Climate Action Tracker

Scaling up climate action

Key opportunities for transitioning to a zero emissions society

CAT Scaling Up Climate Action series

METHODOLOGICAL ANNEX

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CAT Scaling Up Climate Action series

The Climate Action Tracker (CAT) strives to support enhancing climate action in the context of the Paris Agreement implementation. This analysis contributes to the Talanoa Dialogue at COP24 and future revisions of mitigation targets, and aims at spurring an increase in climate mitigation actions, to close the gap between current emissions projections and required Paris-compatible pathways.

As part of this, we have been researching the potential for countries to scale up climate action in different focus areas. The analysis in this report is relevant to Parties considering revisions to their Nationally Determined Contributions (NDCs) to be submitted under the Paris Agreement by 2020, and also to their submission of long-term low greenhouse gas development plans, also due by 2020.

The result is our **Scaling Up Climate Action** country series, which identifies options for increased sectoral action that would move a country towards a pathway compatible with the Paris Agreement's long-term temperature limit and estimates the impact of those actions on emissions and other benefits.

The first round of our analysis covers **South Africa**, the **European Union**, **Indonesia**, **Turkey**, **Argentina**, and **Australia**.

The consistent method and similar structure for all six reports allows for country-specific insights, while enabling a cross-country comparison to draw general research findings and lessons learnt on global potentials.

www.climateactiontracker.org/publications/scalingup

1 Overview of methodological approach

A consistent method and similar structure for all six reports under the Scaling Up Climate Action country series aims for country-specific insights, while enabling a cross-country comparison to draw general research findings and lessons learnt on global potentials.

Each country report starts with the analysis of climate policy activity and respective gaps in comparison to sectoral benchmarks in line with the Paris Agreement temperature goals of 1.5°C above pre-industrial levels for all sectors (**Chapter 2**). This sectoral-level analysis results in a qualitative rating for each sector on its current transitional status towards a low-carbon economy.

Based on this overview and rating and on additional considerations of the specific countries' circumstances, the reports focus on three areas for in-depth analysis on accelerated climate action (**Chapter 3**). This in-depth analysis comprises the quantification of mitigation impacts of accelerated climate action and selected co-benefits (**Chapter 4**).

Table 1: Methodological approach for all country reports under the Scaling Up Climate Action country series

All sectors	**Chapter 2**	**Overview of national climate policy actions and gaps**
		• Policy activity analysis based on a climate policy matrix • Policy ambition analysis using sectoral benchmarks
In-depth analysis on three focus sectors	**Chapter 3**	**Selection of three focus areas for enhancing climate action**
		Application of different criteria (e.g. relevance in terms of GHG emissions) for prioritization of three focus areas for in-depth analysis
	Chapter 4	**Quantification of emission reduction potential and co-benefits**
	1	Identification of indicator levels for three scenario categories • 1.5°C Paris Agreement compatible benchmarks • Applying best-in-class level(s) • National scenarios
	2	Scenario quantification using PROSPECTS scenario evaluation tool
	3	Co-benefits quantification using internal/external methodologies

Contents

2 Chapter 2: Overview of national climate policy actions

All sectors	Chapter 2	Overview of national climate policy actions and gaps
	• Policy activity analysis based on a climate policy matrix • Policy ambition analysis using sectoral benchmarks	

The overview of national climate policy actions comprises all main sectors, namely (1) electricity and heating supply, (2) transport, (3) buildings, (4) industry, as well as (5) agriculture and forestry. For each sector, a policy activity analysis categorizes all existing and planned policies according to policy classification proposed by the Climate Policy Database (NewClimate Institute, 2016). Thereupon, a policy ambition analysis examines the differences between sectoral policy activity and required action to meet 1.5°C compatible pathways using sectoral benchmarks derived from the literature (Kuramochi et al., 2018).

2.1 Policy activity analysis based on a comprehensive policy matrix

The policy activity analysis aims to provide a comprehensive overview of existing and planned policy measures. The overview primarily focuses on policies at the national level but further includes sub-national policies where relevant. The policy activity analysis uses classification matrixes proposed by the Climate Policy Database for each sector (NewClimate Institute, 2016).[1] Each sectoral matrix differentiates between policies in the following general categories:

- Changing activity
- Energy efficiency
- Renewables
- Nuclear or CCS or fuel switch
- Non-energy

Annex A lists all six sectoral classification matrixes for the five sectors as well as for listing general overarching policies. The overview matrixes' structure might be adjusted to account for country-specific circumstances in the respective country analyses. The overview matrixes provide no evaluation on the current state of implementation, their effectiveness, or their level of (mitigation) ambition. To provide more detail for particularly relevant policies, a written summary per sector overviews the most important policies and recent developments.

