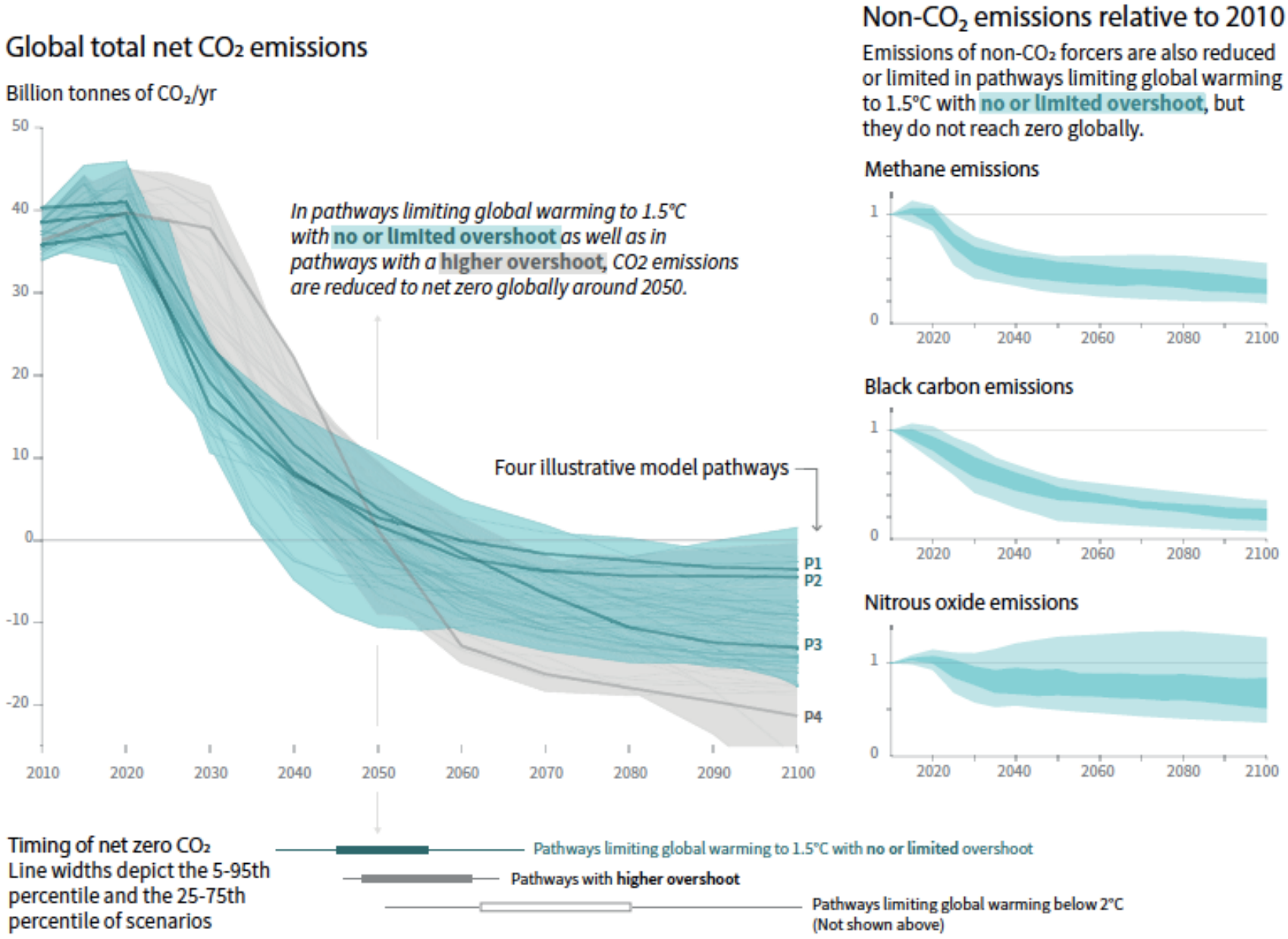
1. A major shift in the long-term global temperature goal - from 2 degrees previously to "well below 2 degrees" and 1.5 degrees. The IPCC's Special Report on 1.5 degrees confirmed the significant difference in climate impacts between 2 and 1.5 degrees, and emphasized current impacts.
2. A dramatic change in the relative prices of key energy technologies, which in turn changes the cost of mitigation significantly, including in South Africa, and changes mitigation priorities.

National Climate Change Response White Paper:

- “Make a fair contribution to the global effort to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.”
- “South Africa’s approach to mitigation.. ..balances the country’s contribution as a responsible global citizen to the international effort to curb global emissions with the economic and social opportunities presented by the transition to a lower-carbon economy as well as with the requirement that the country successfully tackles the development challenges facing it”

What is a “fair” contribution?

