Energy and Climate Change

Identifying the Research Gaps

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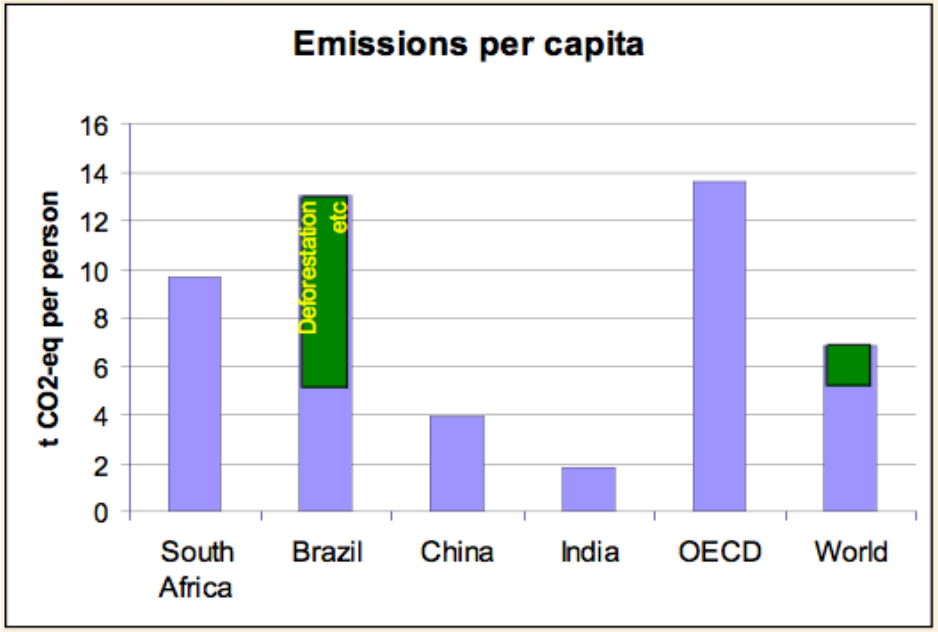
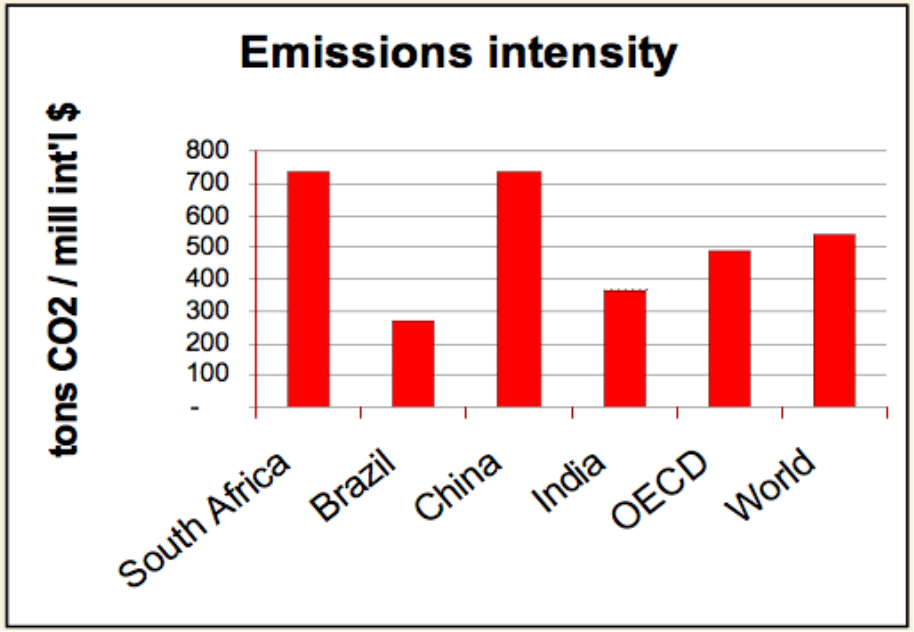
9 November 2010

Outline of presentation

- Emissions profile
- Approach to climate policy formulation
- The Copenhagen undertaking
- Interventions in the energy sector
- The Challenge of Decoupling
- Research Opportunities

