GLOBAL ENVIRONMENT FACILITY
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CEO Approval (CEO) entry ? Medium Sized Project ? GEF - 7

Sustainable energy systems for urban-industrial development in South Africa

Part I: Project Information

GEF ID
10817

Project Type
MSP

Type of Trust Fund
GET

CBIT/NGI
CBIT **No**
NGI **No**

Project Title
Sustainable energy systems for urban-industrial development in South Africa

Countries
South Africa

Agency(ies)
UNIDO

Other Executing Partner(s)
National Cleaner Production Centre of South Africa (NCPC-SA)

Executing Partner Type
Government

GEF Focal Area
Climate Change

Taxonomy

Focal Areas, Sustainable Development Goals, Climate Change, Climate Change Mitigation, Energy Efficiency, Renewable Energy, Influencing models, Strengthen institutional capacity and decision-making, Transform policy and regulatory environments, Stakeholders, Private Sector, SMEs, Local Communities, Communications, Behavior change, Awareness Raising, Type of Engagement, Partnership, Information Dissemination, Consultation, Participation, Beneficiaries, Civil Society, Academia, Gender Equality, Gender Mainstreaming, Women groups, Gender-sensitive indicators, Sex-disaggregated indicators, Gender results areas, Knowledge Generation and Exchange, Participation and leadership, Capacity Development, Capacity, Knowledge and Research, Knowledge Generation, Workshop, Training, Knowledge Exchange, Peer-to-Peer

Sector
Mixed & Others

Rio Markers
Climate Change Mitigation
Climate Change Mitigation 2

Climate Change Adaptation
Climate Change Adaptation 0

Submission Date
5/26/2022

Expected Implementation Start
9/1/2022

Expected Completion Date
8/31/2026

Duration
48In Months

Agency Fee($)
115,874.00

A. FOCAL/NON-FOCAL AREA ELEMENTS

Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CCM-1-1	Promote innovation and technology transfer for sustainable energy breakthroughs for decentralized power with energy usage	GET	609,862.00	7,120,000.00
CCM-1-3	Promote innovation and technology transfer for sustainable energy breakthroughs for accelerating energy efficiency	GET	304,930.00	3,000,000.00
CCM-1-4	Promote innovation and technology transfer for sustainable energy breakthroughs for cleantech innovation	GET	304,930.00	3,000,000.00
		Total Project Cost($)	**1,219,722.00**	**13,120,000.00**

B. Project description summary

Project Objective

Reducing GHG emissions and other environmental and social impacts by accelerating the decarbonization of industrial parks addressing both the energy supply and demand side

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
1. Fostering the coordination towards sustainable energy transformation of IPs / SEZs by creating a conducive enabling environment under consideration of social equity	Technical Assistance	Outcome 1: Government and local authorities ensure a conducive IP / SEZ-associated policy and regulatory environment, especially with regards to energy generation and consumption formulated in a sustainable and inclusive manner	Output 1.1: The coordinative capacities for sustainable energy solutions are strengthened at 6 IP / SEZ municipality management levels through coordination plans Output 1.2: Analysis of typical energy profiles based on the introduced energy database conducted and disseminated with IPs, industrial establishments, the government, and municipalities Output 1.3 IP / SEZ management and tenant companies are provided with guidance on establishing IP / SEZ energy strategies at local sites that are sustainable and foster social inclusion Output 1.4: The capacities of key stakeholders	GET	315,322.00	3,150,000.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
Demonstration of low-carbon and sustainable energy interventions in target IPs / SEZ	Investment	Outcome 2: IP / SEZ managements and manufacturing businesses gain confidence and sufficient evidence of the technical, economic, social and environmental viability and benefits of sustainable energy solutions for industrial production in the urban-industrial-energy nexus	Output 2.1: Sustainable energy technology at 3 IP / SEZ pilot projects are implemented to demonstrate low-carbon energy solutions at industrial zone level	GET	549,750.00	6,303,000.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
3. De-risking scheme for upscaling and replication of sustainable energy solutions in IPs / SEZs	Technical Assistance	Outcome 3: The Government and the financial sector enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IPs / SEZs	Output 3.1: Strategy for upscaling of IP / SEZ sustainable energy pilot programme is put in place considering gender lens investment principles Output 3.2: A project pipeline of sustainable energy technology investments in IPs / SEZs identified Output 3.3: The capacity of key stakeholders on financing options for sustainable energy investments in IPs / SEZs are strengthened through establishing a virtual marketplace and conferences	GET	194,250.00	1,570,000.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
4. Monitoring and evaluation	Technical Assistance	Outcome 4: The project?s achievements and impact effectively monitored and evaluated	4.1: Mid-term review 4.2: Terminal evaluation	GET	50,000.00	637,000.00
				Sub Total ($)	**1,109,322.00**	**11,660,000.00**

Project Management Cost (PMC)

GET	110,400.00	1,460,000.00
Sub Total($)	**110,400.00**	**1,460,000.00**
Total Project Cost($)	**1,219,722.00**	**13,120,000.00**

Please provide justification

C. Sources of Co-financing for the Project by name and by type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Recipient Country Government	NCPC-SA	In-kind	Recurrent expenditures	900,000.00
Recipient Country Government	the dtic	In-kind	Recurrent expenditures	5,500,000.00
Donor Agency	DBSA	Loans	Investment mobilized	5,000,000.00
GEF Agency	UNIDO/SECO	Grant	Investment mobilized	1,250,000.00
GEF Agency	UNIDO	In-kind	Recurrent expenditures	120,000.00
GEF Agency	UNIDO	Grant	Investment mobilized	50,000.00
Recipient Country Government	NCPC-SA	Grant	Investment mobilized	300,000.00
			Total Co-Financing($)	**13,120,000.00**