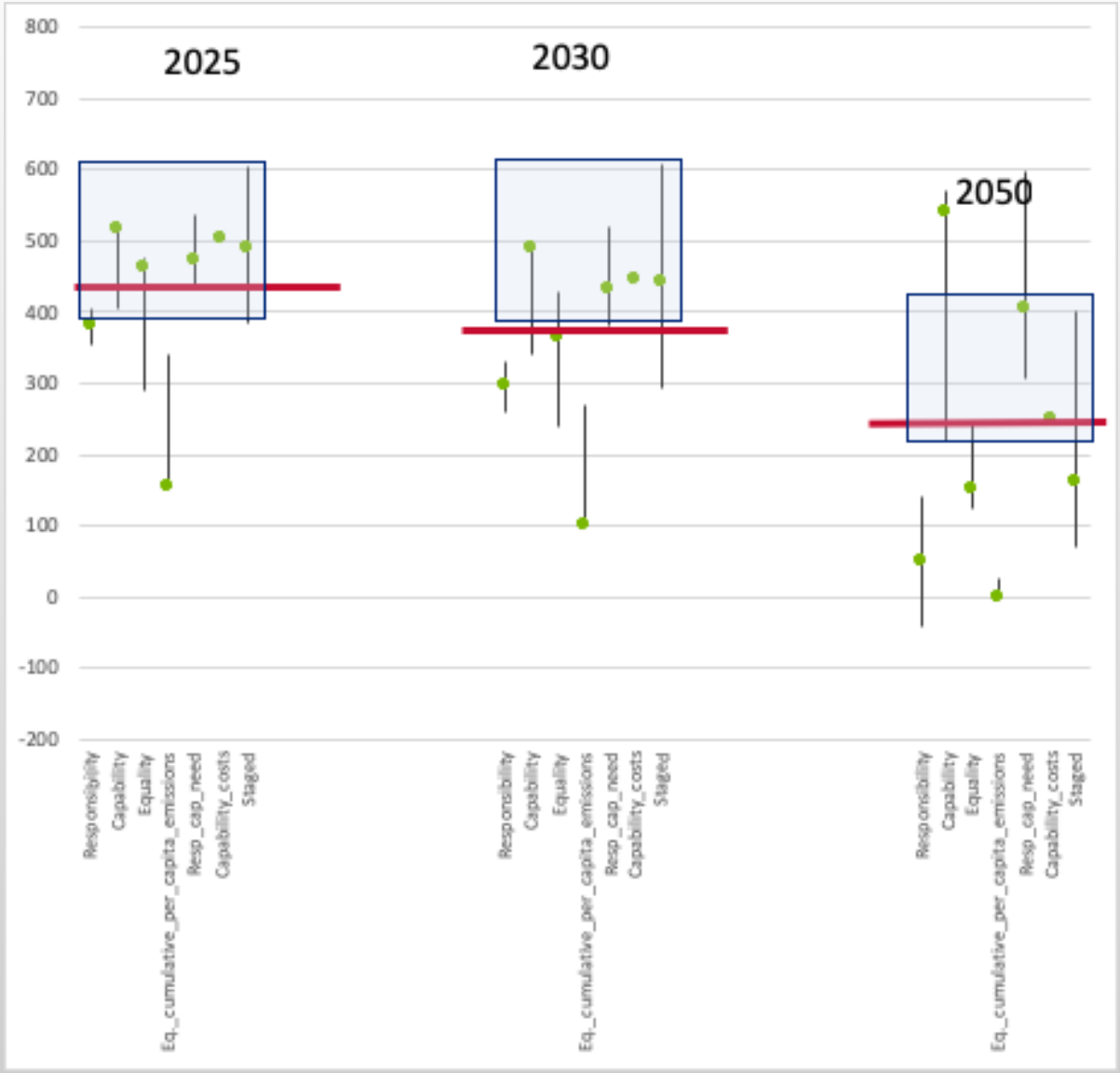
- Collectively, current NDCs are inadequate
- The “burden sharing” problem is generally expressed as how to divide either a) the global carbon budget, or b) the mitigation effort (reduction from a global baseline) in relation to a specific temperature goal
- South Africa’s current NDC was assessed as “fair” in relation to (a) the lower part of the PPD, (b) in relation to an older baseline, and (c) in relation to a 50% chance of not exceeding 2 degrees. All of this is out of date.
- The IPCC’s Special Report sets new benchmarks for meeting both 1.5 and 2 degree targets


Global total net CO_2 emissions
Billion tonnes of CO_2/yr
50
40
30
20
10
0
-10
-20
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
In pathways limiting global warming to 1.5°C with no or limited overshoot as well as in pathways with a higher overshoot, CO2 emissions are reduced to net zero globally around 2050.
Four illustrative model pathways
P1
P2
P3
P4
Non-CO_2 emissions relative to 2010
Emissions of non-CO_2 forcers are also reduced or limited in pathways limiting global warming to 1.5°C with no or limited overshoot, but they do not reach zero globally.
Methane emissions
Black carbon emissions
Nitrous oxide emissions
1
0
2020
2040
2060
2080
2100
Timing of net zero CO_2
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios
Pathways limiting global warming to 1.5°C with no or limited overshoot
Pathways with higher overshoot
Pathways limiting global warming below 2°C
(Not shown above)

Key messages:

- For 1.5 degrees, globally, 45% reduction in CO_2 by 2030, net zero CO_2 by 2050
- For 2 degrees, globally, 25% in CO_2 by 2030, net zero CO_2 by 2070
- Other gases decline, not to zero by these dates
- Many mitigation pathways – quantity of “negative emissions” varies significantly
- Implies massive and rapid decarbonization of energy sectors globally, room for differentiation is considerably narrower under 1.5 degree scenarios than 2 degree scenarios

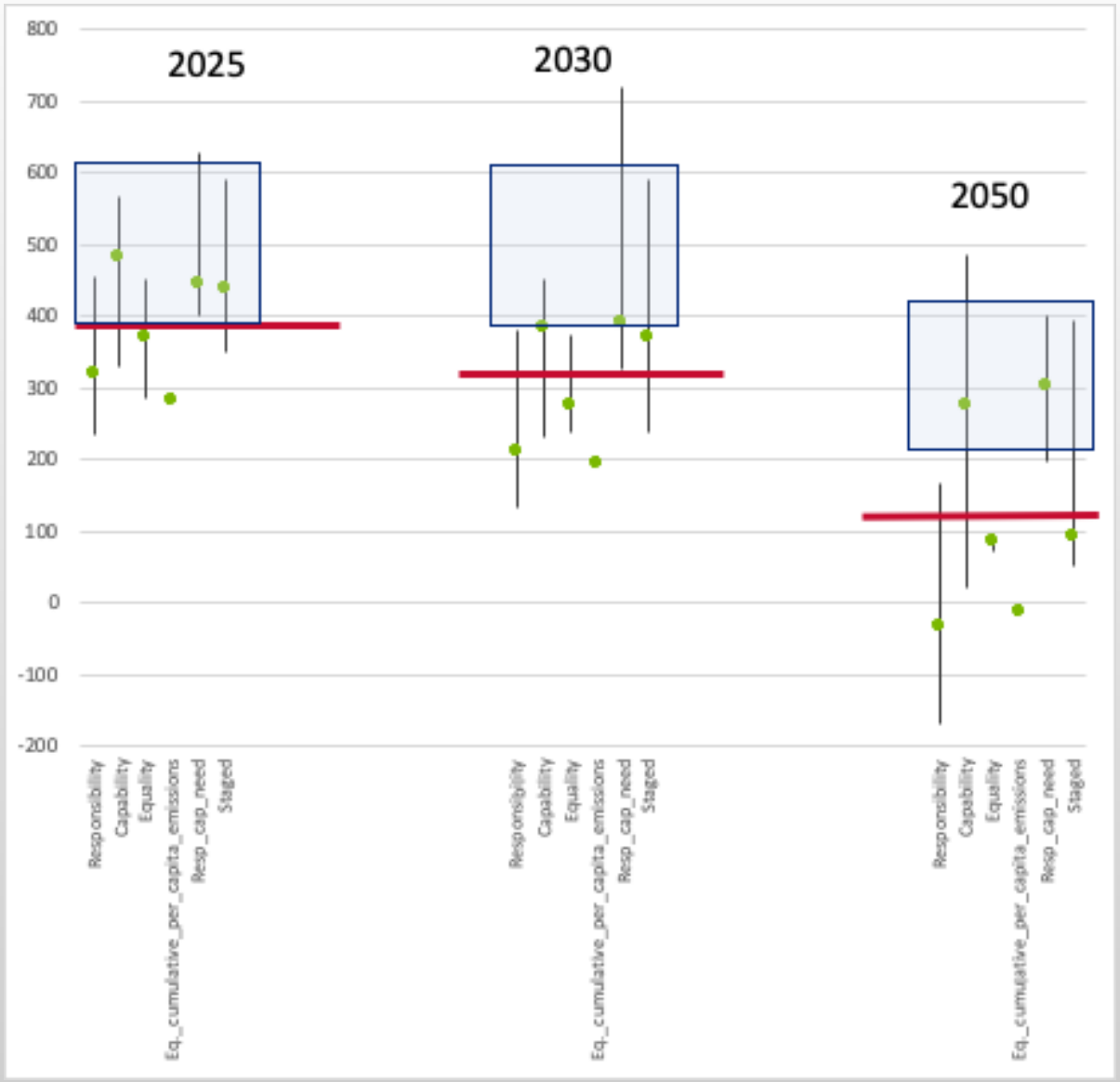
CAT technical equity analysis 2 degree global target – SA "fair share"



- Analysis EXCLUDES sinks – for SA, only baseline estimate = 30-40 Mt CO_2 (Stevens et al 2016) – high level of uncertainty
- GLOBAL temperature outcome ranges from +3 if all countries choose the tops of their ranges, to below 1.5 if all countries choose the bottom of their ranges
- Based on AR5 and higher than current baseline projections

Source: own analysis based on CAT South Africa analysis- https://climateactiontracker.org/countries/south-africa/

CAT technical equity analysis 1.5 degree global target – SA “fair share”