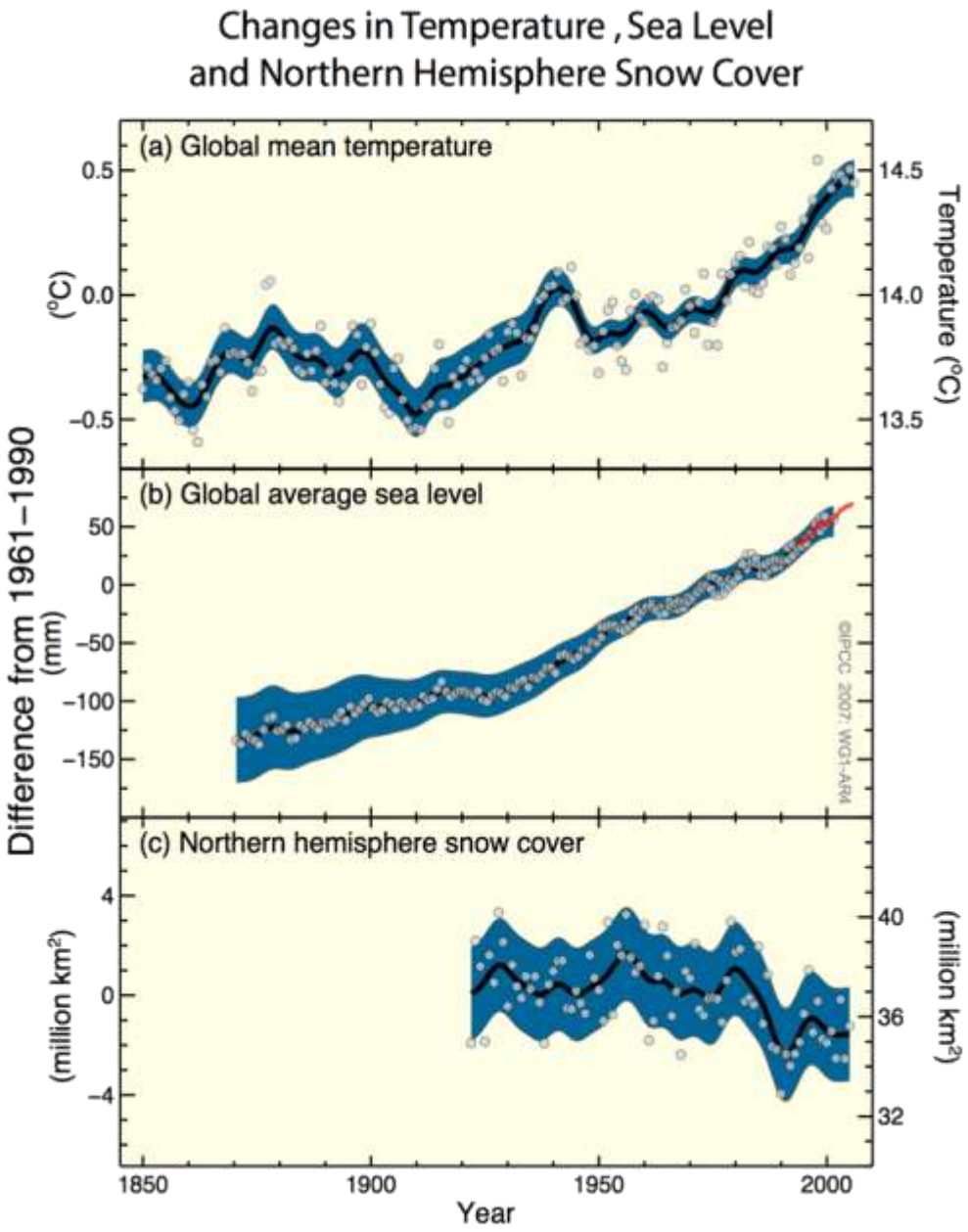
World trends and SA



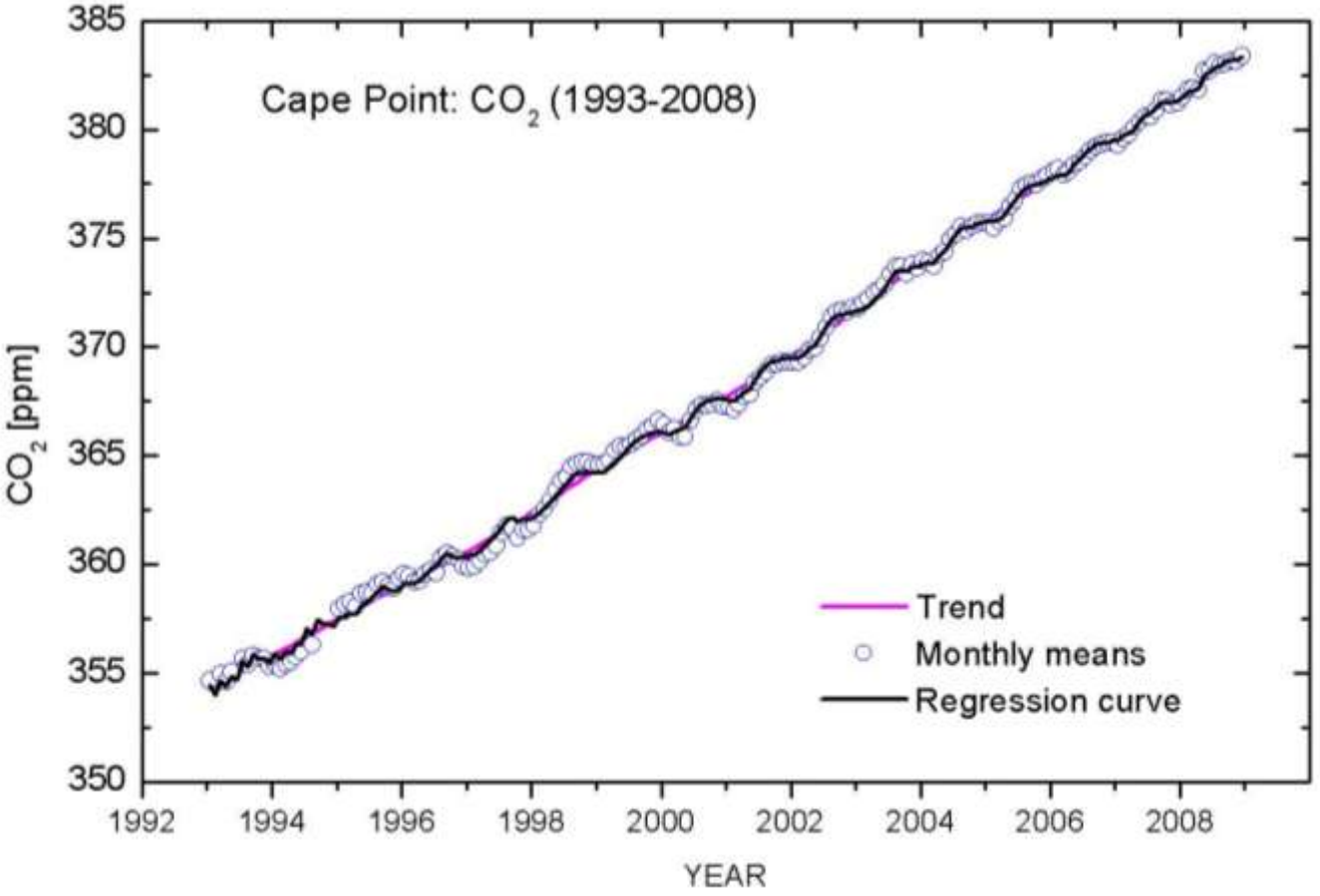


Observed changes

- Global mean temperature
- Global average sea level
- Northern hemisphere snow cover



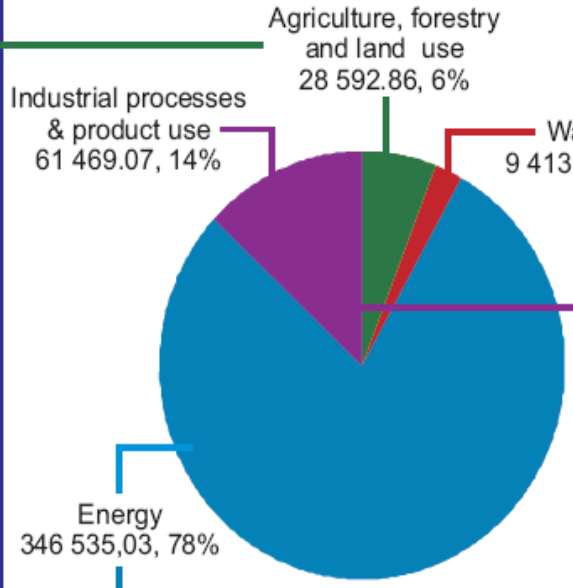
Concentrations of GHGs are increasing



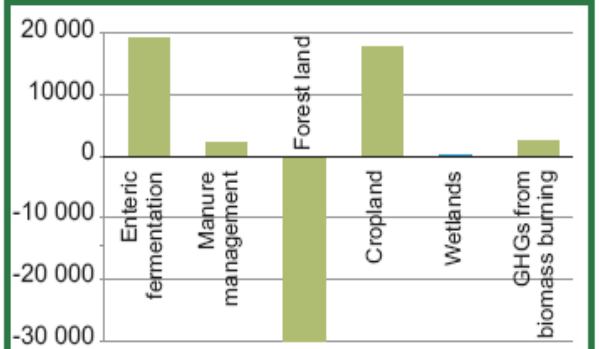
Source: SAWS Annual Report 08/09
Data from SAWS Global Atmosphere Watch

South Africa's greenhouse gas emission profile – 2000

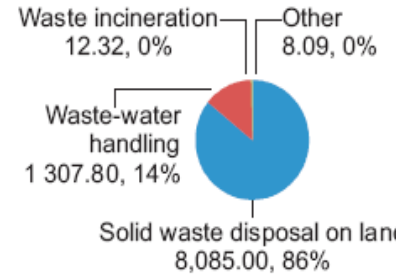
Sector contribution to total GHG emissions