Describe how any "Investment Mobilized" was identified

Co-financing was identified through project/barrier assessments and initial discussions with ministries and implementing partner. The following co-finance source for mobilising investment have been identified: ? Loans by the DBSA though its finance facilities under the Green Climate Fund (GCF) o FP098 : DBSA?s Climate Finance Facility (supporting infrastructure projects that mitigate or adapt to climate change (US$ 170 million for bankable projects in South Africa and Rand-based economies ? Swaziland, Namibia, Lesotho). o FP106 : The GCF-DBSA Embedded Generation Investment Programme (?EGIP?) will support the implementation of renewable energy projects with a capacity of 330 MW, which is comprised of 280 MW Solar PV and 50 MW Wind (US$537 million) Additional co-finance will be provided in-kind by the dtic, incl. through its Industrial Parks Revitalization Programme, UNIDO and the NCPC-SA including co-financing of project management costs. The half of the dtic's co-financing amount related to Industrial Revitalization Programme (IRPR) mentioned in the letter is expected to directly support project outcomes, therefore US$ 5,500,000 is taken as the co-financing amount. The project mobilized grant co-financing from Global Eco-Industrial Parks Programme (GEIPP) in Developing and Transition Countries implemented by UNIDO and funded by the Swiss State Secretariat for Economic Affairs, SECO ? Economic Cooperation and Development. The programme's objective to demonstrate the viability and

benefits of Eco-Industrial Park approaches in scaling up resource productivity and improving economic, environmental and social performances of businesses is align with the project. Due to the interrelated objectives and synergies and South Africa being one of the focus countries under the programme, a co-financing of an amount of US$ 1,250,000 in cash will be made available from the GEIPP for the duration of the project. In addition to the co-financing sources mentioned above, the project will seek further co-financing from the Industrial Development Corporation (IDC) in the form of loan schemes during the project implementation. Please see the initial IDC letter of support attached. IDC offers special financing schemes such as the AFD Green Energy Fund providing finance to renewable energy and energy efficiency investments (fund size ZAR 1 billion, approx. US$ 66 million). The project team is negotiating on the specific amount and type of IDC co-financing to the project, this will be solidified during the project inception phase.

D. Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNIDO	GET	South Africa	Climate Change	CC STAR Allocation	1,219,722	115,874	1,335,596.00
			Total Grant Resources($)		**1,219,722.00**	**115,874.00**	**1,335,596.00**

E. Non Grant Instrument

NON-GRANT INSTRUMENT at CEO Endorsement

Includes Non grant instruments? **No**

Includes reflow to GEF? **No**

F. Project Preparation Grant (PPG)

PPG Required **true**

PPG Amount ($)

50,000

PPG Agency Fee ($)

4,750

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNIDO	GET	South Africa	Climate Change	CC STAR Allocation	50,000	4,750	**54,750.00**
				Total Project Costs($)	**50,000.00**	**4,750.00**	**54,750.00**

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)	3330000	1291449	0	0
Expected metric tons of CO?e (indirect)	11000000	5100000	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)				
Expected metric tons of CO?e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)	3,330,000	1,291,449		
Expected metric tons of CO?e (indirect)	11,000,000	5,100,000		
Anticipated start year of accounting	2022	2022		
Duration of accounting	20	20		

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)				

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)
Solar Photovoltaic select		10.00		
Solar Photovoltaic select		20.00		
Wind Power select		10.00		

Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	4,500	5,000		
Male	10,500	10,000		
Total	15000	15000	0	0

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided

Part II. Project Justification

1a. Project Description

Main changes occurred between PIF and CEO Endorsement stages

During PPG, no major changes made on the PIF design. Some project outputs are fine-tuned in line with the outcomes of the project as explained in the table below:

PIF	CEO	Change/explanation
Output 1.1: The coordinative capacity for sustainable energy solutions in IPs are strengthened on municipality and IP management level(s)	Same	Minor change: the wording on ??6 IPs/SEZ?? added
Output 1.2: Analysis of typical energy profiles is made available to IPs, industrial establishments, the government and municipalities supported by introduced energy audits	Same	-
Output 1.3 IP management and tenant companies are provided with guidance on establishing IP energy strategies at local sites that are sustainable and foster social inclusion	Same	-
Output 1.4: Key stakeholders are aware and trained on sustainable energy aspects (including gender dimensions) at IPs	Same	-
Outputs 2.1: Sustainable energy infrastructure at IP pilot projects is implemented demonstrating sustainable energy solutions at IP level	Output 2.1: Sustainable energy technology at 3 IP / SEZ pilot projects are implemented to demonstrate low-carbon energy solutions at industrial zone level	Output 2.2 is moved to the activity level, kept under the same output (see Activity 2.1.1.6). Output 2.3 is moved to the activity level under the Output 1.1.4 (see Activity 1.1.4.3) to be consistent with the knowledge sharing activities.
Output 2.2: Lesson learned, including social and equity impacts, from the sustainable energy pilot demonstration in the urban-industrial-energy nexus are derived		
Output 2.3: Knowledge about best practice examples for low-carbon IP activities in South Africa and globally are disseminated amongst IP managers through a Community of Practice		
Output 3.1: Strategy for upscaling of IP sustainable energy pilot programme is in place considering gender lens investment principle	Same	-
Output 3.2: A project pipeline for investment replicating the IP sustainable energy pilot approaches identified	Same	-

Output 3.3: The understanding of key stakeholders on financing options for sustainable energy activities in IP are strengthened through establishing a marketplace	Same	-
Output 4.1: Mid-term review	Output 4.1: Mid-term review	Gender monitoring is integrated into all outputs as a cross-cutting activity.
Output 4.1.2: Gender analysis and regular monitoring of the gender mainstreaming action plan		
Output 4.1.3: Final evaluation	Same	-

1.1 Global environmental problem

The growing global demand for materials is a major factor affecting the total energy consumption and CO2 emissions in industrial sub-sectors. Material demand has historically been linked closely with both population growth and economic development. Decoupling material demand from economic and population growth can help curb growth in energy consumption and CO2 emissions from material production. In recent decades, the growth in global demand for key energy-intensive bulk materials has outstripped population growth ? and for many materials, GDP growth as well.[1][1] The extractives sector has seen dramatic growth due to growth in global population and consumption patterns. The twentieth century witnessed a massive increase in extraction: a 27-fold increase in the extraction of ores, 34-fold increase in demand for construction materials and a 12-fold increase in oil extraction.[2][2]