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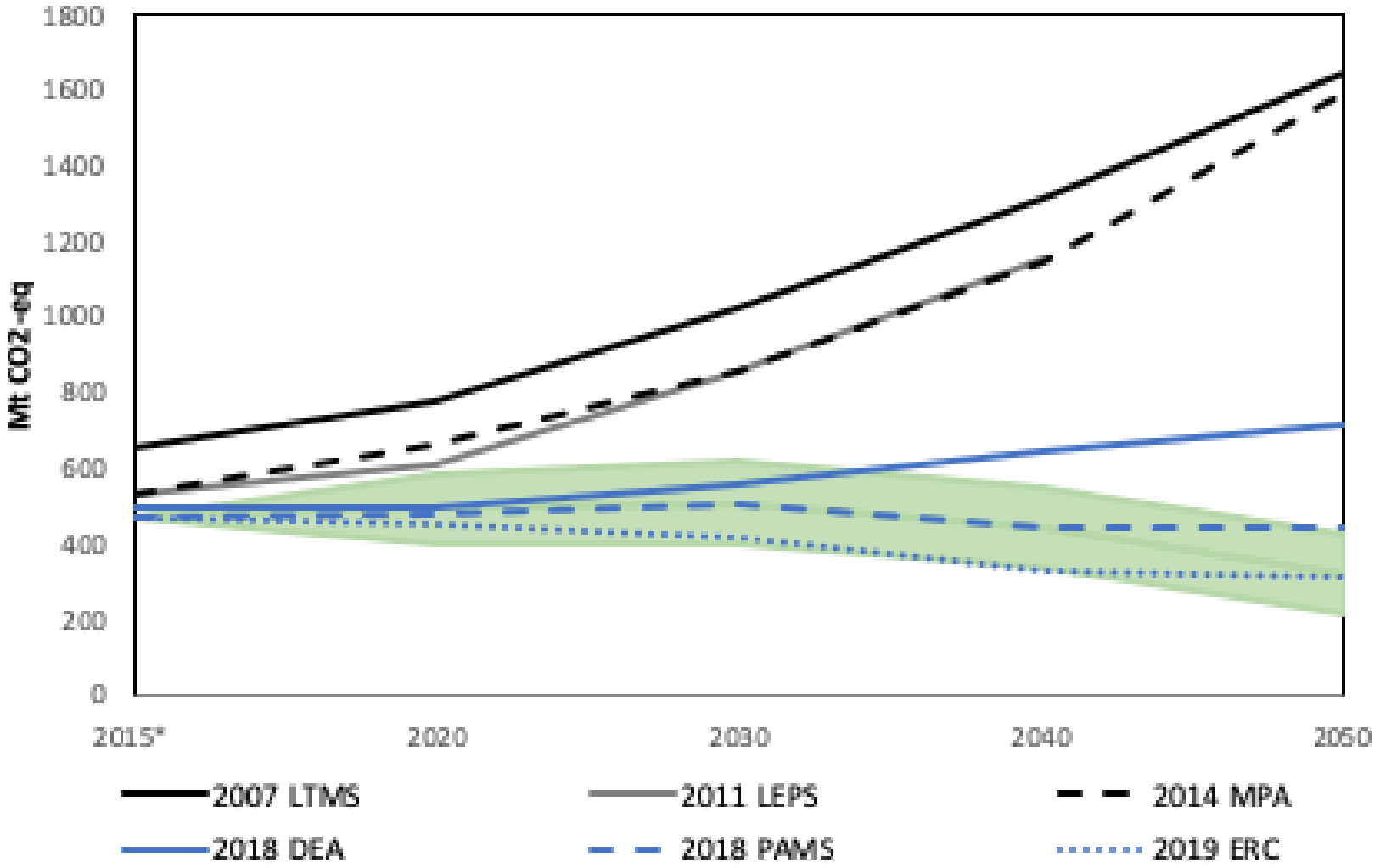
Key lessons

- Normative basis for analysis leads to wide divergences by 2050; also uncertainties from a) current GHG inventory, b) BAU projections, and c) land use emissions
- Average trend is lower than PPD, peaks rather than plateaus (in the 2020s) and declines faster
- 1.5 degree pathways narrow options, and with land use emissions, overall SA emissions approach net zero between 2050-2060
- Certainty re the global outcome based on where countries make their choice in the overall range

Changes in national GHG emissions scenarios for South Africa since 2007

- "reference" scenarios tell us broadly where we expect emissions to go, and are a good indication of the context for mitigation policy
- Dependent on:
  - GDP, population assumptions (in South Africa, GDP primarily)
  - Technology costs and their anticipated evolution
- Differing assumptions mean that comparability is limited, but very good indicators of different expectations
- Least cost diverges from "Business as Usual" (they used to converge)
- Technically, the basis for mitigation potential analyses