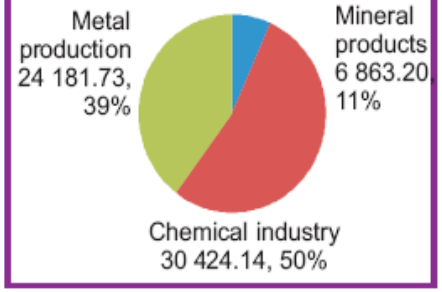
Agric., forestry & land use emissions



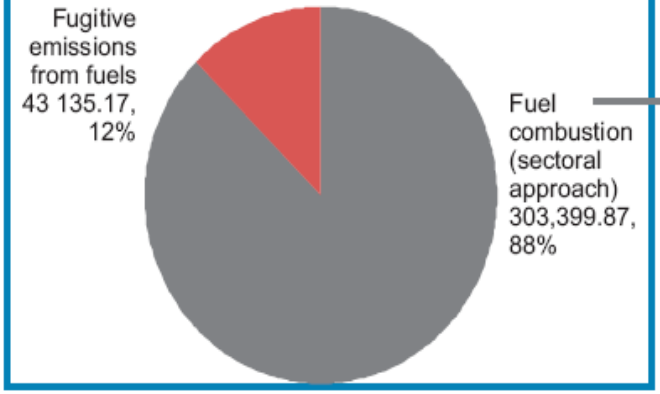
Waste emissions



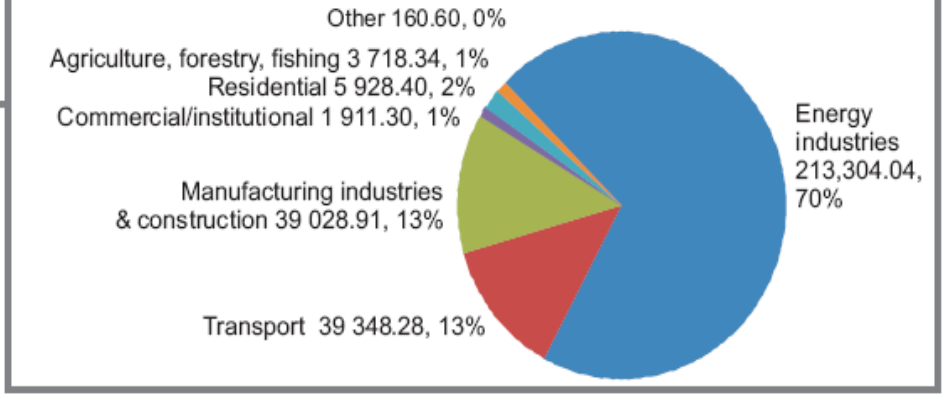
Industrial processes & product use



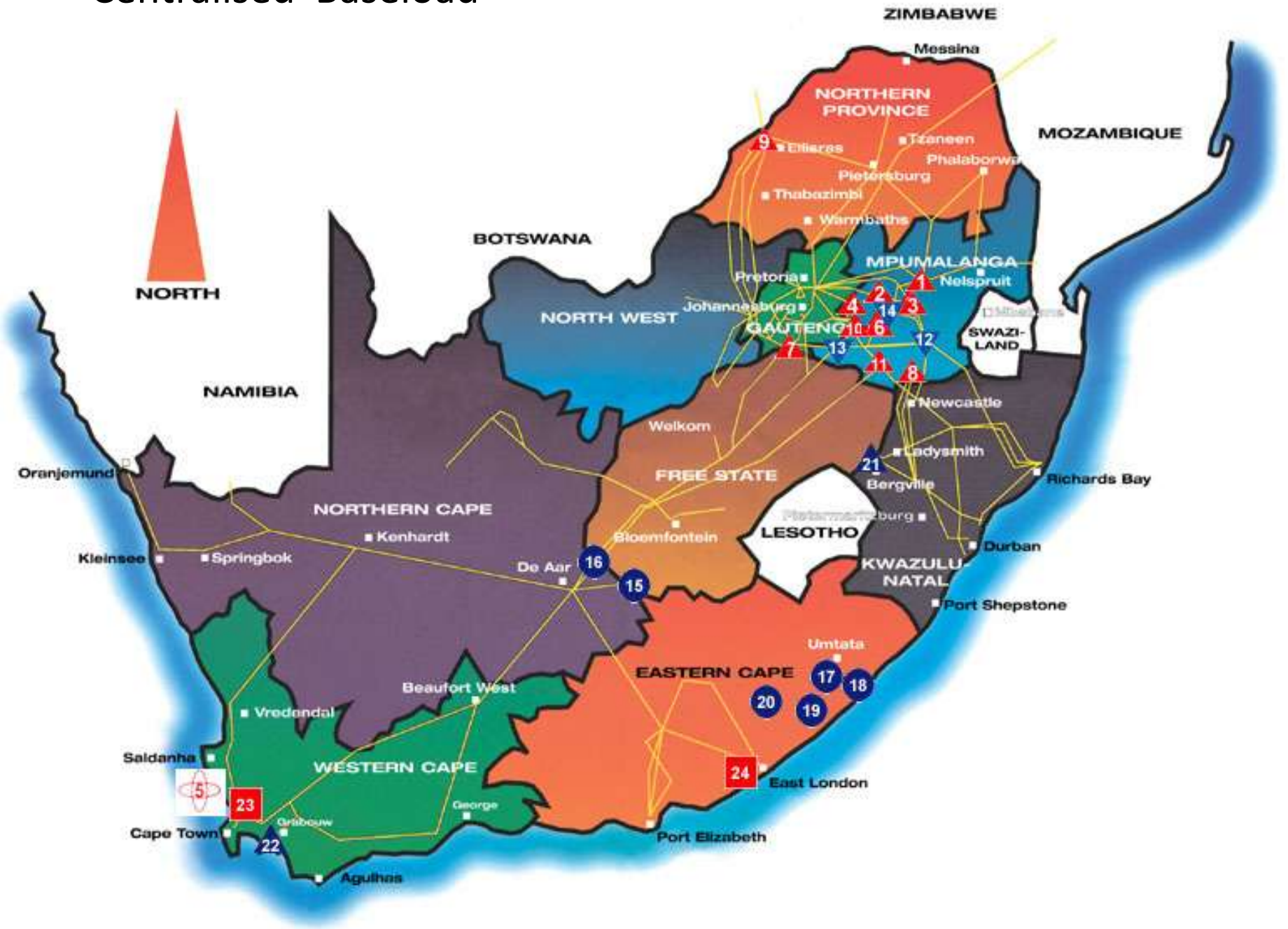
Energy emissions



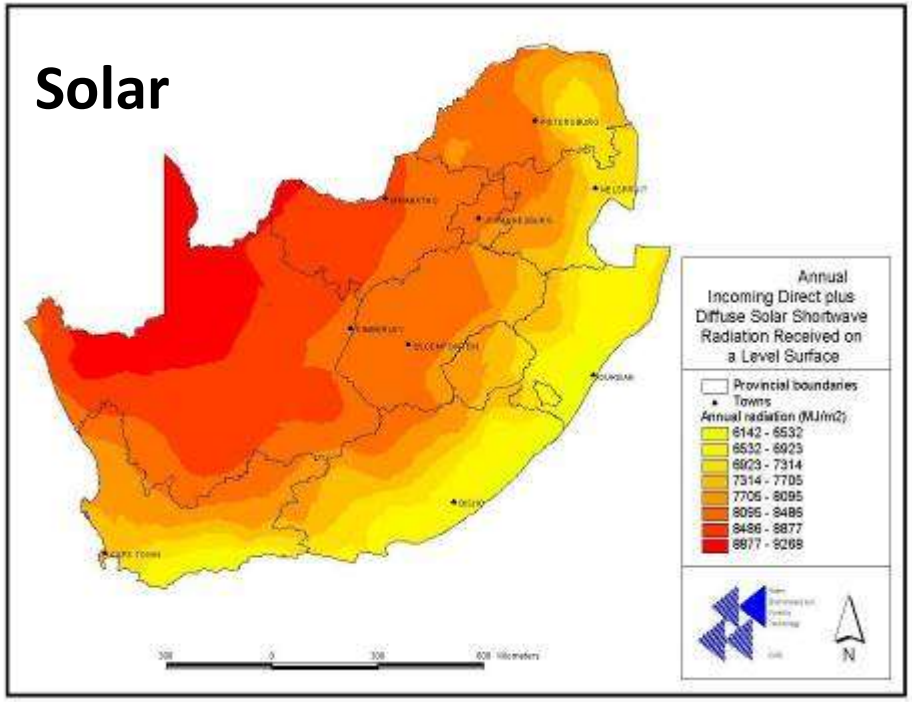
Fuel combustion (sectoral approach)