Over the past couple of decades, industrial energy efficiency has continuously improved, and resulting CO2 emissions have even declined substantially in many sectors. However, the aforementioned growing global demand for industrial products (and the raw materials it takes to produce them) has more than offset this progress. As a result, total industrial energy consumption and CO2 emissions have continued to rise significantly since the turn of the millennium. Projections of future energy use and emissions show that without a decisive immediate action, these trends will continue.[3][3]

Industrial energy supply is traditionally depended on fossil fuels and is heavily subsidised ? relying often on lower quality fuels as well as inefficient and outdated technologies that lead to high energy consumption and carbon emissions in the industrial sector.[4][4] Consequently, the industry sector accounted for 37% (157 EJ) of the total global final energy use in 2018 (including energy use for blast furnaces and coke ovens and feedstocks). This represents a 0.9% annual increase in energy consumption since 2010, with 0.8% growth in 2018, following stronger growth of 1.6% the previous year. Growth in energy consumption has been driven largely by an ongoing long-term trend of rising production in energy-intensive industry sub-sectors (i.e., chemicals, iron and steel, cement, pulp and paper and aluminum).[5][5]

Industrial activities represent a significant share of global GHG emissions. In 2018, the industry sector was responsible for almost 19% of total anthropogenic GHG emissions, of which 6% originated from

industrial processes and 13% in the energy sub-sector manufacturing/construction.[6][6] In total, the global industry sector (consisting of the two sectors, Industrial processes and manufacturing/construction, previously mentioned) emitted over 9,060 MtCO2e in 2018.[7][7]

As in other major industrialised nations and emerging economies (G20 member states), this trend can also be observed in the South African economy, which is the third largest in Africa and the most industrialised, technologically advanced, and diversified economy in Africa overall.[8][8], [9][9] South Africa is classified as an ?upper-middle income country? and was ranked third among the BRICS economies in the World Economic Forum's (WEF') 2019 Global Competitiveness Index.[10][10], [11][11] Its most prominent economic sectors include mining, transport, energy, manufacturing, tourism, and agriculture.[12][12]

As for mining: Between 2004 and 2014, South Africa?s overall production (extraction) of coal has increased by approx. 7%, while the extraction of gold and platinum has decreased by about 55% and 32% in that period, respectively.[13][13] According to the World Bank, natural resources depletion[14][14] (as percentage of gross national income (GNI)) in South Africa stood at 2.2% in 2019.[15][15] Since 2015, the trend of this indicator is pointing upwards again. It is likely that South Africa?s steadily increasing coal production (which amounts to approx. 3% of the world?s annual total)[16][16] is significantly contributing to this trend.

Without a significant change towards a sustainable energy system, the increased domestic production of coal is supposed to satisfy South Africa?s growing demand in the energy sector, which is the backbone of the country?s economy. The energy sector is a vital economic sector, creating jobs and value through the extraction, transformation and distribution of energy goods and services throughout the economy. South Africa?s steady economic growth, coupled with an increasing focus on industrialization and a mass electrification programme to bring electricity into deep rural areas, has resulted in a steep increase in energy demand in recent years.[17][17]

South Africa?s CO2 emissions per capita are amongst the highest per capita emissions in the developing world, which is mainly due to a high energy intensity profile. Since 2000, the country?s GHG emissions (excl. FOLU[18][18]) have increased by 14.2% (from 448.9 MtCO2e to 512.7 MtCO2e), while GHG emissions (including FOLU) have increased by 10.4% (from 436.7 MtCO2e to 482 MtCO2e) in the same period (refer to Figure 3 in the Baseline section).[19][19]

The country?s energy consumption is the main contributor to these constantly increasing GHG emission levels. A strong reliance on a coal-based energy production system for the generation of electricity and for the production of a significant proportion of the liquid fuels consumed in the country, including for transport. Also, the economy is dominated by large-scale, energy-intensive primary minerals beneficiation industries and mining industries. So far, renewable energy resources are used only to a limited extent as energy sources. Thus, the primary energy supply in South Africa is dominated by coal (59%), followed by crude oil (16%), renewable resources and waste (20%)[20][20], natural gas (3%) and nuclear energy (2%).[21][21] Coal currently accounts for over 85% of fuel input in electricity generation.[22][22] In 2019, over 90% of total electricity generation in South Africa was produced by the public electricity utility Eskom (also known as Electricity Supply Commission (ESCOM)).[23][23] The company alone emitted over 40% of South Africa?s total GHG emissions that year.[24][24] The share of renewable energies for electricity generation is still low: By 2016 and 2017, the penetration levels of wind and solar energy resources had increased to 3% (6.9 TWh) and 4% (10.8 TWh), respectively.[25][25]

In terms of GHG emissions, the total amount of emissions from the energy sector for 2017 (as reported in the 4th BUR, 2021) is estimated to be 380.5 MtCO2e, with fuel combustion activities being the main contributor, accounting for almost 93% of emissions from the sector. Overall, power generation (energy industries) is the main source of emissions from the energy sector, accounting for 51% (followed by transport with 11% and manufacturing industries and construction with 6%, respectively) in 2017. Together, these sectors made up the lion's share of South Africa?s emissions, accounting for approximately 68% of total GHG emissions. Furthermore, the residential and commercial sectors are both heavily reliant on electricity for meeting energy needs.[26][26]

South Africa?s industry sector is of high relevance for addressing the high levels of GHG emissions. With 47%, the industrial sector (which includes mining, iron and steel, chemicals, non-ferrous metals, non-metallic minerals, pulp and paper, food and tobacco, and other) is the largest user of energy in South Africa.[27][27] In terms of sources, most energy is used from biomass (30%), electricity (29%), followed by coal (23%), gas (11%).