Evolution of South African reference GHG emissions scenarios

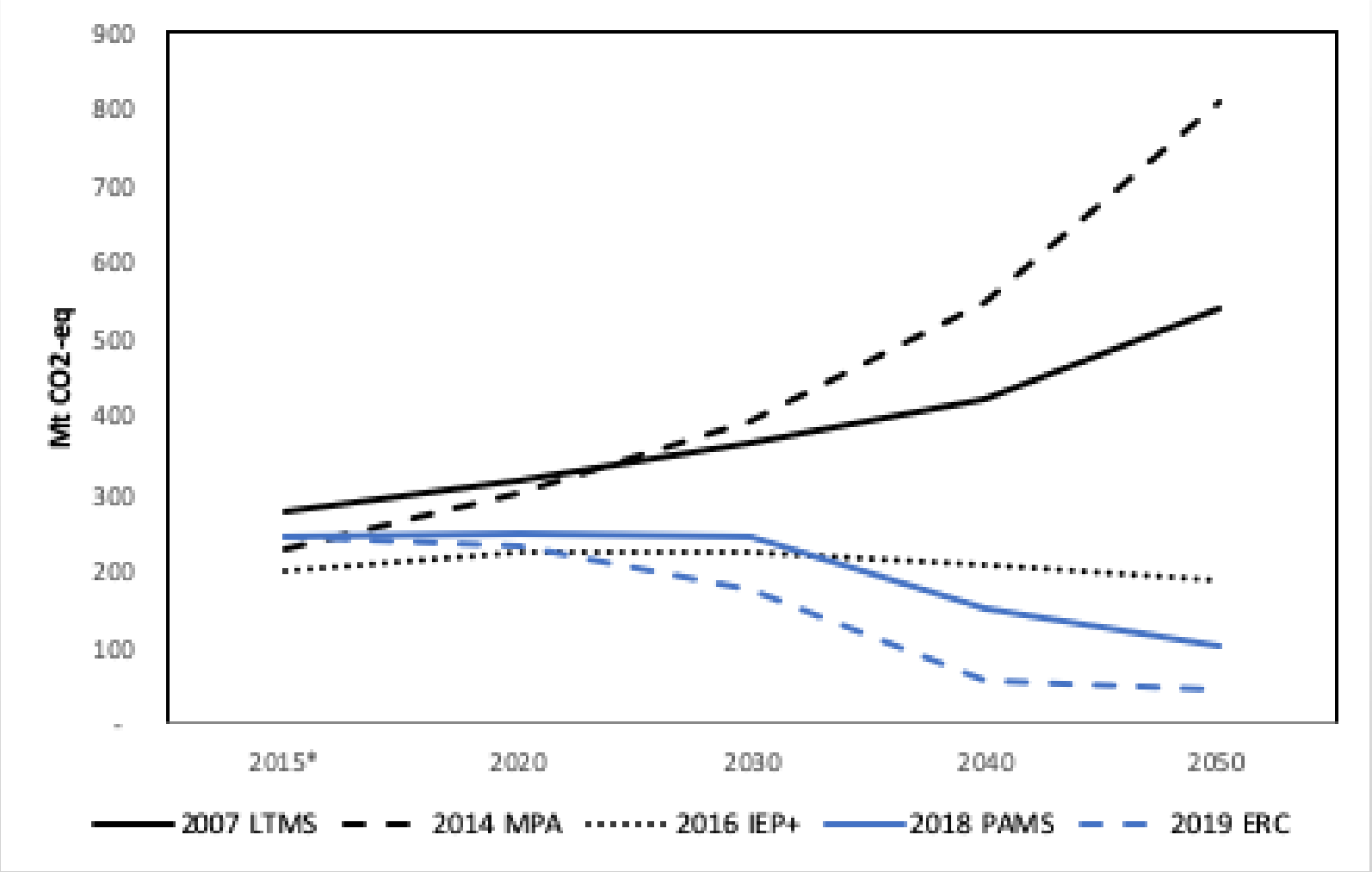


Source: Hartley et al (forthcoming)