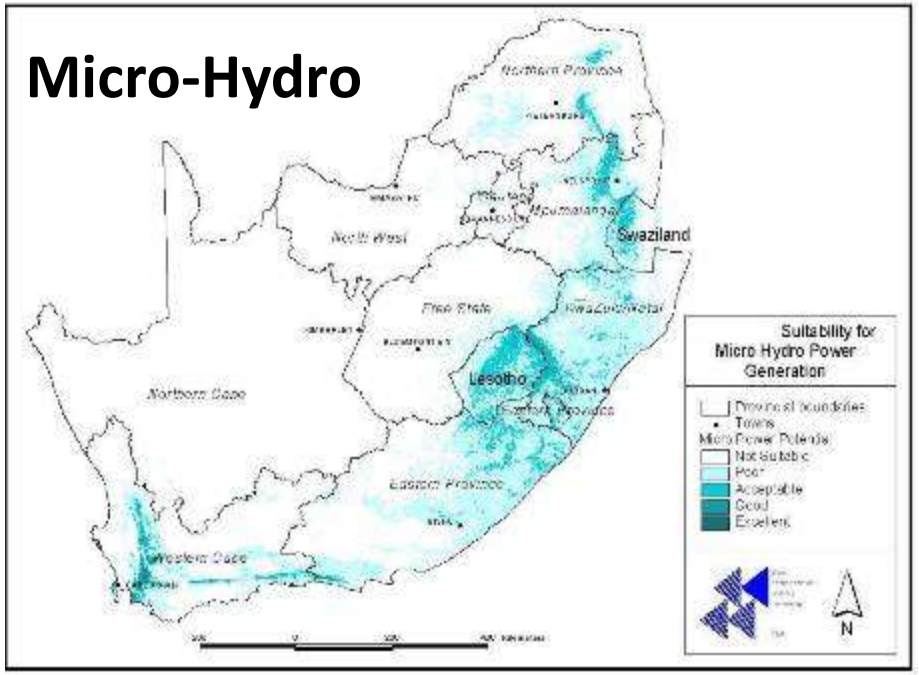
Centralised Baseload



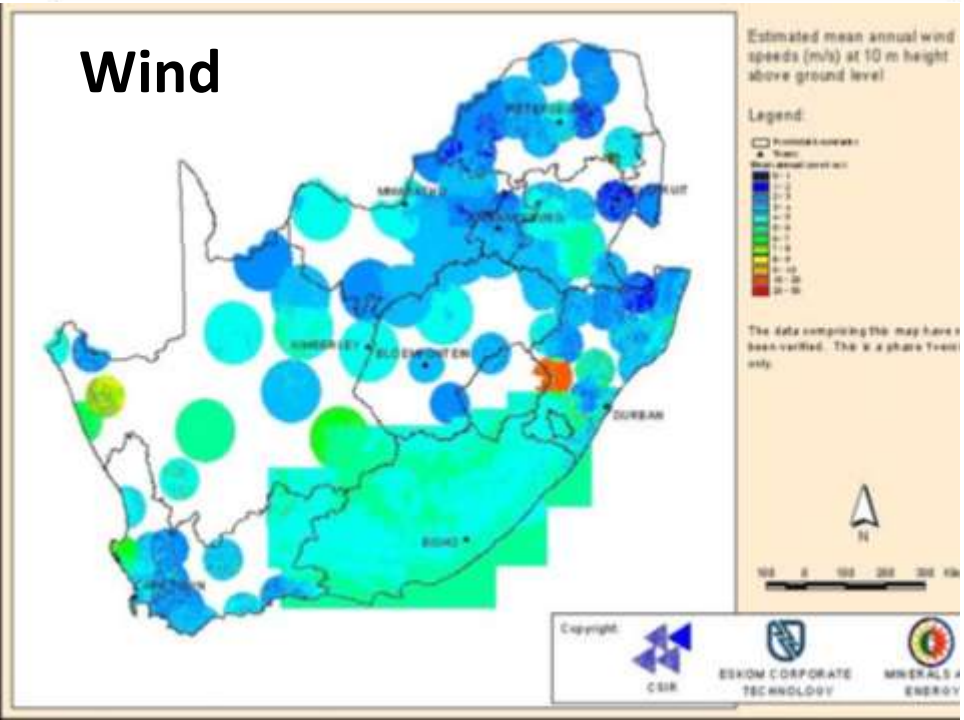
Solar



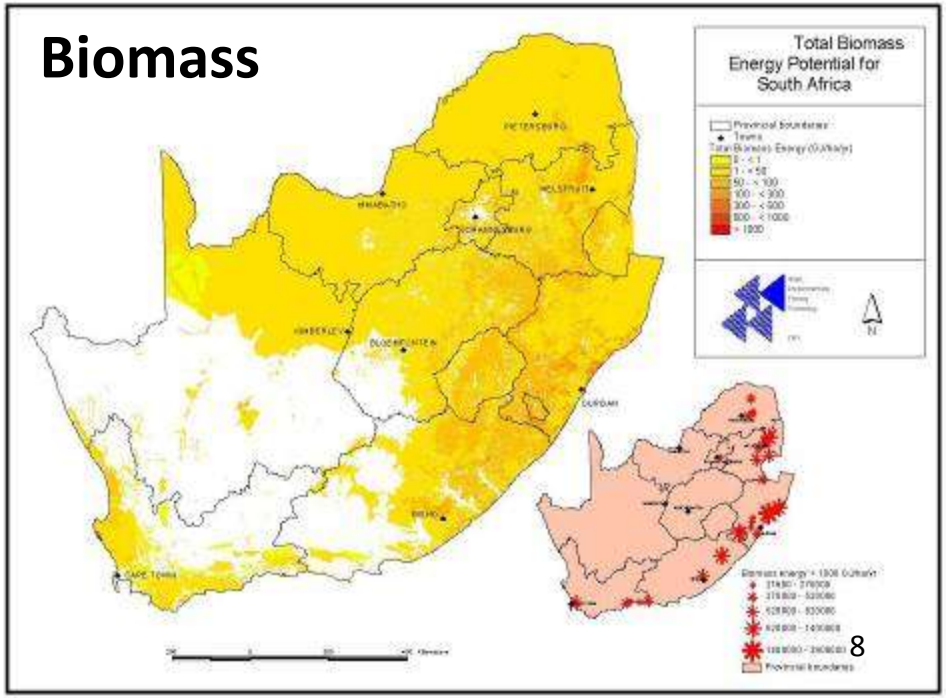
Micro-Hydro



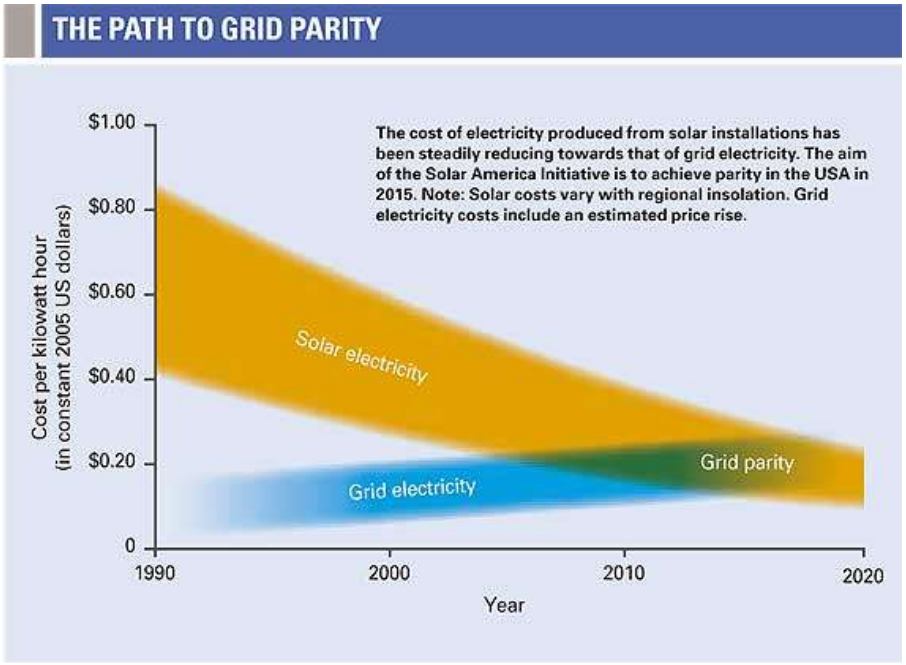
Wind

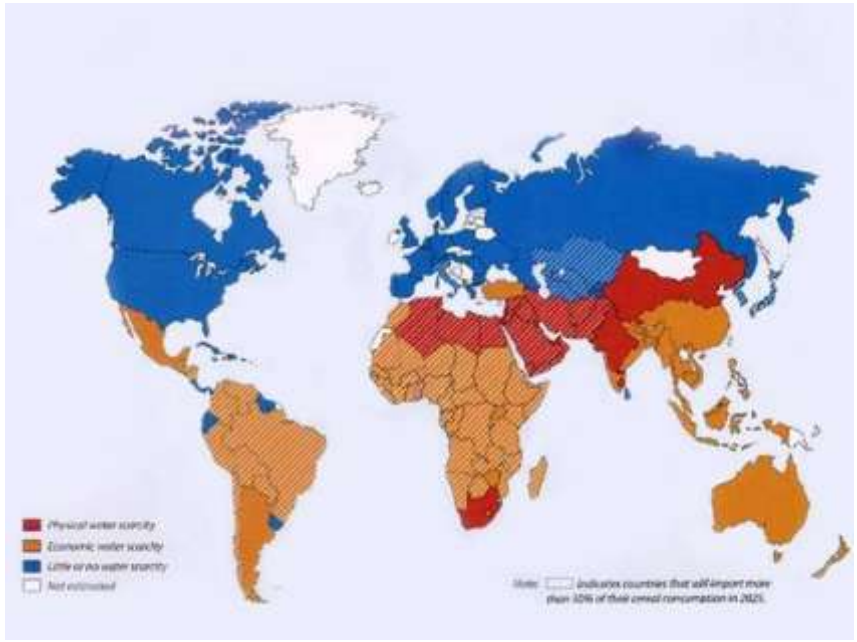


Biomass



Move to sustainability





(Graph source: BP)

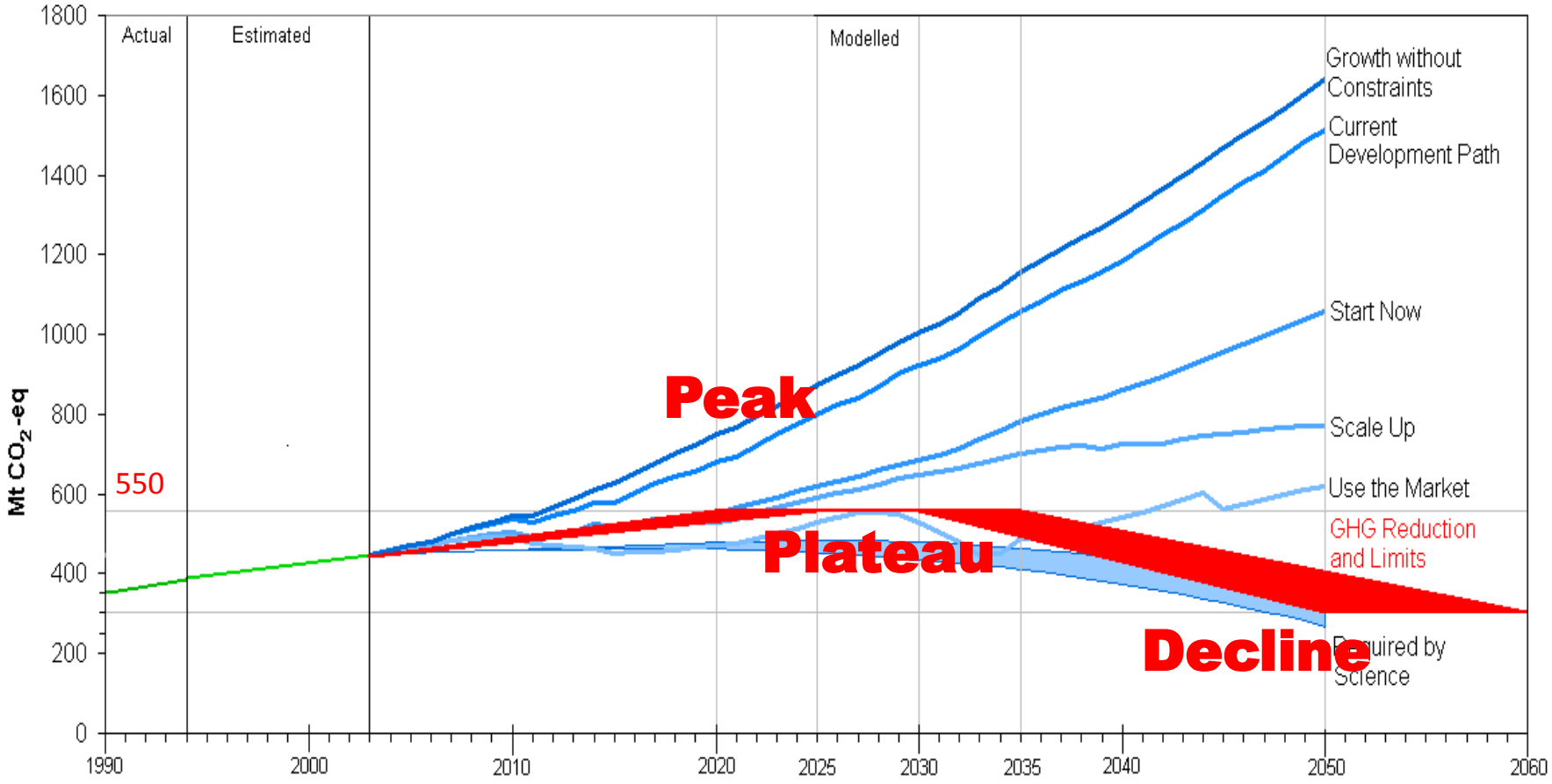
Access to energy programmes

- Integrated National Electrification Programme:-
  - A capital subsidy programme
  - Initially funded by ESI, now funded through fiscus
  - Peak delivery-over 450 000 connections per year.
  - 36% access to electricity in 1994
  - Target-Universal Access
  - to date, 4.835 m households electrified
  - Percentage electrified to date, about 76%
  - Backlog, about 3.4 million hhs
  - Rate of electrification in rural areas: 50-60%
  - 70% of rural hhs use fuelwood (also LPG, paraffin)
  - Living in the shadows of modern energy services
- Free Basic Electricity Programme
  - An operational subsidy programme
  - Free 600kWh per indigent household pr year.
- National Solar Water Heating Programme
  - A capital subsidy programme
  - Mainly funded by the ESI
  - Target 1 000 000 SWH by 2014
  - Potential-12.5m households

SA numbers based on LTMS, adjusted for electricity

- Long-term mitigation scenarios (LTMS): peak, plateau and decline agreed by Cabinet mid-2008
- Now ‘internationalised’ thru Copenhagen Accord
- LTMS numbers formed basis of calculating ‘deviation below BAU’
  - Based on rigorous modeling combined with strategic stakeholder inputs
  - Adjusted for near-term electricity plans
- Even with adjustments, possible to slow the growth of emissions significantly – if take aggressive action

Strategic direction:
GHG emissions peak, plateau and decline



The Copenhagen undertaking 2009

- “South Africa will undertake mitigation actions which will result in a deviation below the current emissions baseline of around 34% by 2020 and by around 42% by 2025”

- Based on mitigation commitments by developed countries as distinct from mitigation actions by developing countries. The principle of equity and common but differentiated responsibility remains relevant.