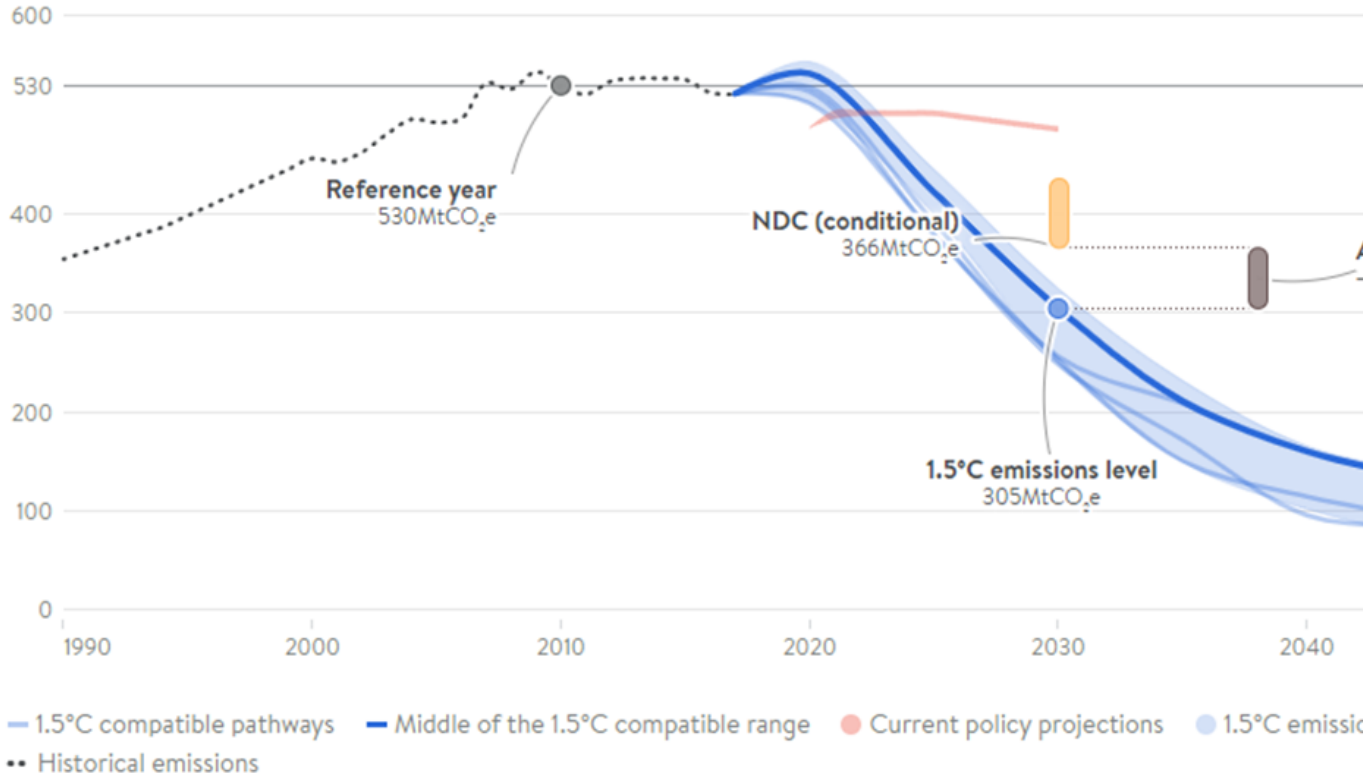
Accordingly, GHG emissions from the industry sector are significant. Emissions from the industrial processes and product use (IPPU) sector are slowly increasing (except for the reduced emissions during the recession). The main GHG emission driving processes in the IPPU sector are the metal industries, particularly iron and steel production and ferro-alloy production. In 2017, the IPPU sector produced 43.2 MtCO2e, which corresponds to 7.5% of South Africa?s emissions (excluding FOLU).[28][28]

In addition to fact that South Africa is a high energy intensity and carbon intensity country, the following observations were made: According to the 2021 Energy Trilemma Index[29][29], developed by the World Energy Council, South Africa is ranked 64th on the Energy Trilemma Index out of 101 countries. South Africa?s low performance in environmental sustainability (rank 77 out of 101) in this

index is due to the electricity sector?s heavy reliance on coal, while increasing petroleum prices, coupled with rising electricity tariffs, contributed to the low score on energy equity (rank 70 out of 101).[30][30] The country?s low performance in environmental sustainability becomes particularly evident when considering the primary impacts arising from mining (especially coal mining). Coal mining generates air pollution, as the toxic gases such as Sulphur (SF6), nitrous oxide (N2O), carbon dioxide (CO2) and methane (CH4) are released into the air during the coal extraction process. For example, the province of Mpumalanga has been recognised as a province where air quality is a huge problem. Presently, because of coal mining, uncontainable underground fires and power plants coal-burning activity, the province has been declared the worst air quality problem in the world.[31][31]

As the South African economy is highly dependent on its abundant natural resources, the country is particularly vulnerable to the effects of climate change. As a result, the South African government has recognised the need to take action to mitigate climate change in order to ensure the continued growth and development of the economy and to promote South Africa's international leadership on this issue.[32][32] Although the country currently generates electricity through the burning of fossil fuels, with a grid emission factor of approx. 0.950 tCO2/MWh,[33][33] it has set ambitious targets to decarbonize its power sector in its nationally determined contribution (NDC) and is starting to achieve this (see Baseline section). Complementary to such efforts, there is a need to decarbonize the industry sector to enable South Africa to achieve its NDC targets, contribute to the Paris Agreement, and generate global environmental benefits. The following diagram shows the projected pathway for low emissions and climate-resilient development to be achieved through the implementation of the economy-wide mitigation component of South Africa?s updated NDC. As can be seen, further ambition is required to achieve an emission reduction pathway that is compatible with 1.5?C goal.