2.2 Policy ambition analysis

Overall approach and sectoral benchmarks

The policy gap analysis examines the gap between historical and future sectoral developments under existing and planned policies in comparison to a 1.5°C compatible emissions pathway for each sector. For this purpose, the analysis uses nine sectoral benchmarks identified by Kuramochi et al. (2018) as part of research for the Climate Action Tracker (CAT). These benchmarks are considered the most important short-term benchmarks for action in line with the long-term perspective for the required 1.5°C compatible low-carbon transition. The nine benchmarks are based on a comprehensive review of existing emission scenarios and existing

[1] The Climate Policy Database can be accessed under www.climatepolicydatabase.org.

analysis on required sectoral transitions in each sector. Table 2 provides a full overview of all nine benchmarks applied in the country analyses.
The gap analysis compares historical developments and projected developments under current policies to the global benchmarks without any further adjustments to country specific circumstances and capabilities. For this reason, the gap analysis mainly provides an indication to which degree current national developments in each sector align with required steps on a global level and presents a standardized approach to be applied to all countries under analysis. Country-specific circumstances and considerations are only addressed in the in-depth analysis on enhanced climate action for three focus areas.

Table 2: Summary table of sectoral benchmarks identified in Kuramochi et al. (2018)

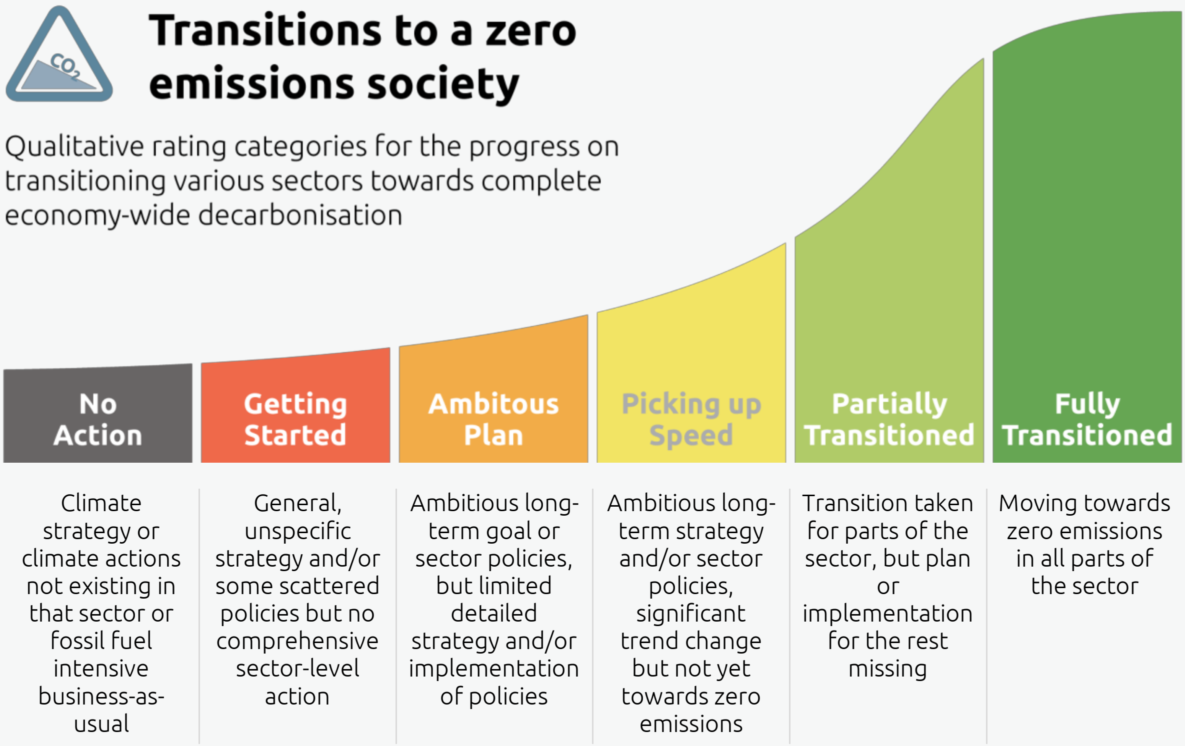
Sector	1.5 °C-consistent benchmark
Electricity and heat sector	Sustain the global average growth of renewables and other zero and low-carbon power until 2025 to reach 100% by 2050
	No new coal plants, reduce emissions from coal power by at least 30% by 2025
Transport sector	Last fossil fuel car sold before 2035
	Aviation and shipping: Develop and agree on a 1.5°C compatible vision
Buildings sector	All new buildings fossil free and near zero energy by 2020
	Increase building renovation rates from <1% to 5% by 2020
Industry sector	All new installations in emissions-intensive sectors are low-carbon after 2020, maximise material efficiency
LULUCF	Reduce emissions from forestry and other land use to 95% below 2010 by 2030, stop net deforestation by 2025
Commercial Agriculture	Keep emissions in 2020 at or below current levels, establish and disseminate regional best practice, ramp up research