Key patterns / drivers in baseline decline over time

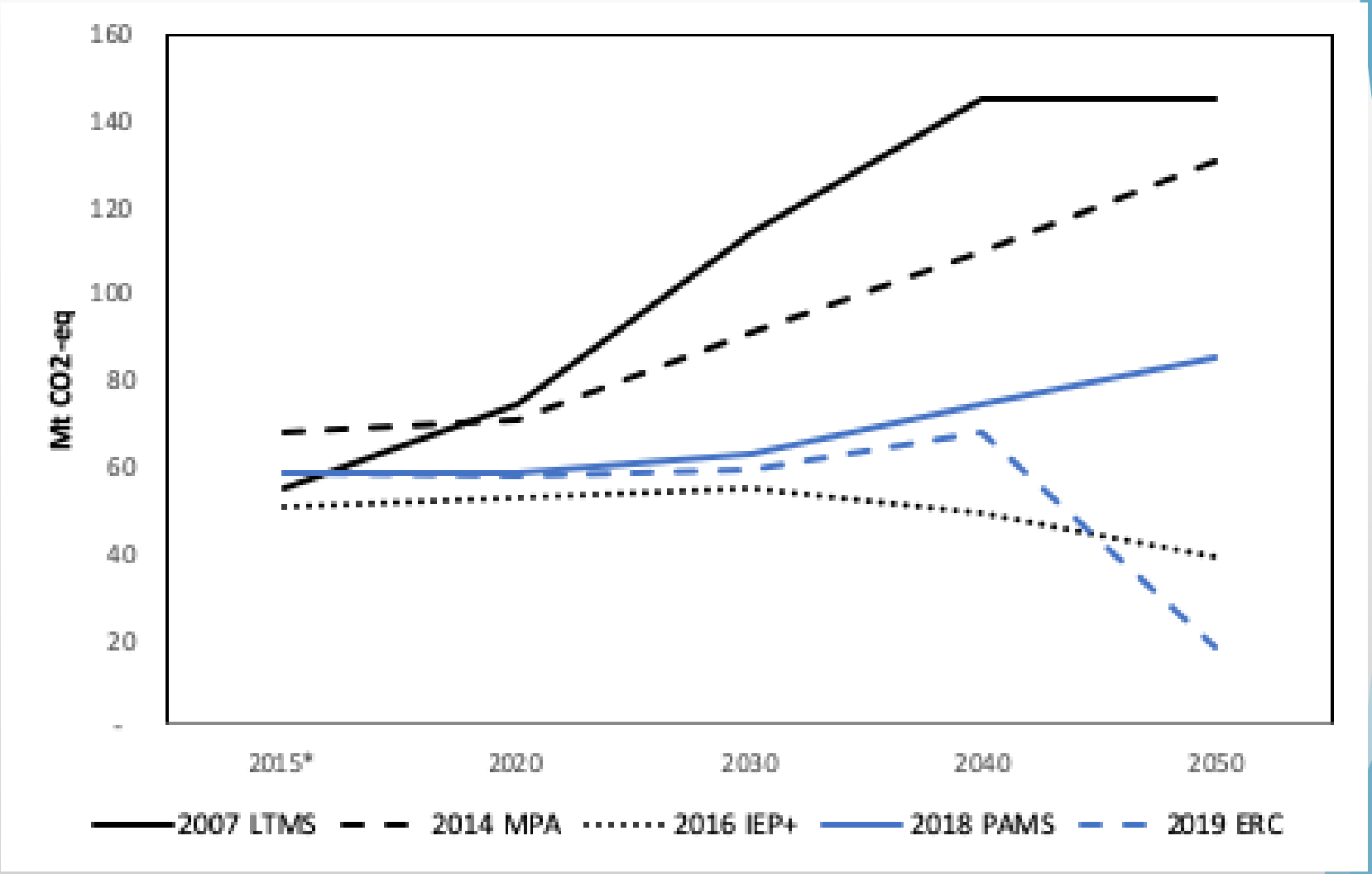
- Dropping economic growth assumptions (less demand for emissions-intensive goods and services) – from 4.4% (LTMS) to 3.3% (ERC 2019)
- Low historical emissions growth since 2007 (different starting points) – economic growth plus changing GHG intensity
- Increase in the carbon sink (land sector)
- Technology change: massive shift in the power sector (from coal to renewable energy), in transport (to zero emissions vehicles), and different assumptions re synthetic fuels

Sectors: Power sector



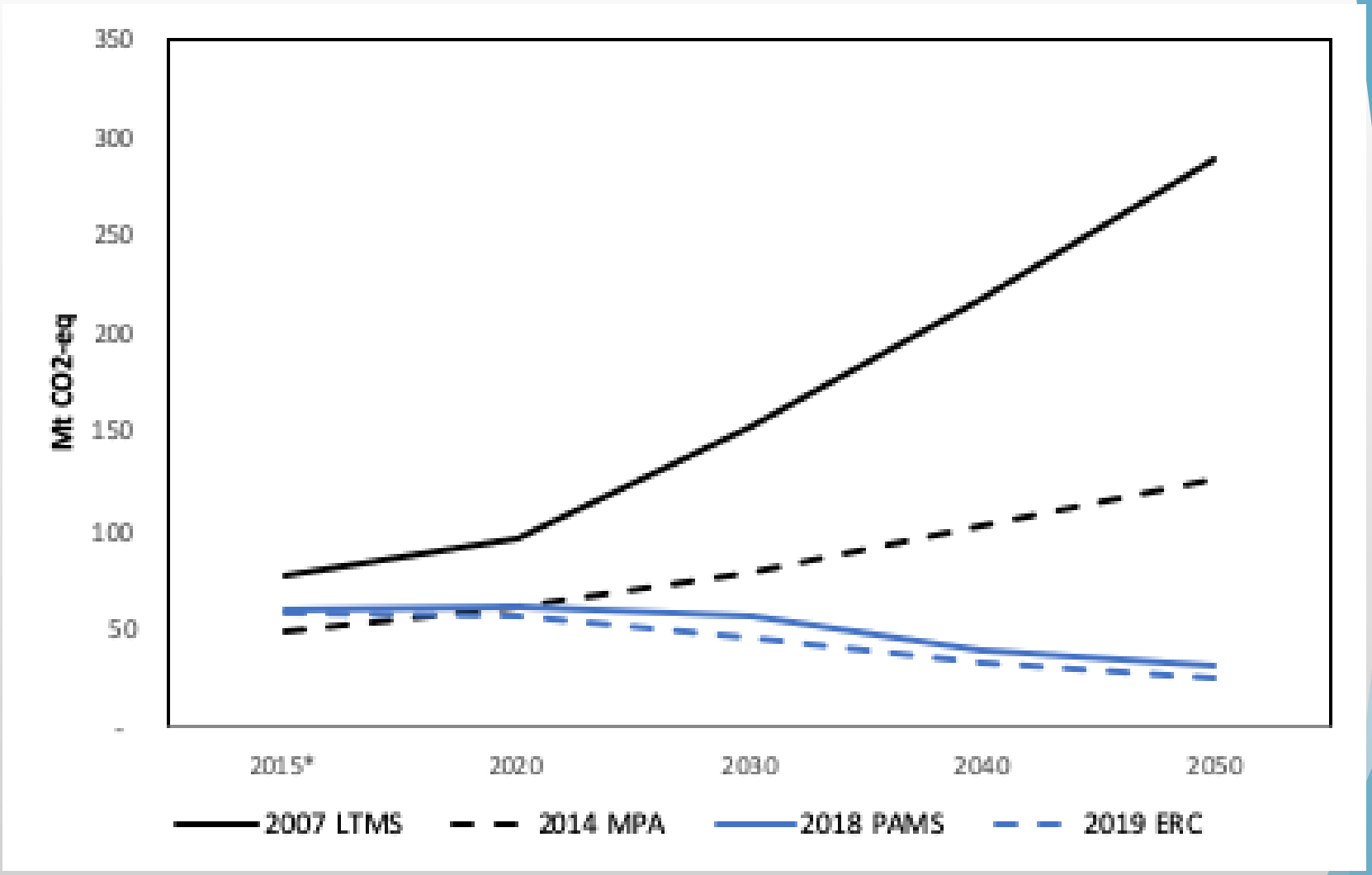
Source: Hartley et al (forthcoming)