Figure 1: South Africa?s pathway to limit global warming to 1.5?C



Source: Climate Analytics (2021): What is South Africa?s pathway to limit global warming to 1.5?C? URL: https://1p5ndc-pathways.climateanalytics.org/countries/south-africa/

1.2 Barriers and root causes of the global environmental problem

In order to support South Africa?s NDC target and accelerate the decarbonization of the country?s energy system and industry the energy transition in Industrial Parks (IPs) and Special Economic Zones (SEZs) towards sustainable energy demand and supply will be the key solution. The improvement and development of IPs / SEZs towards a clearly sustainable energy setting is required to decrease the energy intensity and related GHG emissions. In general, major common barriers and challenges hindering the further development of industrial parks in South Africa cover a comprehensive spectrum, including aspects of security and reliability of water, electricity supply, technical and management capacities of park management entities, outdated and malfunctioning infrastructure, access-to-finance for new and existing companies, or functional and aesthetic deficiencies.[34][34] In consequences, industrial establishment in IPs / SEZs suffer on unreliable energy supply (e.g. load shedding) and high dependency on fossil fuels, which leads to high carbon intensity.

According to NCPC-SA, the dtic and UNIDO (2019) these root causes are systemic problems and therefore need to be addressed in a holistic manner at national, provincial, and municipal, as well as industrial park and factory levels, when fostering industrial park development. With respect to the context of energy, research and stakeholder interviews generally confirm the above. For better addressing the problem statement that sustainable energy aspects of industrial activities are

insufficiently integrated into the operation of IPs / SEZs and the urban development planning of municipalities, the most relevant issues can be clustered along three barriers, as presented below.

Barrier 1: Insufficient integration and coordination of sustainable energy strategies, policies and regulation for IPs / SEZs at national, provincial and municipal levels

Stakeholder consultations and baseline analysis made clear that some of the major barriers hindering IPs / SEZs from moving towards sustainable energy is the existing regulatory environment and lack of systematic data collection and coordination. This includes the legislation for electricity generation from RE (and Independent Power Providers - IPPs), a variety of rules and inconsistent laws differing between municipalities (and IPs / SEZs), and insufficient coordination and integration of sustainable energy aspects in IPs / SEZs and in urban planning.

Root causes leading to this barrier comprise:

a) Lack of coordination and consultation on promoting sustainable energy solution

Missing coordination between national, provincial and municipal level and horizontal coordination across ministries / departments leads to insufficient integration of sustainable energy strategies, policies and regulation for IPs / SEZs at government level. A result is the disconnection of municipal planning (on energy aspects and related infrastructure) of IPs/SEZs and neighbouring communities. One important reason is that the responsible institutions, e.g., municipalities and IP / SEZ managements as well as parks tenants have limited awareness of potential energy solutions, including enhance integrated energy management and the utilization of alternative energy source, such as renewable energies and excess energy. This is reinforced by limited coordination efforts amongst IP / SEZ management and tenant companies regarding the industrial zone-wide energy strategies. In consequences, this situation leads to unsustainable energy supply and demand, with industrial establishments suffering under current load shedding schemes, high energy intensive industrial production and high carbon intensive energy supply. As of December 2019, Eskom has published 8 stages of load shedding, each stage representing the removal of 1000 MW demand by controlled shut down on sections of the supply grid based on a predetermined schedule. Schedules may vary by location. Stage 6 (6000 MW reduction) was implemented for the first time in December 2019.

b) Lack of energy data and mechanisms for related data collection at IP / SEZ

The lack of reliable energy data covering supply and demand in general, but in particular sector / production specific load profiles hinder an improved energy management at industrial zone level. If tenants and IP / SEZ operators would have access to viable data and benchmark information this will support the strategic planning and inform the decision marking.

c) Lack of inclusive long-term planning on sustainable energy solutions at municipality and IP / SEZ level

Limited priority of sustainable energy aspects in urban planning, i.e., regulatory issues and policy agenda, hinder the acceleration of integrated and systematic development of local and decentralised energy systems. Currently the energy supply, in particular on power supply, is centralised. An integrated municipal energy planning could support the localisation leading to an enhanced urban-industry-energy nexus that supports local value chains and service providers, that are currently rather scare.

d) Lack of training, skills and knowledge on sustainable energy solutions on sustainable energy supply and demand side solutions, collective park level energy services as well as of sustainable energy logistics opportunities within industrial parks

Lack of capacity of responsible institutions, e.g., municipalities and IP / SEZ management as well as parks tenants prevent investment, as the decision market are not aware of or perceive risk in sustainable energy solution. Focusing on their core business companies, in particular SMEs, lack a proper energy management and technical understanding of optimization potentials. A lack of knowledge, understanding and trust in the potential of sustainable energy for industrial parks prevails within many parks (tenant companies and management), and the public sector (on municipal as well as government level). The existing programmes and initiatives that do support renewable energy generation as well as energy efficiency in industrial processes are often times not sufficiently known to a broader group of stakeholders, leaving those in uncertainty about the larger potential of such activities. The limited awareness of opportunities and benefits of sustainable energy solutions at tenant and at park management level led to a limited advocacy, therefore. This is accomplished with a limited understanding for the potential of alternative energy solutions for sustainable and economic growth for the economy and the individual business. Hence, experience with the decarbonization of industry and logistics in industrial parks are absolutely essential, to enhance the technical know-how on sustainable energy solutions at park management and tenant level.