Quantitative and qualitative policy gap analysis

The policy gap analysis compares recent sectoral developments and future projections in quantitative and qualitative terms. The former compares available current policy projections for each sector to the respective benchmark, including both quantitative analysis by the Climate Action Tracker (CAT) as well as external forecasts and projections. The latter evaluates the historical and expected future progress in each respective sector in qualitative terms, considering national sectoral circumstances and barriers. The qualitative analysis results in a rating of each sector's current transition state towards 1.5°C Paris Agreement compatibility. Box 1 introduces the six rating categories and explanations for each category.

Box 1 Qualitative policy rating for sectoral transition to zero-emissions society

The qualitative analysis of policy activity and ambition of this analysis for South Africa results in a rating of each sector. The rating aims to reflect the sector's current transition state towards 1.5°C Paris Agreement compatibility. For this purpose, the rating accounts for existing sectoral long-term strategies and/or policies, their status of implementation, as well as the general state of transition of the sector under analysis.



3 Chapter 3: Selection of three areas for enhancing climate action

In-depth analysis on three focus sectors	Chapter 3	Selection of three focus areas for enhancing climate action
	Application of different criteria (e.g. relevance in terms of GHG emissions) for prioritization of three focus areas for in-depth analysis	

Informed by the policy activity and policy ambition analysis, Chapter 3 selects three focus areas for in-depth analysis on scaling up climate action. Given the scope of each country report, an in-depth analysis can only be undertaken for a limited number of up to three areas.

This section explains the reasoning for looking further into these three areas, considering the South African national context and country-specific circumstances. Note that the selection to focus on these areas in no way indicates that less mitigation action is needed in all other remaining sectors. Relevant literature in the field and most recent emission scenarios clearly indicate that all sectors need to maximise their efforts for 1.5°C Paris Agreement compatibility (Kuramochi et al., 2018). The selection of focus areas for scaling up climate action is based on the following criteria combined with expert judgement by the authors. The selection of three focus areas for enhanced climate action is based on several criteria combined with the authors' expert judgement. The applied criteria are the following:

i. **GHG emissions:** The relevance of the (sub-)sector in terms of historical and projected future GHG emissions
ii. **Existing gap**: The existing gap between currently existing and planned policies and 1.5°C compatible benchmark(s)
iii. **Potential for scaling up climate action:** The potential for enhancing climate action given local and global sectoral development (e.g. decreasing prices for RE technologies, CCS capacities, pending investment in infrastructure)
iv. **Priority in the national discourse:** Priority of the respective (sub-)sector in the national discourse or opportunities to enhance climate action due to recent social, political, or economic developments
v. **Overlaps with other sectors:** The (sub-)sector's degree of overlap with other sectors relevant for long-term decarbonization (e.g. CO_2-neutral electricity sector in parallel to electrification trends in the transport or buildings sector)
vi. **Co-benefits potential and sustainable development goals:** Potential to realise co-benefits of scaling up climate action in a given country context (e.g. local job development through ambitious renewables deployment or reduction in urban air pollution due to modal shift away from combustion engines), especially linking to the country's sustainable development goals

While each country analysis contains a country-specific selection of three focus areas, the final selection might overlap between the different country analyses. Most prominently, the decarbonization of the electricity sector carries distinct importance in each country for the objective to meet the Paris Agreement temperature goal. This overlap in selected focus areas allows for a cross-country comparison on opportunities to accelerate climate action and subsequent impacts on sectoral emission trajectories and co-benefits of mitigation action.

4 Chapter 4: Quantification of emission reduction potential and co-benefits

In-depth analysis on three focus sectors	1	Identification of indicator levels for three scenario categories • 1.5°C Paris Agreement compatible benchmarks • Applying best-in-class level(s) • National scenarios
	2	Scenario quantification using PROSPECTS scenario evaluation tool
	3	Co-benefits quantification using internal/external methodologies

4.1 Identification of indicator levels for three scenario categories

The quantification of emission reduction potentials of enhanced climate action and respective co-benefits covers three different scenario categories presented in the following. This approach allows to compare sectoral emission trajectories and the opportunity to achieve co-benefits of mitigation action for different sets of indicator values informed by recent research and literature in the field.