Liquid fuels supply



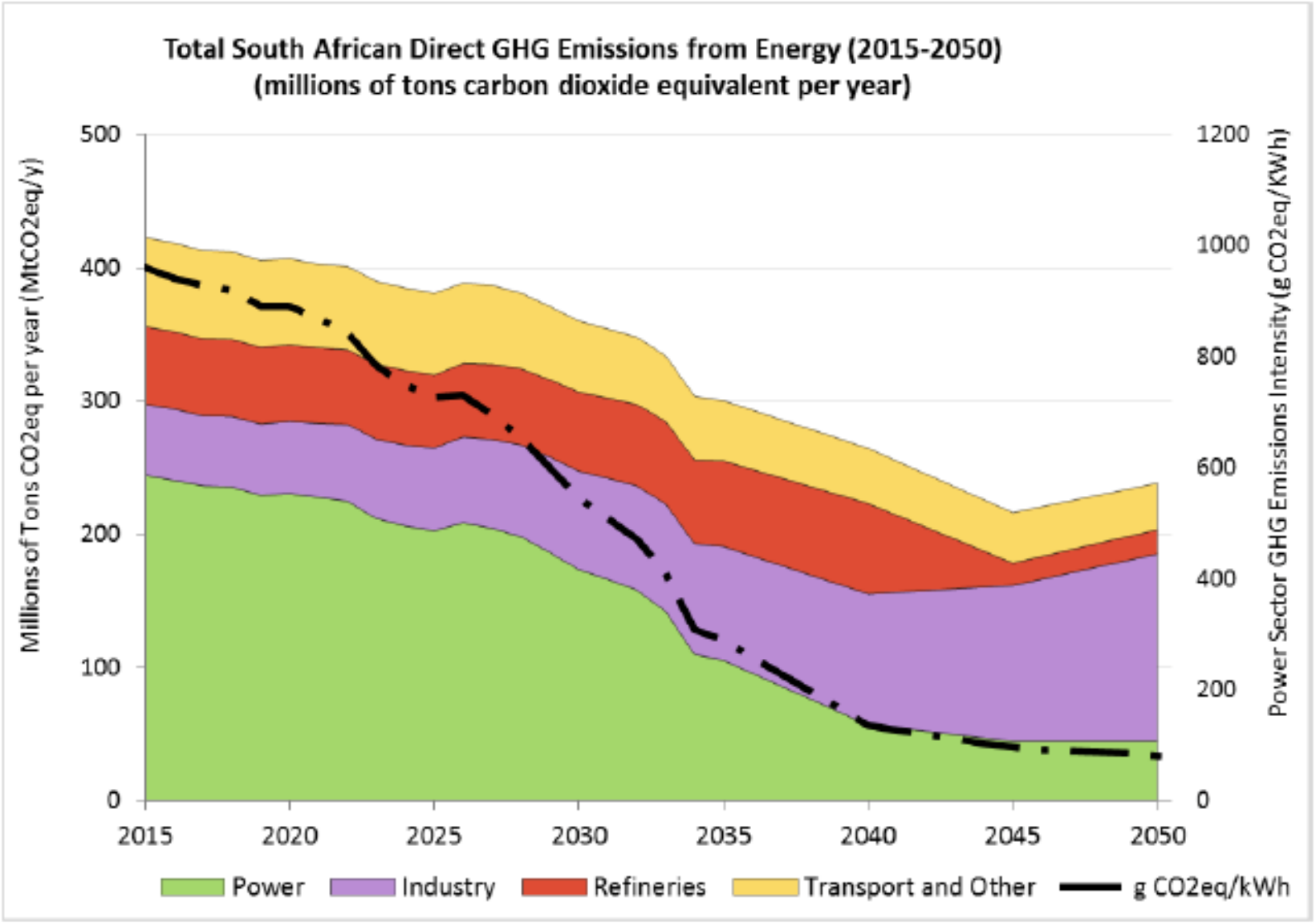
Source: Hartley et al (forthcoming)