Barrier 2: Industrial parks do not consider sustainable energy and/or integrated energy solutions due to insufficient evidence-based experience

a) Lack of awareness, knowledge and in sustainable energy and integrated solutions for serving industrial zones energy needs

First attempts to convert IPs / SEZs into eco-industrial parks exist[35][35], and some parks are actively progressing such a green transformation (be it driven by tenant companies or by external regulators). Though, these are at rather early stages and cannot yet serve as champion projects guiding development in other parks. So far, for the broad majority of stakeholders in manufacturing and industrial processes the opportunities of sustainable energy solutions are simply not conceived (while challenges are assumed). A lack of knowledge, for instance on sustainable energy business models and trust in maturity of renewable energy supply opportunities prevents tenants, park managers as well as municipal decision makers from embarking on a sustainable energy pathway. Developing, implementing, testing and successful running of innovative concepts for energy on both demand and supply side in industrial parks, but also related aspects such as mobility, is urgently needed. In this context, the lack of data on energy use is imminent. According to stakeholder interviews, the general quality of data on energy use is poor, and for the majority of parks one can assume that hardly any data on self-generation is known. Though, for addressing the challenges related to high energy intensity and high carbon intensity of industrial and commercial activities, energy data and profiles for each tenant and on aggregated park level are required.[36][36]

Furthermore, only few practical examples exist in the country, hence stakeholders fail to understand how to overcome practical barriers (in particular with bureaucracy) and are discouraged to take action.

Additional root causes are:

? Limited priority given to increase awareness and knowledge on sustainable energy aspects in IPs / SEZs on management and tenant level

? Larger industrial companies are hesitant towards renewable energies due to lack of knowledge on:

  ? Required space, e.g., roof top area if solar panels were used;

  ? Power stability for their technical requirements;

  ? Upfront cost, pay-back period.

? Insufficient baseline and energy data (energy profiles of tenants and IPs / SEZs)

? Lack of proven experience and limited national best practice examples

b) Participation of women in investments on mainstreaming green technologies in Industrial Parks

Even though South African government has made significant shifts through social policy to abolish discriminatory practices in women ownership of businesses and participation in the labour force, the likelihood of women owning businesses is slim. In 2019, the labor force participation rate of women in South Africa was about 49% while men are approximately 62% ? which is 13% lower than that of men. There are high unemployment and informal work among women, low numbers of female entrepreneurs lagging behind as well as the graduates in science, technology and engineering (STEM sector), specifically in engineering (35,000 engineers in South Africa, of whom only 3,000 are women).

The projects investments that are designed with due consideration to gender dimensions can bring significant benefits to women in terms of increased access to employment, markets, education and health services, as well as directly reducing their time poverty. Therefore, a gender lens will be applied as one of the criteria for selecting the pipeline of climate-smart investment projects.

Barrier 3: Lack of financial and investment environment to enable and promote investments in integrated sustainable integrated energy interventions in IPs / SEZs

c) Absence of strategies and regulation which incentivizes adoption of sustainable energy solution

The financial and investment environment as well as existing incentives (such as tax schemes) are not sufficiently attractive for overcoming investment barriers, particularly for SMEs. Due to the prevailing practice of utilising fossil fuels which are still financially attractive compared to alternative solution, investments in sustainable energy systems are prevented at scale. Even though the cost of renewable energies has decreased in recent years holistic approaches and investments at IPs / SEZs level are still missing due to a missing enabling framework (regulatory and financially). Enhanced enabling conditions are also required to overcome challenging technical aspects of energy supply. Following an extensive public consultation process and a significant amount of technical work undertaken by the

Department of Mineral Resources and Energy, the Electricity Regulation Act has been amended to increase the NERSA licensing threshold for embedded generation projects from 1 MW to 100 MW. The amended regulations will exempt generation projects up to 100 MW in size from the NERSA licensing requirement, whether or not they are connected to the grid. In the past, the 1 MW limit has been a significant barrier to investment in embedded generation projects.

d) Gap between project ideas and access to adequate finance

Financing and access to finance for sustainable energy solutions in industrial parks is a key challenge. There is still a perceived investment risks for sustainable energy solutions by IP / SEZ management / tenant companies. While some funding opportunities exist, IPs / SEZs as well as tenant lack the resources and capacity to develop and to close the gap between project concept and bankable projects. A lack of knowledge, for instance on sustainable energy business models and trust in maturity of renewable energy supply opportunities oftentimes lead to risk premiums charged by commercial banks, which hamper investment opportunities[37][37].

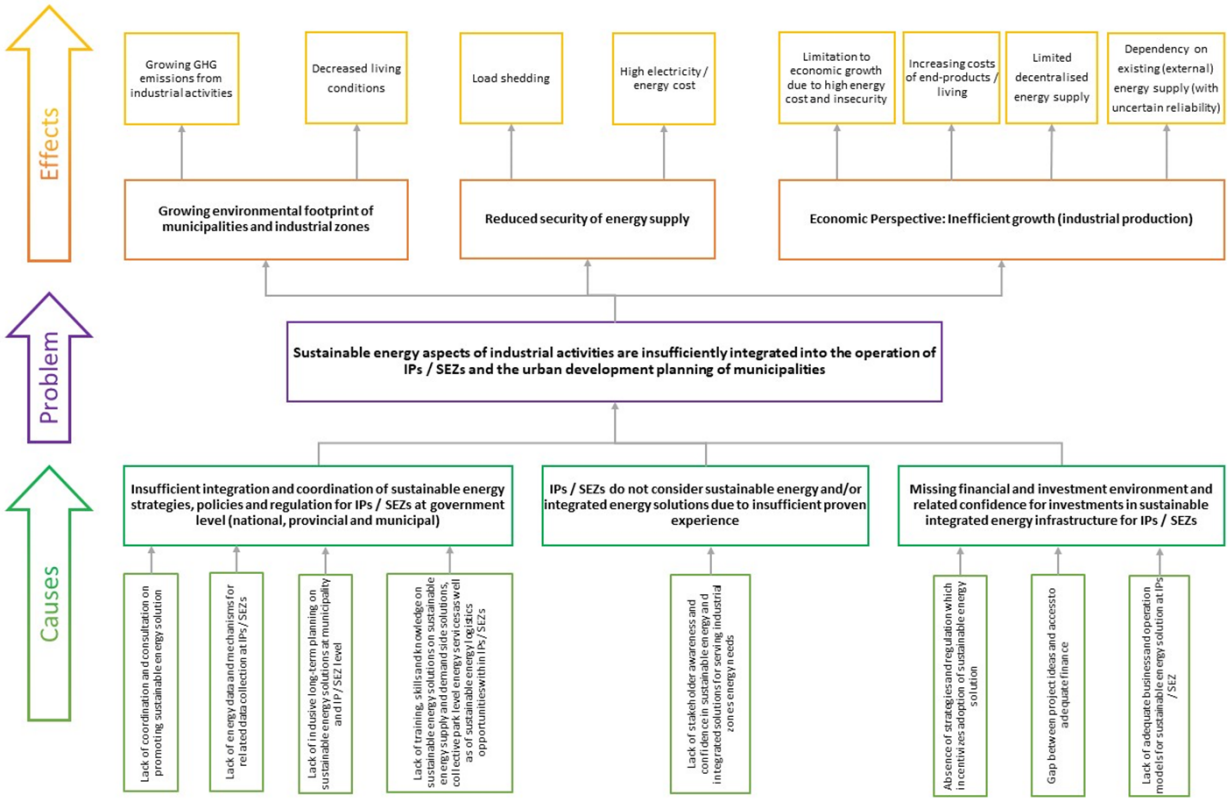
e) Lack of adequate business and operation models for sustainable energy solution at IPs / SEZ