The comparison further allows to identify overlaps or gaps between sector transitions required to be in line with the Paris Agreement temperature goal and those sector transitions stipulated by international/regional frontrunners and scenarios considering the national context.

Where different analyses are available, some scenario categories present a range of indicator values, thus accounting for an upper and lower bound of indicator values. The starting point for each sector analysis is a sector-specific Current Development Scenario (CDS) ranging until 2050.

Current Development Scenario (CDS) / Reference Scenario

The **Current Development Scenario (CDS) / Reference Scenario** forecasts sectoral trajectories until 2050 under currently implemented policies as well as current technology trends for all sectors. For this purpose, the CDS reflects existing policies in the given country context as well as national and international sector-specific activity and intensity indicators (depending on availability). The aggregation across sectors results in CDS projections of total emissions for the respective country, excluding LULUCF emissions.

1.5°C Paris Agreement compatible benchmarks

The **scenario category of '1.5°C Paris Agreement compatible benchmarks'** comprises of sectoral indicator values, which are in line with a 1.5°C compatible sectoral emission trajectory. Where available, these indicator values are country-specific benchmarks (e.g. country-specific RES indictor values for different points in time until 2050). Otherwise, this scenario category relies on indicator values representing global average levels or levels from countries/regions/cities with similar characteristics as default indicator values. The analysis in this scenario category enhances the general understanding about required sectoral transitions in the national context to be in line with the most ambitious end of the Paris Agreement's temperature target.

Applying best-in-class level(s)

The **scenario category 'Applying sectoral best-in-class level(s)'** identifies indicator values from international and regional frontrunner(s) on national climate action in the respective (sub-)sector. The absolute indicator level(s) or growth rate(s) from such reference cases are applied to historical national developments in the respective sector. These scenarios illustrate what impact the replication of sectoral transitions achieved by international frontrunners would imply in the respective national context. This approach might only partially account for potential differences in economic, political, and geographical circumstances between the international or regional front-runners and the countries under analysis.

National scenarios

The **scenario category 'National scenarios'** applies sectoral indicator levels obtained from research conducted by national research institutions or governmental agencies of the respective country under analysis. Such analysis might include least-cost scenarios, analysis on the general potentials for (sub-)sectoral transformation or long-term strategies/sectoral plans proposed by national governments or national non-state actors. This scenario category aims to illustrate the sectoral emissions abatement potentials suggested by national studies that consider the country-specific circumstances.

4.2 Scenario quantification using PROSPECTS scenario evaluation tool

General quantification approach for sectoral emission trajectories

The Scaling Up Climate Action series uses the PROSPECTS scenario evaluation tool for the quantification of sectoral and total emission trajectories until 2050. The analysis of accelerated climate action in three focus (sub-)sectors for each country under analysis then identifies value ranges of relevant indicators in the different scenario categories (see Section 4.1 for more explanation on different scenario categories).

These indicators serve as direct input into the PROSPECTS scenario evaluation tools in the respective sectors. All other sectoral indicators are kept at the same value levels as in the current development scenario. As a result, emission trajectories are available for each of the three focus (sub-)sectors under current development scenario as well as the scenario categories for '1.5°C Paris Agreement compatible benchmarks', 'Applying best-in-class level(s)', and 'National scenarios'.

The aggregation across all sectors in each scenario category further allows for a combined analysis. For non-focus sectors, the aggregation uses sectoral trajectories under a current development scenario. In a final step, total emission projections under current development scenarios and the three scenario categories are harmonized to latest official inventory data provided by the respective country under analysis.

Introduction to PROSPECTS scenario evaluation tool

The PROSPECTS (*Policy-Related Overall and Sectoral Projections of Emission Curves and Time Series*) scenario evaluation tool is a sector-level bottom-up Excel tool which can track and predict overall and sectoral GHG emissions trends of a country. The tool is based on the historic and future development of relevant indicators for decarbonisation and allows for projections of future GHG emissions responding to policy and technology shifts.

ClimateWorks Foundation has developed the Carbon Transparency Initiative (CTI) tool for 5 countries/regions (Mexico, China, India, EU, USA). The CTI tool is spreadsheet-based, with a detailed methodology to determine greenhouse gas emission pathways between 2010 and 2030, across all sectors of the economy. Besides, the Climate Action Tracker (CAT) has developed a database which contains emission data of more than 30 countries/regions. PROSPECTS combines the merits of the CTI tool and the CAT database: (a) it simplifies the sectoral level details in the current CTI tool to achieve the ability to cover a wider range of countries more easily, and (b) uses a range of data sources representing a large number of countries (currently only 6 CTI country models exist), which are contained in the CAT database. Through the proposed sectoral level approach, the PROSPECTS scenario evaluation tool can reveal where rapid decarbonization is occurring and where more action can be taken.