- Level of effort is based on existing actions, policies and sector targets (NAMAS)

SA Deviation from Business As Usual

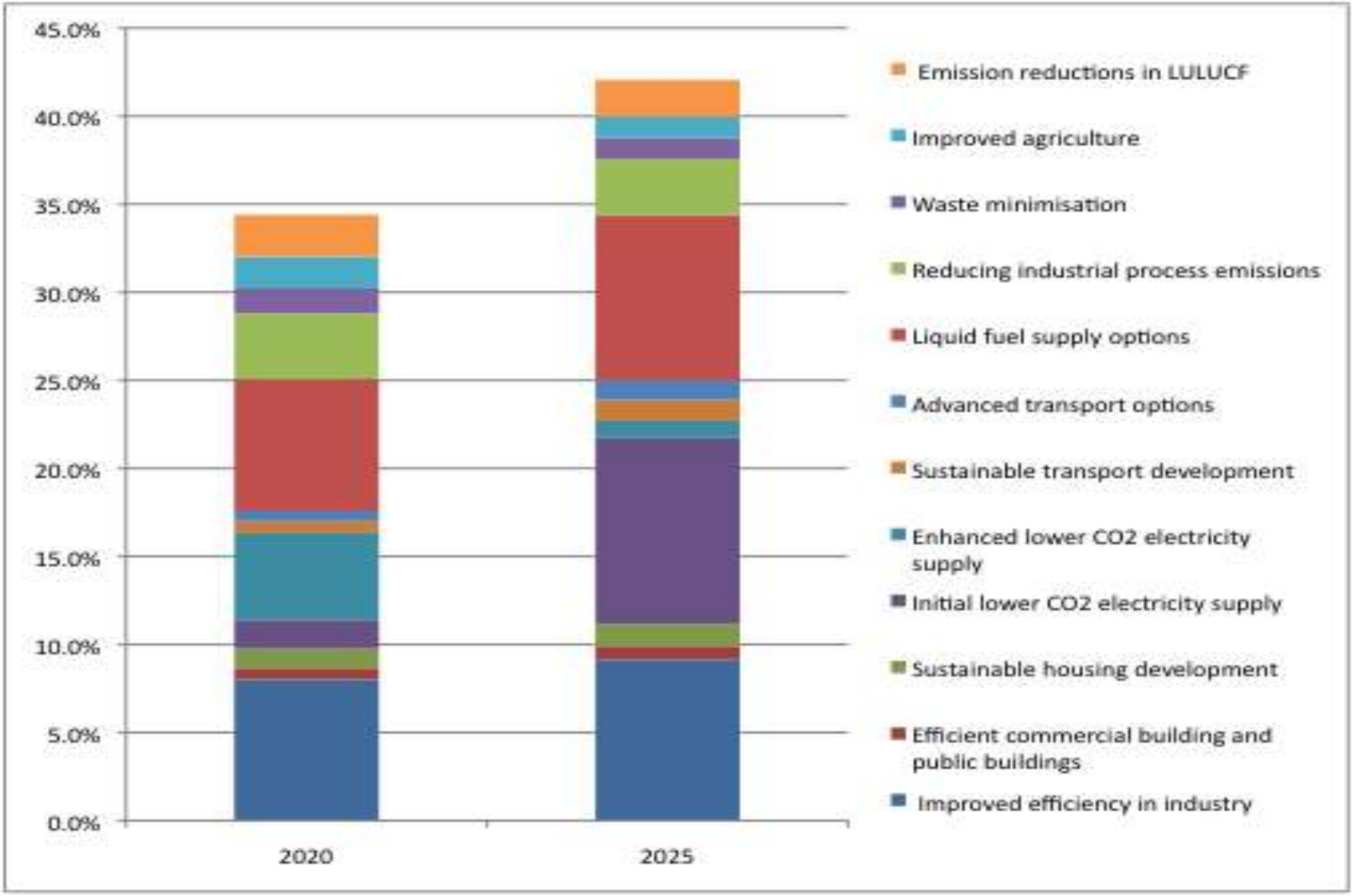
- The pledge was conditional on two factors – a fair, effective and inclusive global deal being reached and support from developed countries
  - Provision of significantly scaled-up, binding public funding
  - Binding commitment by developed countries to technology development, transfer and diffusion, including the climate-friendly energy technologies that SA needs to achieve the deviation
  - Support to enhance the institutional capacities in SA - to implement the NAMAs

SA Deviation from Business As Usual

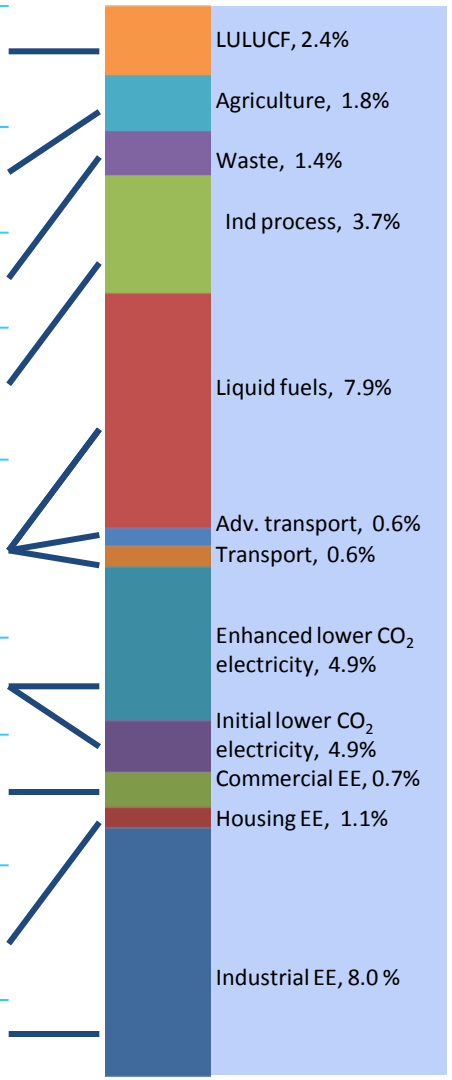
- SA's approach is based on science.
- cannot be achieved without:

a) developed countries taking responsibility for historical emissions, and

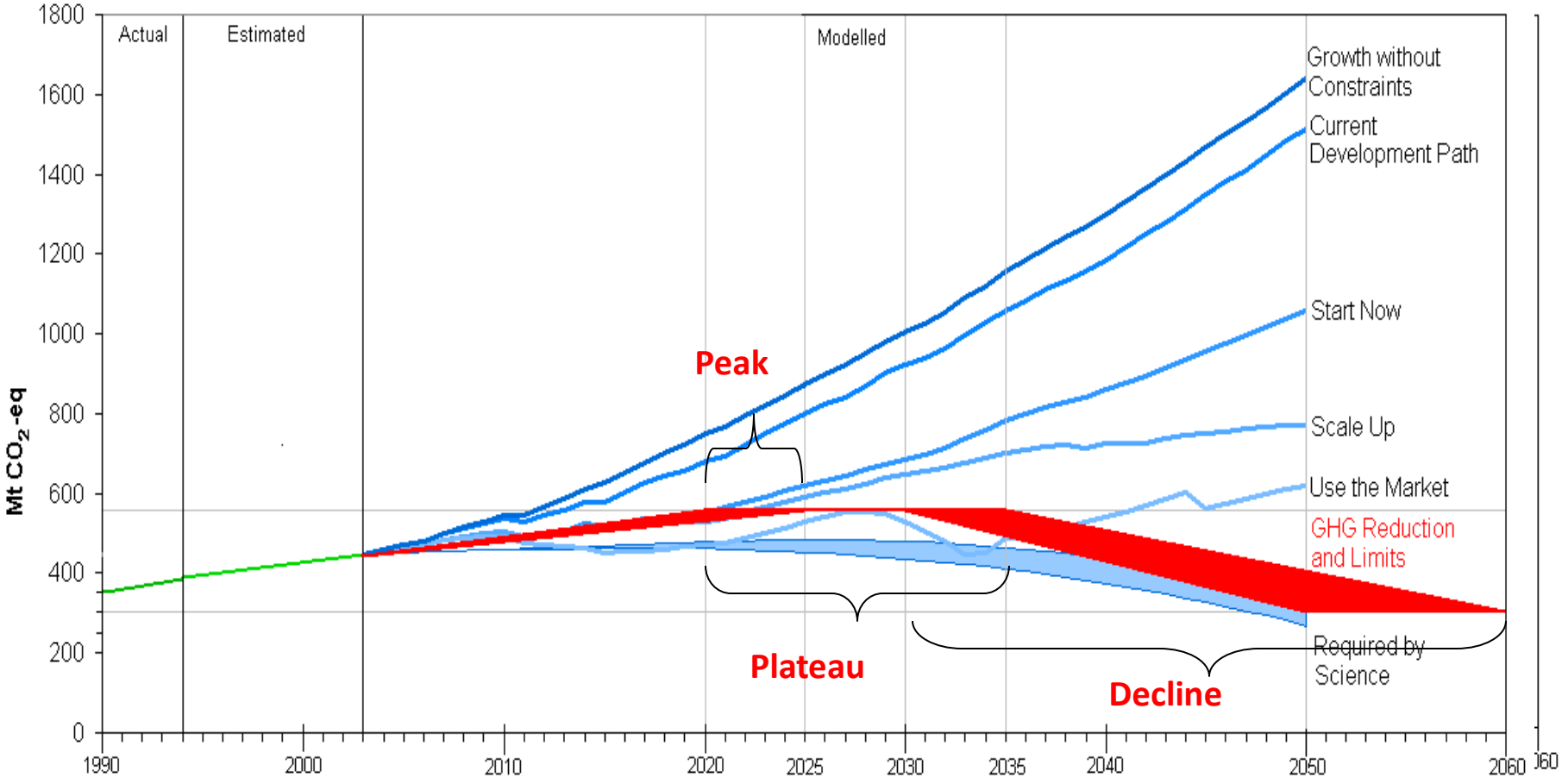
b) the common and differentiated responsibility of both developed and developing countries of their share of emissions in future,


45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
2020
2025
Emission reductions in LULUCF
Improved agriculture
Waste minimisation
Reducing industrial process emissions
Liquid fuel supply options
Advanced transport options
Sustainable transport development
Enhanced lower CO2 electricity supply
Initial lower CO2 electricity supply
Sustainable housing development
Efficient commercial building and public buildings
Improved efficiency in industry

FOUNDATIONAL PROGRAMMES	2020 TARGET REQUIREMENTS
Emissions reduction /sinks in land use/ forestry – Land Affairs, Forestry – no current programmess	Enhanced fire control, savannah thickening, increased forest cover
Improved agriculture – DoA – no current programmess	Progs to reduce tillage, reduce enteric ferm-entation & increase manure management
Waste minimisation – national & local govt – limited current programmes	Progs to minimise waste, promote composting
Industrial process emissions – DTI, DEAT, others – no current programmes	CCS, methane capture for existing synfuel plants, GHG mitigation for aluminium plants, coalmine methane
Transport options – DoT, local govt, DTI, Transnet – rollout of public transport (Gautrain, BRT)	Vehicle efficiency prog, expanded public transport, shift freight to rail, promote hybrids & electric vehicles, no further CTL plants without CCS for all GHG emissions, promote biofuels
Lower CO_2 electricity supply – DoE, NERSA, Eskom –REFIT RE target	Expanded low-carbon electricity supply prog – regulation / incentives in electricity sector
Residential energy efficiency (EE): DoE, local authorities - current DSM prog, EE Strategy, EE Accord, NEEA	Full implementation of current EE strategy, plus other progs, eg sustainable housing facility
Commercial EE: DoE, Eskom, DPW, local authorities - current DSM prog, EE Strategy, EE Accord, NEEA	Full implementation of current EE strategy, plus additional accelerated progs
Industrial EE: DoE, Eskom - Current DSM prog, EE Strategy, EE Accord, NEEA	Full implementation of current EE strategy, plus additional accelerated progs



GHG EMISSION REDUCTIONS AND LIMITS



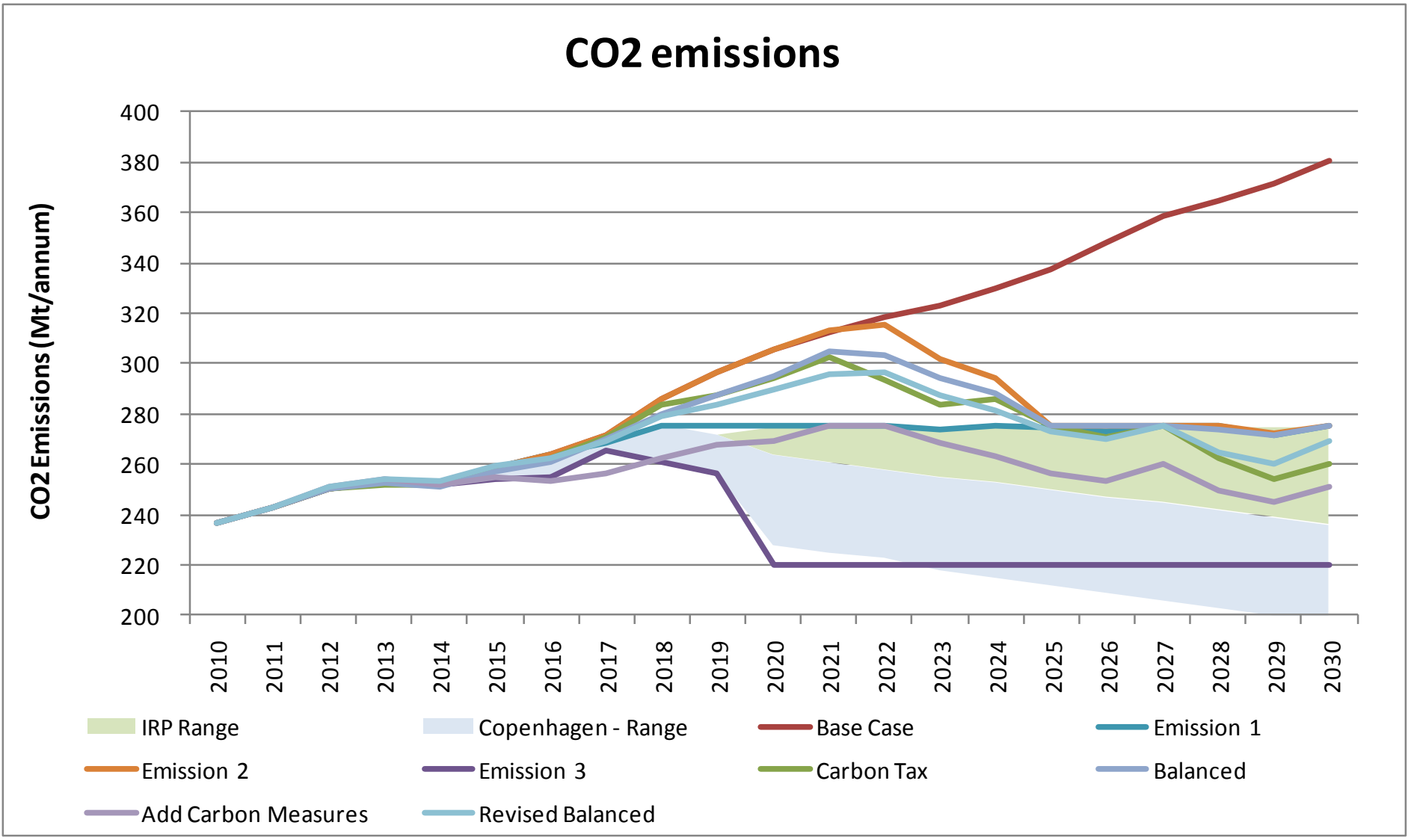
Challenge: Decoupling growth and emissions