There is a lack of service providers and business models for Energy Service Companies (ESCOs) and Independent Power Providers (IPPs) at local level. Existing service providers are insufficiently able to effectively support companies and IPs / SEZs on identification, evaluation and implementation of sustainable energy solutions. Attractive incentives and adequate business models for service providers such as ESCOs and IPP will be required beyond the existing programmes.[38][38] The existing centralised structure of the energy system hamper the further localisation and decentralisation of energy solutions and services.

1.3 Problem tree

The following diagram summarizes the aforementioned barriers and root causes in a problem tree.

Figure 2: Problem Tree



2) Baseline scenario and any associated baseline projects

This section presents the project?s baseline scenario and associated baseline projects. It starts by providing an overview of the national GHG emissions profile. Following this the industry sector is described, with a particular focus on how the industrial sector is structured. The energy sector in South Africa is then considered, followed by an overview of existing strategies, plans and other future activities in both sectors.

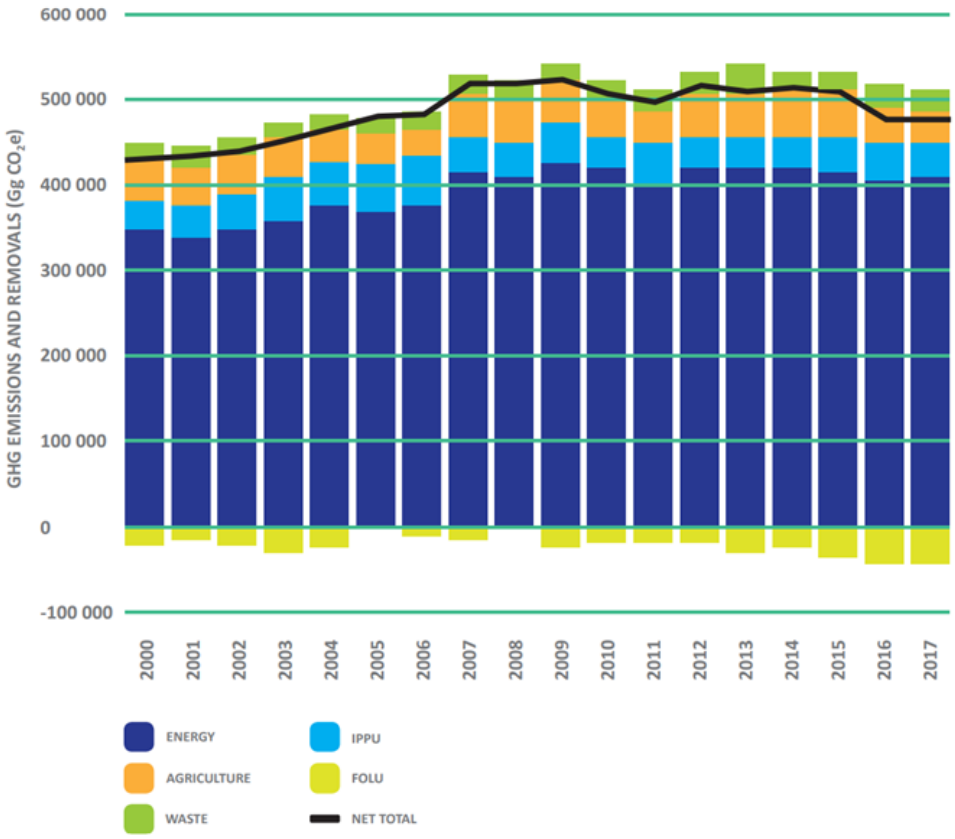
2.1 Emission profile of South Africa

According to the World Resources Institute, South Africa?s total GHG emissions (514.3 MtCO2e) contributed 1.08% to global GHG emissions in 2018 ? placing the country 15th on the list of the world?s largest GHG emitters.[39][39] In 2018, South Africa was the 13th largest emitter of CO2 in the world and was responsible for more than half the CO2 emissions in Sub-Saharan Africa.[40][40] CO2 accounts for approximately 85% of total GHG emissions in South Africa.[41][41]

South Africa?s CO2 emissions per capita are amongst the highest per capita emissions in the developing world, which is mainly due to its high energy intensity profile. Between 2000 and 2017, the

country?s GHG emissions (excl. FOLU) have increased by 14.2% (from 448.9 MtCO2e to 512.7 MtCO2e), while GHG emissions (including FOLU) have increased by 10.4% (from 436.7 MtCO2e to 482 MtCO2e) in the same period (refer to Figure 3 below). The average annual growth rates between 2000 and 2017 amounted to 0.7% (excl. FOLU) and 0.6% (including FOLU), respectively.[42][42]

Figure 3: South Africa?s GHG emissions between 2000 and 2017 by sector[43][43]