The PROSPECTS framework is developed under an indicator-led methodology, which measures key indicators that shape emission trends on sectoral level for each country (e.g. emission intensity of electricity generation for the power sector or passenger km travelled per person for the transport sector). By breaking down macro-level emissions into sectoral-level indicators, the approach increases transparency on decarbonization in each sector and allows comparisons among regions and over time at multiple levels of the economy. An aggregation of all sectoral trends in the model then leads to an overall emissions profile of a country.

The tool covers all emissions-generating sectors: power and heat, buildings, transport, various industrial sectors (i.e. steel, cement, and aggregated other categories of light industry and heavy industry), waste, agriculture, and oil & gas. Electricity and heat sectors are *supply-side* sectors since they provide electricity and heat, respectively, to other sectors. Other sectors are *demand-side* sectors. The tool covers the time period from 1990 to 2050.

By providing sufficient details at sector level and allowing users to define different scenarios, this model can provide better transparency on GHG emission in a country and provide ideas of how to achieve the goals of Paris Agreement more efficiently. The approaches in this work can also be useful in the medium term for improved policy analysis in advance of the 2018 Global Stocktake. Furthermore, the developed model will be usable in general to assess a country's emission profile under various types of policy scenarios and enhanced-ambition scenarios.

Table 3: Key assumptions for data filling in different PROSPECTS scenario evaluation tools

Tool version	Key assumptions for development of Current Development Scenario (CDS) in focus sectors under analysis
PROSPECTS South Africa	**Electricity supply sector** • **Historical data (1990-2015)**: All data inputs for electricity generation, emissions intensity, as well as electricity exports, imports, losses and own use based on IEA Energy Balance 2017 (IEA, 2017) • **Projections (2016-2050)**: Projections of fuel mix in electricity generation and emissions intensity based on World Energy Outlook (WEO) 2017 forecasts for South Africa. The renewable energy capacity assumed to be installed in the WEO2017 was adjusted to reflect the 2010 Integrated Resource Plan (IRP) policy. Total import and export of electricity are kept constant over time. Own use as percentage of total generation is assumed to decrease proportional to total coal-based generation and losses as percentage of total generation is assumed to decrease with a constant annual rate of 0.5% per year. • **Electricity demand from end-use sectors (historical and projections)** originate from bottom-up calculations for the steel, cement, aggregated other light and heavy industry, and agriculture sectors (see data inputs in PROSPECTS South Africa scenario evaluation tool for further information)

	Transport sector • **Historical data (1990-2015)**: All inputs for historical activity and intensity data for the passenger and freight transport sectors based on IEA's Mobility Model of 2017. Domestic and international passenger aviation is combined under 'domestic aviation' in PROSPECTS' passenger transport category. • **Projections (2016-2050)**: All inputs for activity and intensity data for projections of passenger and freight transport based on the 4° Degree Scenario (4DS) of IEA's Mobility Model of 2017. Domestic and international passenger aviation is combined under 'domestic aviation' in PROSPECTS' passenger transport category. **Buildings sector** • **Historical data (1990-2015)**: All inputs for historical activity and intensity data for the residential and commercial buildings sectors based on IEA's Buildings Model of 2017. • **Projections (2016-2050)**: All inputs for activity and intensity data for projections of the residential and commercial buildings sectors based on the 4° Degree Scenario (4DS) of IEA's Buildings Model of 2017. The PROSPECTS South Africa tool (incl. all input data for supply and demand sectors) can be accessed under www.climateactiontracker.com/scalingup/southafrica/propsects.
PROSPECTS European Union	*Key assumptions for development of Current Development Scenario (CDS) will be added to an updated version of this methodological annex once country analysis released.*
PROSPECTS Indonesia	*Key assumptions for development of Current Development Scenario (CDS) will be added to an updated version of this methodological annex once country analysis released.*
PROSPECTS Argentina	*Key assumptions for development of Current Development Scenario (CDS) will be added to an updated version of this methodological annex once country analysis released.*
PROSPECTS Australia	*Key assumptions for development of Current Development Scenario (CDS) will be added to an updated version of this methodological annex once country analysis released.*
PROSPECTS Turkey	*Key assumptions for development of Current Development Scenario (CDS) will be added to an updated version of this methodological annex once country analysis released.*