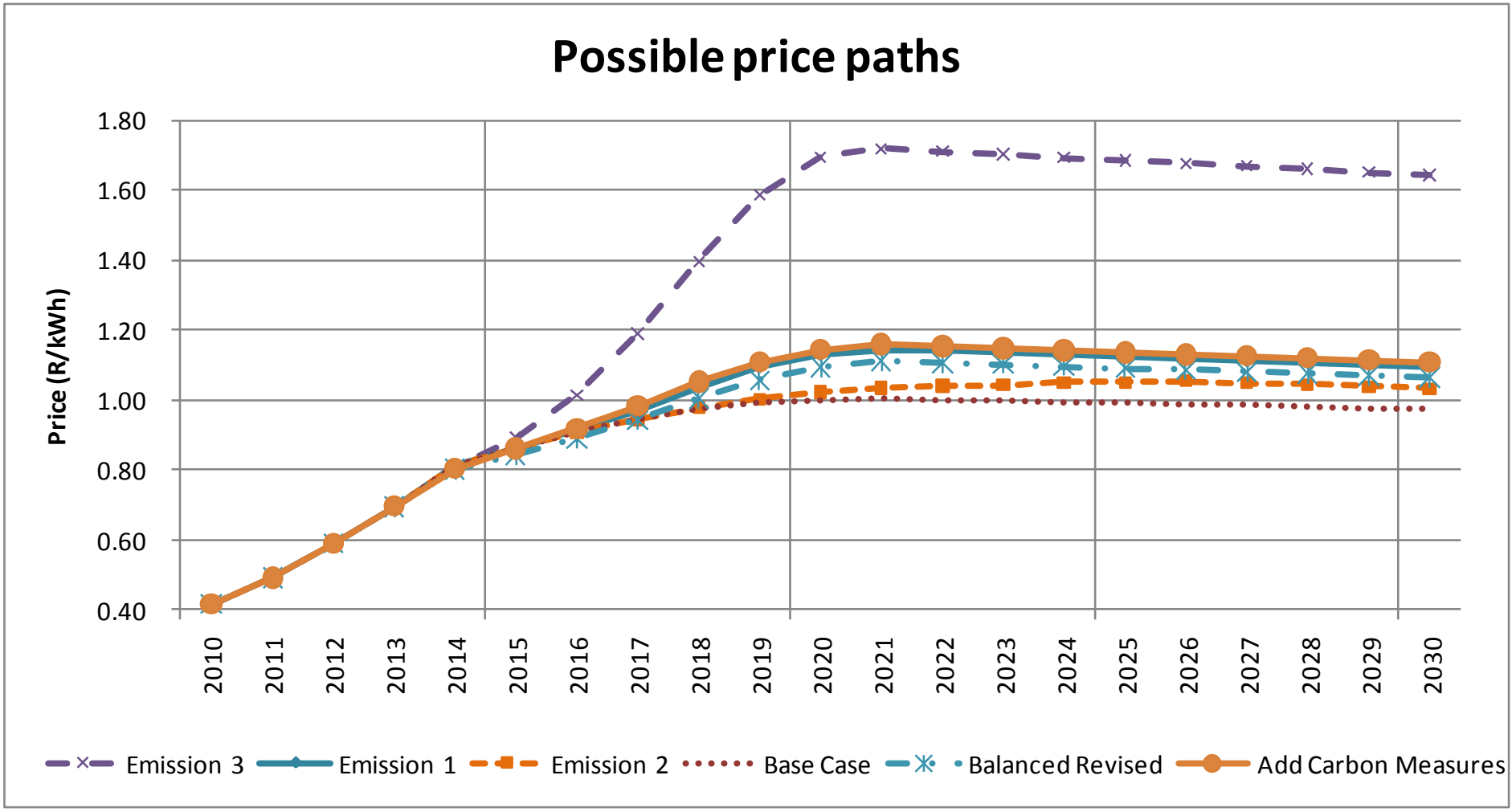
- How to limit emissions in the medium term, and put SA in a position to reduce emissions dramatically in the long term
- How to do this:
  - With the least economic cost to the country
  - With the most economic benefit to the country, including the most employment created, the most technology and industrial development
  - While meeting sustainable development goals – employment, poverty reduction, environmental protection, sustainable infrastructure development – in short, *how to have a better life for all and less GHG emissions*

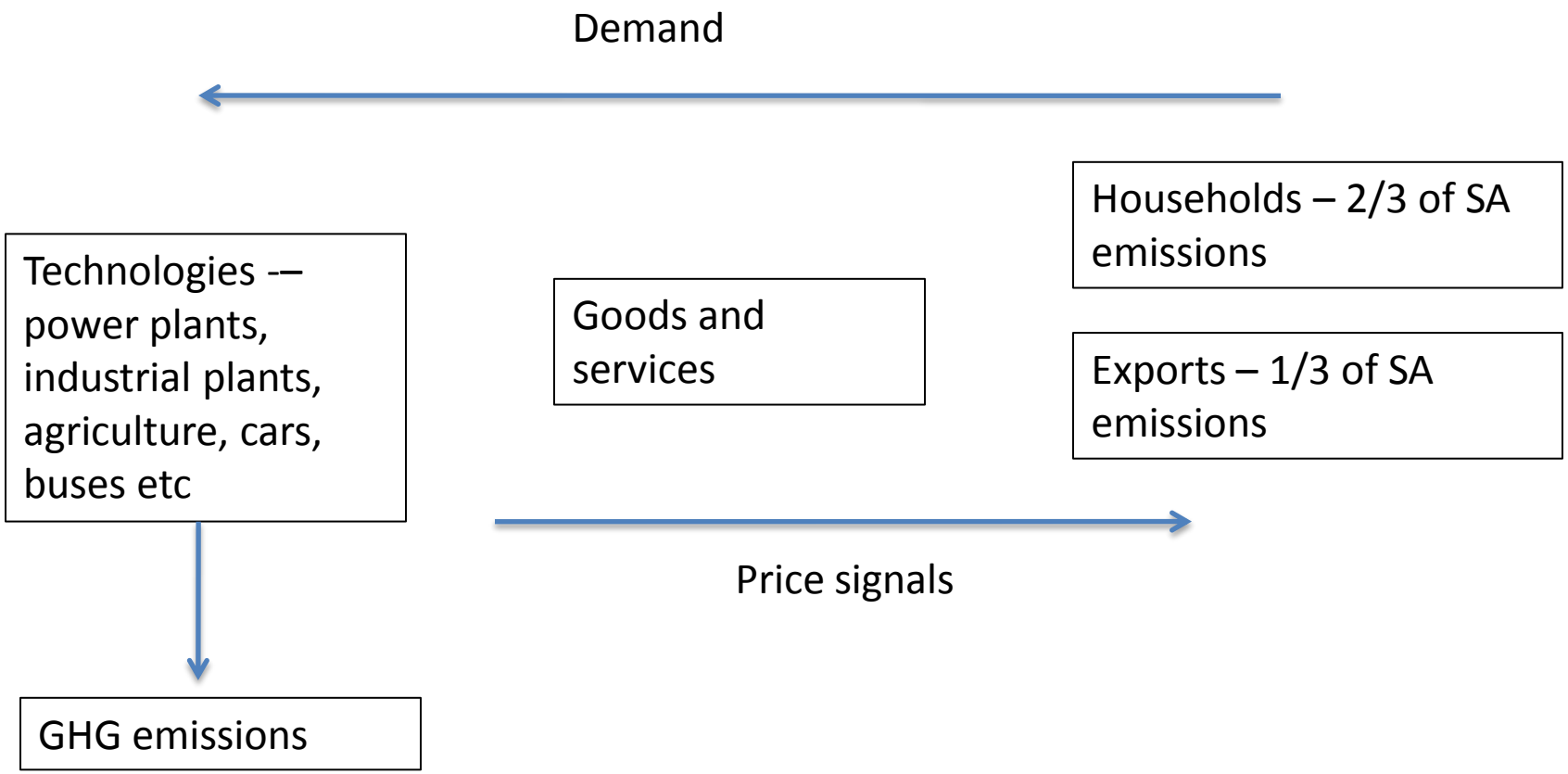
Policy outcomes – mitigation programmes, plus systems for M and V, and systems for developing further mitigation opportunities in the future – sectoral actions plus general systems (data, technology, analysis)

DEA input to IRP (2030)

- IRP needs to enable electricity sector contribution to SA's pledge that GHG emissions will deviate below BAU
- How much should the carbon budget be for the electricity sector be – 50%? 40% less in future
- Any share requires full implementation of existing policy on energy efficiency – and more to reach EE potential
- Currently 16% RE (installed capacity)
- Early action on renewables: 2010-2020
  - Long lead times of nuclear
  - RE on equal footing – study RE fleet


CO2 emissions
CO2 Emissions (Mt/annum)
400
380
360
340
320
300
280
260
240
220
200
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
IRP Range
Copenhagen - Range
Base Case
Emission 1
Emission 2
Emission 3
Carbon Tax
Balanced
Add Carbon Measures
Revised Balanced