Transport



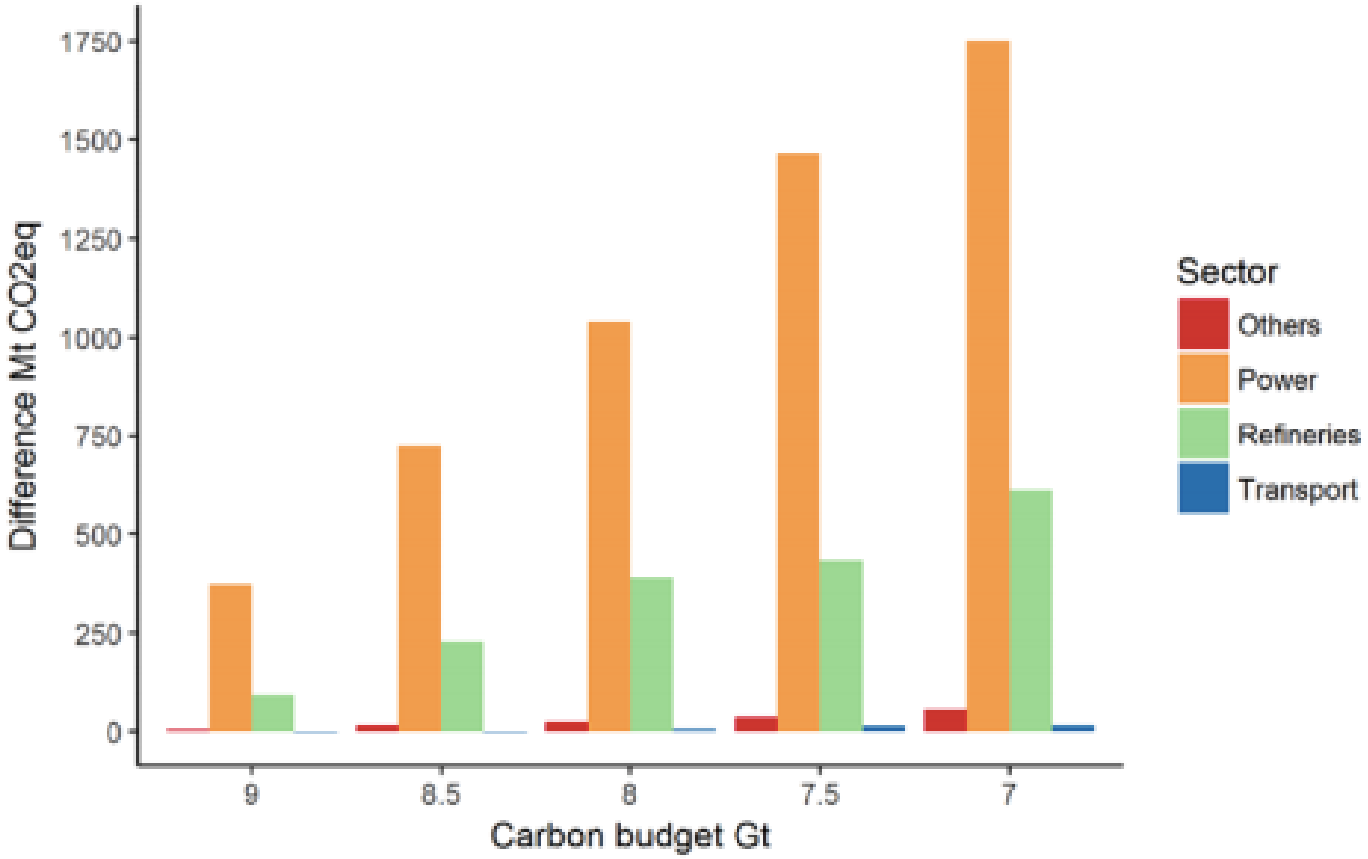
Source: Hartley et al (forthcoming)

Reference case, ERC 2019



Source: McCall et al, 2019

Sources of additional mitigation with an increasingly constrained emissions budget



Source: McCall et al, 2019

Conclusions

- Mitigation potential / costs plus changes in the global temperature goal make a compelling case to shift South Africa's NDC
- Next NDC is due end-2024/beginning 2025
- Much unmapped territory in terms of what is possible – energy-economic model is idea to explore these – technologically realistic and takes social-economic consequences into account
- Key challenges around the transition / implementation over the short/medium/longer term
- Mapping net-zero pathways for South Africa (2050/2060/2070) has not been done before – we have just started to scope this