4.3 Quantification of employment impacts in the electricity supply sector

We estimate domestic employment impacts of different electricity supply sector development using a spreadsheet-based economic model developed by NewClimate Institute.[2] The Economic Impact Model for Electricity Supply (EIM-ES) derives estimates of employment in each year of the modelling horizon based on investments in electricity supply across the different sectors of the economy in a given year and corresponding annual wage estimates for each sector. The model covers all relevant electricity supply technologies and therefore estimates net employment effects across the system. For a given scenario with data on future capacity and generation, the model calculates direct, indirect and induced jobs associated with the installation of new capacity and the operation and maintenance of existing and new capacity. Indirect and induced economic impacts are derived using an Input Output modelling framework, which captures the interrelations between economic sectors.

The analysis is based on capital investment, operation (including fuel supply) and maintenance cost data inputs that is disaggregated, where possible, into its component parts for electricity generation (see **Error! Reference source not found.** for an illustration of default component parts for onshore wind). Capital expenditure is expressed per unit of new capacity ($/MW) and operational expenditures are split into fixed costs per unit of capacity per year ($/MW/yr) and variable costs per unit of electricity generation ($/MWh).

For each component the share of local expenditure – i.e. how much of the investment is actually spent in the analysis country, rather than on imported goods and services - has to be determined from field or literature research, including sectoral level trade data and industry studies. For example, approximately 20% of all towers for new wind turbine installations in Argentina are purchased from local manufacturers, whereas gas turbines are exclusively imported. Correspondingly, the model treats 20% and 0% of all investment being made in wind turbine towers and gas turbines as domestic expenditure.

Table 4: Illustrative investment cost breakdown for onshore wind including information on the in-country share, the allocation of sectors to components and the share of spending channelled to the labour market.

Onshore wind

Cost Item	Cost Category	Share Input	Value	In-country Share	In-country Spend	Sector	Labour Share of Spend	In-country Labour Spend
Total	Capex		928					
Total	OpexFixed		34					
Total	OpexVariable		-					
Nacelle	Capex	35%	322	75%	241	C31: Electrical machinery and a	19%	47
Blades	Capex	14%	128	75%	96	C26: Other non-metallic mineral	15%	14
Tow er	Capex	13%	118	75%	89	C28: Fabricated metal products	24%	22
Transport	Capex	5%	43	50%	22	C60T63: Transport and storage	19%	4
Electrical balance of plants	Capex	10%	95	25%	24	C31: Electrical machinery and a	19%	5
Installation	Capex	7%	64	90%	58	C45: Construction	14%	8
Project planning and management	Capex	3%	29	75%	22	C73T74: R&D and other busines	28%	6
Civil w orks	Capex	9%	80	85%	68	C45: Construction	14%	9
Contingency and finance	Capex	5%	47	97%	46	C65T67: Financial intermediatior	30%	13
Operation	OpexFixed	40%	14	75%	10	C40T41: Electricity, gas and w a	18%	2
Maintenance	OpexFixed	60%	20	75%	15	C31: Electrical machinery and a	19%	3

[2] For the analysis of employment impacts in the EU, a different approach is applied. Due to the large heterogeneity within the EU, we focus on estimating impacts on direct employment only, using employment factor empirically derived for Europe.

All domestic expenditure is allocated to the different sectors of the economy and subsequently multiplied by a sector specific factor for the share of domestic spending that is directed to the labour market. The sectoral level "labour share of spend" factors are derived from country Input Output tables, although they can be manually adjusted in the model if more accurate information relating explicitly to the component part exists.[3] The resulting value constitutes the investment channelled to local labour for a given component part, with the remaining amount spent on non-labour inputs such as raw materials, intermediate component parts or land. Dividing the investment in the local labour market by an estimate of the average wage costs for workers employed in that sector, including taxes and any other costs borne by employers, yields the number of direct job years created by the investment. Sectoral level wage cost estimates are typically sourced from annual national statistical publications.

Figure 1 shows an illustrative example of a $100 investment in a component part, such as the tower for a wind turbine. In this case $60 of the total is spent in the country and the remaining $40 is spent on imported parts and services, which does not stimulate domestic employment. Approximately one third of the domestic investment ($20) is spent on the labour market, with the remaining amount spent on non-labour inputs such as cement and steel. In this illustrative example the annual wage is $2. The $20 investment in the labour market therefore directly stimulates ten jobs for one year; or alternatively five jobs for a period of two years if the investment was spread across a two-year construction period.