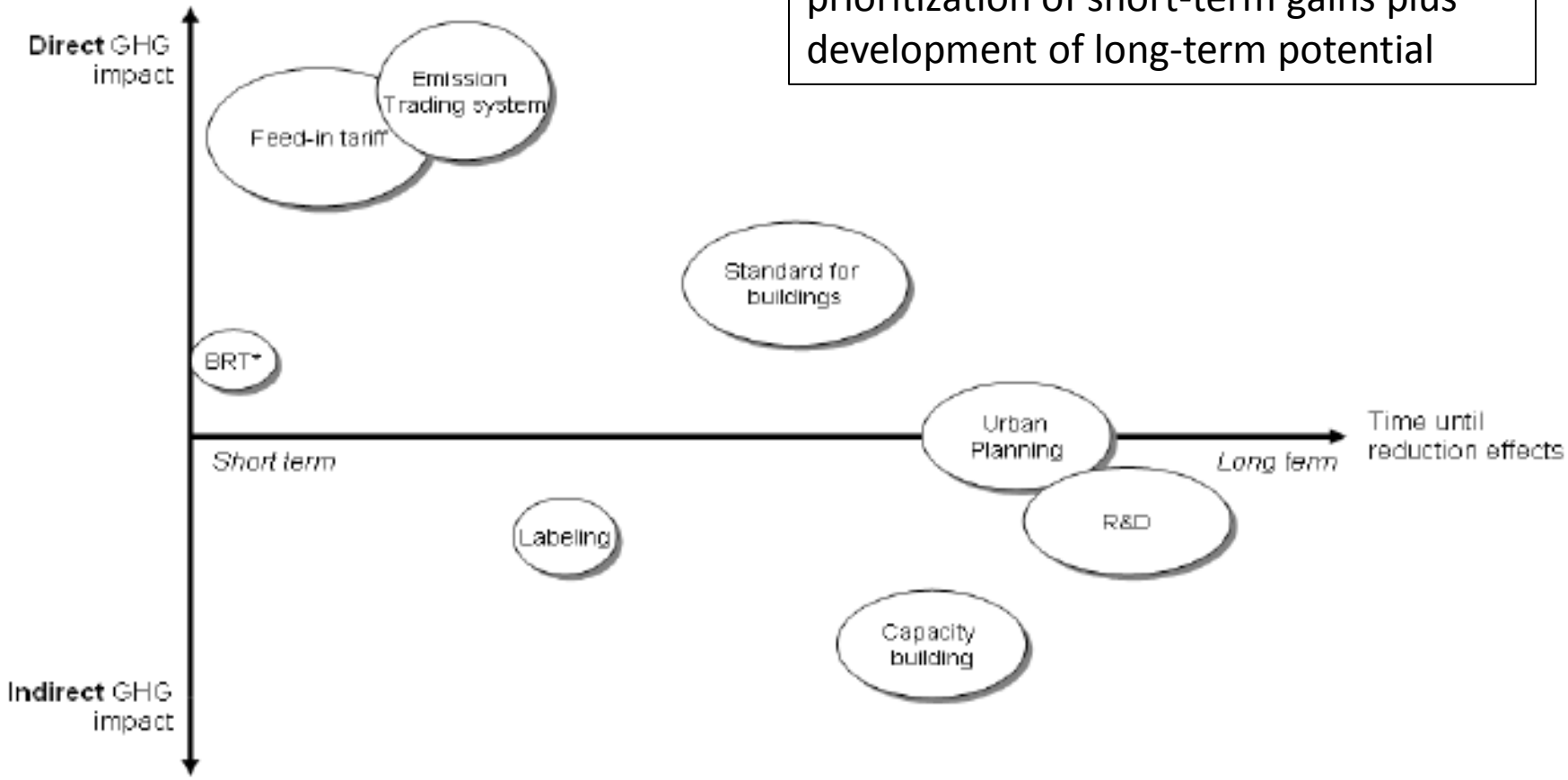

Possible price paths
Price (R/kWh)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Emission 3
Emission 1
Emission 2
Base Case
Balanced Revised
Add Carbon Measures

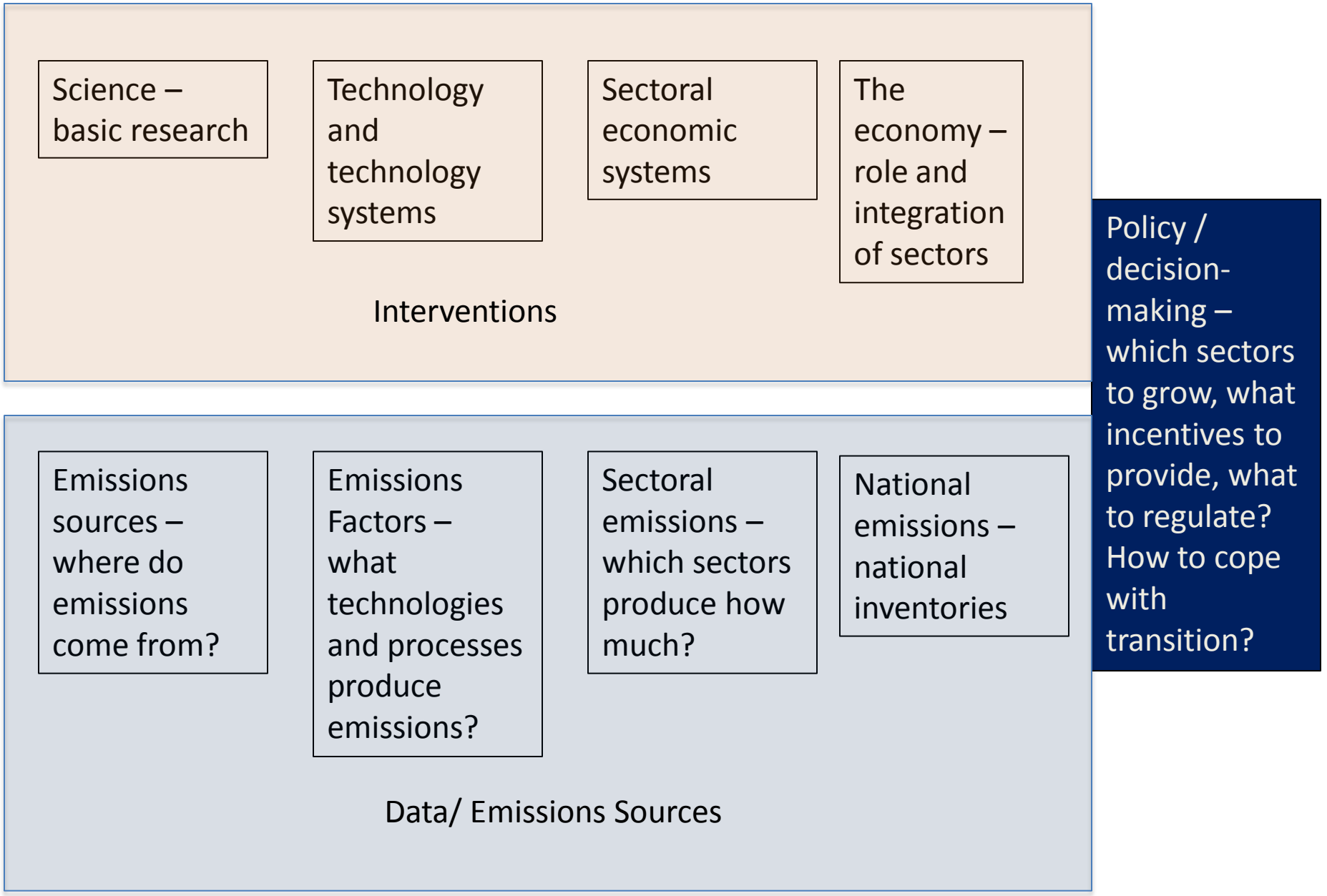

Demand
Households – 2/3 of SA emissions
Technologies -– power plants, industrial plants, agriculture, cars, buses etc
Goods and services
Exports – 1/3 of SA emissions
Price signals
GHG emissions

[from Höhne and Ellerman – Ecofys 2010]

GHG effects of actions over time

Immediate policy requirements – prioritization of short-term gains plus development of long-term potential




Science – basic research
Technology and technology systems
Sectoral economic systems
The economy – role and integration of sectors
Interventions
Policy / decision-making – which sectors to grow, what incentives to provide, what to regulate? How to cope with transition?
Emissions sources – where do emissions come from?
Emissions Factors – what technologies and processes produce emissions?
Sectoral emissions – which sectors produce how much?
National emissions – national inventories
Data/ Emissions Sources

For Example:	Data – how well do we understand emissions, potential	Technology	Systems / implementation
Electricity supply	Good, lacking on demand side	Available, some opportunities for local development	Technical integration, institutional challenges
Energy efficiency	Bad – very little good data	Not the main problem, but NB for future	Key challenges – institutional, incentives
Transport	Moderate	Significant scope, e.g. EVs	Very complex – infrastructure, policy
Industrial policy / structural shifts	No clear understanding of alternatives	Marginally relevant, NB for specific sectors	Key questions – poorly understood
Urban infrastructure	poor	Significant potential	Key questions – poorly understood
Non-energy emissions	difficult	potenital	Not well understood

Key points:

- Technology – standards very NB – need to see it as technology complexes / systems – e.g. standards, linkages, localisation
- Data Systems – very sketchy, very poor – especially energy sector demand-side data and understanding of what demands for goods and services give rise to emissions
- Systemic responses in the economy / energy system – systems-based strategies – esp shift to higher-priced energy – synergies, impacts of mitigation, e.g. poor households – very complex
- Policy and decision-making – VERY under-researched – how can we set up decision-making systems to get the most emissions reductions AND get the most national benefits?
- Many contradictory / un-coordinated / decision-making processes with very significant emissions implications for decades – partly a policy issue, partly a system design issue

In a nutshell – need more research on economic impact, systems (energy and other), decision-making, and development paths. Supported by technology research. Short, medium and long-term goals.

Short-term research agenda

- Several key areas:
  - More targeted analysis building on the LTMS with short-medium term focus – what are key short-medium-term interventions, plus establishing long term programmes – updated LTMS framework with different timeframe
  - Economic opportunities / impacts of key mitigation strategies, and opportunities for growth – national tradeoffs, interaction between climate and other policy imperatives, impact on the poor, different growth paths
  - Policy/programme co-ordination – low-carbon development, technology complexes, standards, regulation, institutions
  - Technology research to inform policy, and as an outcome of policy – short/medium/long term

Research opportunities

- Energy provision and challenges for rural electrification and infrastructure development
- Economic opportunities through provision of off-grid, mini-hybrid systems
- Success of Public-Private sector Partnerships
- Climate / carbon off-set financing (CDM projects)
- Implementation of specific RETs: small wind, solar PV, CPV, biofuel, micro-hydro, biogas.
- Mini-grids and grid connected (solar parks, community-owned wind farms)
- Conducive regulatory and institutional support regime for the development of RETs.

Thank you

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