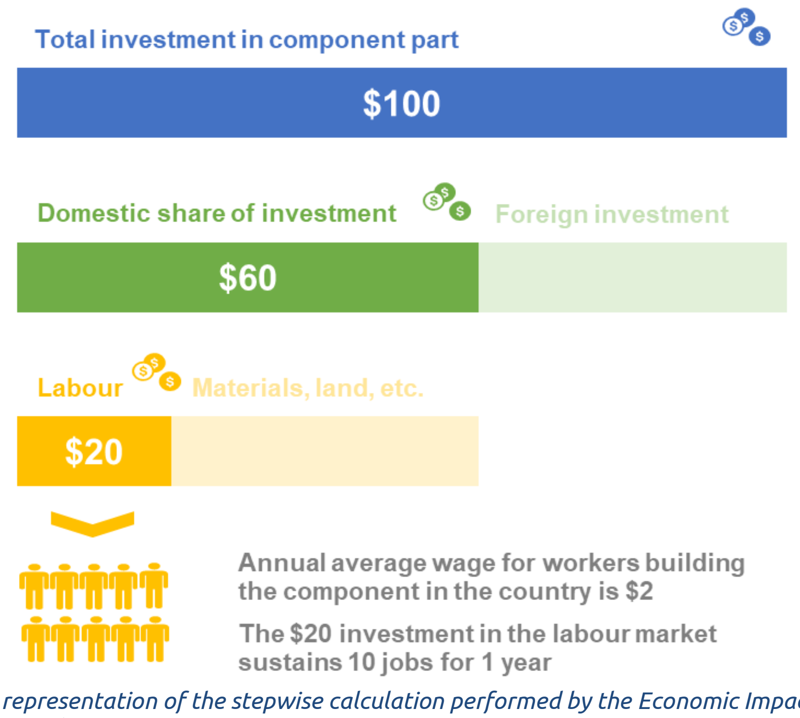


Figure 1: Schematic representation of the stepwise calculation performed by the Economic Impact Model for Electricity Supply (EIM-ES).

The model apportions estimates of direct employment over time based on the annual capacity additions and electricity generation defined by the scenario as well as assumptions related to the duration of the various tasks and services. Construction jobs typically may last between one to eight years, depending on the technology. Jobs related to the provision of operational and maintenance services typically extend over a longer period, linked to the expected lifetime of the asset. Jobs in the fuel supply industry – for example the mining of coal or the extraction of

[3] Please see Bacon & Kojima (2011) and Jenniches (2018) for an overview of challenges in assessing regional economic impacts of a transition to renewable energy generation under different approaches such as employment ratios, supply chain analyses, input-output models, and computable general equilibrium models.

natural gas - are linked directly to fuel consumption from thermal generation capacity. The annual estimates of direct employment over the scenario horizon offer interesting insights into the likely pace and magnitude of growth (and decline) of employment opportunities by technology and economic sector.

In addition, the model calculates indirect and induced employment impacts by drawing on Input Output tables for the economy. These are estimated in aggregate over the defined modelling period, rather than annually. Input Output tables reflect the interdependencies of sectors across the economy, based on national statistics, derived from detailed census information as well as sectoral level output and trade data. The modelling framework implicitly assumes that the relationships captured in the Input Output table are preserved for the duration of the modelling period. This simplified approach avoids the need for more complex – and typically less transparent – modelling and assumptions regarding the future development of the structure of the economy. Despite this limitation, the use of Input Output tables provides an indication of the order of magnitude of the wider economic impacts of investment in electricity generation. The model also reports additional economic indicators, such as annual and total investment requirements for the scenario, the share of the investment as a proportion of country GDP and the economic value added across different sectors as a result of the investments.

The scenarios designed in PROSPECTS report electricity generation by fuel source do not contain data on the generating capacity but only on the generation by fuel. For this reason, the quantification of employment impacts requires additional country-specific assumptions outlined in Table 5.

Table 5: Key assumptions for application of the Economic Impact Model for Electricity Supply (EIM-ES) for different country analyses

Tool version	Key assumptions
EIM-ES South Africa	• Investment costs for capital expenditure, fixed and variable operational expenditure by technology adopted from CSIR (Wright et al., 2017) • Plant construction duration and lifetime assumptions adopted from CSIR (Wright et al., 2017) • Load factors to translate power generation scenario from PROSPECTS into a capacity scenario were derived from CSIR scenarios (Wright et al., 2017) • Sectoral salaries were derived from StatsSA and ILO reporting (International Labour Organisation, 2018; StatsSA, 2013, 2018) • The most recent country Input Output table was sourced from the OECD IO database. The data was used to calculate the labour share of sectoral expenditures and to derive the economic multipliers to estimate indirect and induced employment impacts (OECD, 2011) • Local share of investment was informed by trade information contained in the Input Output table, the JEDI international model published by NREL and an assessment presented in the integrated energy plan of the South African Department of Energy (Department of Energy of South Africa, 2016; NREL, 2016)
EIM-ES European Union	*Details on methodology of the approach applied for the EU and key assumptions will be added to an updated version of this methodological annex once country analysis released.*
EIM-ES Indonesia	*Key assumptions will be added to an updated version of this methodological annex once country analysis released.*

EIM-ES Argentina	*Key assumptions will be added to an updated version of this methodological annex once country analysis released.*
EIM-ES Australia	*Key assumptions will be added to an updated version of this methodological annex once country analysis released.*
EIM-ES Turkey	*Key assumptions will be added to an updated version of this methodological annex once country analysis released.*

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Annex A – Sectoral matrixes in Climate Policy Database

General

Table 6: Sectoral matrix for general sector in Climate Policy Database (NewClimate Institute, 2016)

OVERARCHING CLIMATE CHANGE POLICIES OF SOUTH AFRICA				
Changing activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
Climate Strategy				
GHG reduction target				
Coordinating body for climate change				
Support for low-emission R&D				
	National energy efficiency target	**National renewable energy target**		

Electricity and heating supply sector

Table 7: Sectoral matrix for electricity and heating supply sector in Climate Policy Database (NewClimate Institute, 2016)

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE ELECTRICITY AND HEAT SECTOR IN SOUTH AFRICA				
Changing Activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
	Support for highly efficient power plants	**Renewable energy target for electricity sector**	**CCS support scheme**	
	Reduction obligation schemes	**Support scheme for renewables**		
		Grid infrastructure development		
		Sustainability standards for biomass use		
Overarching carbon pricing scheme or emissions limit				
Energy and other taxes				
Fossil fuel subsidies				

Transport sector

Table 8: Sectoral matrix for transport sector in Climate Policy Database (NewClimate Institute, 2016)

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE TRANSPORT SECTOR IN SOUTH AFRICA				
Changing Activity	Energy efficiency	Renewables	Nuclear or CCS or fuel switch	Non-energy
Urban planning and infrastructure investment to minimise transport needs	Minimum energy/emissions performance standards or support for energy efficient for light duty vehicles	Biofuel target	Support for modal share switch	
	Minimum energy/emissions performance standards or support for energy efficient for heavy duty vehicles	Support schemes for biofuels	E-mobility programme	
		Sustainability standards for biomass use		
Tax on fuel and/or emissions				
Fossil fuel subsidies				

Buildings sector

Table 9: Sectoral matrix for buildings sector in Climate Policy Database (NewClimate Institute, 2016)

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE BUILDINGS SECTOR IN SOUTH AFRICA				
Changing Activity	Energy efficiency	Renewables	Nuclear or CCS or fuel switch	Non-energy
Urban planning strategies	Building codes and standards and fiscal/financial incentives for low-emissions choices	Support scheme for heating and cooling		
	Minimum energy performance and equipment standards for appliances	Support scheme for hot water and cooking		
		Sustainability standards for biomass use		
Energy and other taxes				
Fossil fuel subsidies				

Industry sector

Table 10: Sectoral matrix for industry sector in Climate Policy Database (NewClimate Institute, 2016)

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE INDUSTRY SECTOR IN SOUTH AFRICA				
Changing Activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
Strategy for material efficiency	Support for energy efficiency in industrial production	Support schemes for renewables	CCS support scheme	Landfill methane reduction
	Energy reporting and audits	Sustainability standards for biomass use		Incentives to reduce CH4 from oil and gas production
	Minimum energy performance and equipment standards			Incentives to reduce N2O from industrial processes
	Incentives to reduce fluorinated gases			
Overarching carbon pricing scheme or emissions limit				
Energy and other taxes				
Financial Support Schemes for Sustainable Development				
No fossil fuel subsidies				

Agriculture and forestry

Table 11: Sectoral matrix for agriculture and forestry sector in Climate Policy Database (NewClimate Institute, 2016)

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE AGRICULTURE AND FORESTRY SECTORS IN SOUTH AFRICA				
Changing Activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
Standards and support for sustainable agricultural practices and use of agricultural products				
Incentives to reduce CO2 emissions from agriculture				
Incentives to reduce CH4 emissions from agriculture				
Incentives to reduce N2O emissions from agriculture				
Incentives to reduce deforestation or support for afforestation/reforestation				