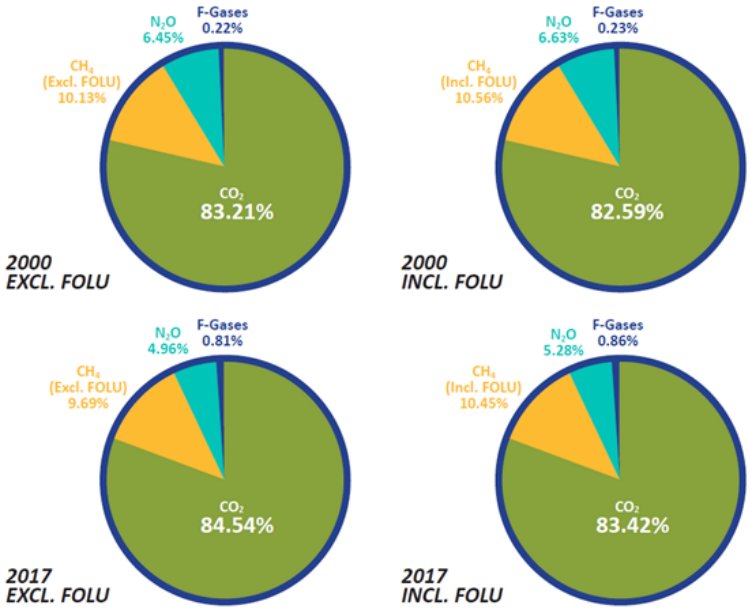
The Energy sector is the largest contributor to South Africa?s total emissions (excl. FOLU), contributing 80% towards these emissions in 2017 which is up from a 78% contribution in 2000.[44][44] Energy sector emissions increased from 349.1 MtCO2e in 2000 to 410.7 MtCO2e in 2017.[45][45] The main contributor to the more robust energy emissions is increased demand for liquid fuels in road transportation, manufacturing industries and construction, civil aviation, and the residential and commercial sectors. This increased demand for fuels is largely driven by population growth and an expanding economy.[46][46]

Fuel combustion activities contributed an average of 92% to the total energy emission between 2000 and 2017. Energy industries contributed an average of 65% to the fuel combustion activity emissions, and an average of 64% to the total energy emissions between 2000 and 2017.[47][47] Transport and other sectors contributed 54.7 MtCO2e (13%) and 38 MtCO2e (9%) to the total energy emissions in 2017, and these are up from 41 MtCO2e and 26 MtCO2e in 2000, respectively.[48][48]

The industrial processes and product use (IPPU)[49][49] sector contributed an average of 7% to the total emissions (excl. FOLU) between 2000 and 2017. In 2017 the IPPU contribution was 32.1 MtCO2e. Emissions increased between 2000 and 2007 when it reached a peak of 42.5 MtCO2e.[50][50] This was followed by a decline to 35.5 MtCO2e in 2010, which was a function of the economy experiencing a recession in 2008/09. Emissions increased slightly in 2011 and then stabilised until 2016. In 2017, emissions declined to 2000 levels. The main drivers in the IPPU sector are the metal industries, particularly iron and steel production and ferroalloy production which contributed 24% and 35% respectively to the total IPPU emissions in 2017.[51][51]

As already mentioned above, CO2 gas is the largest contributor to South Africa?s emissions (see also Figure 4). This is followed by CH4 and then N2O. The contribution from CH4 and N2O generally declined from 2000 to 2017, while the contribution from CO2 and F-gases increased. However, the contribution by F-gas is still below 1.0%.[52][52]

Figure 4: Percentage contributions from each of the gases to South Africa's emissions (excl. FOLU (left) and incl. FOLU (right)) between 2000 & 2017

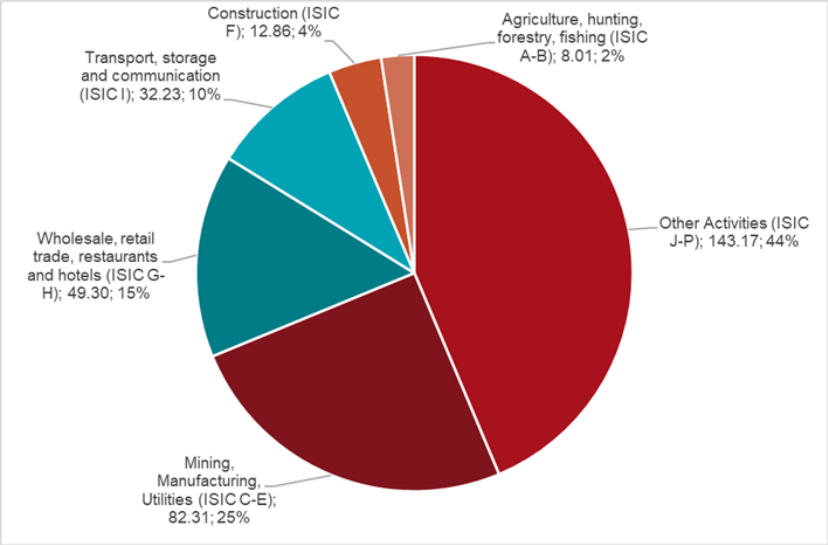


The Climate Action Tracker (CAT) estimates South Africa?s emissions to be 484-488 MtCO2e excluding FOLU by 2030 (also accounting for the potential impact of the COVID-19 pandemic). This would be equivalent to a 3?23% increase above 1990 levels excluding FOLU. Under these current policy projections, South Africa?s emission levels in 2030 will be well above the upper bound of the updated NDC target range for the same year (around 48-52 MtCO2e higher). For more details, please refer to Figure 1.

2.2 The industrial sector

According to the United Nations Statistics Division (UNSD), a country?s economy can be divided into seven separate sectors (economic activities), which are namely: (1) Agriculture, hunting, forestry, fishing; (2) mining, manufacturing, utilities; (3) manufacturing; (4) construction; (5) wholesale, retail trade, restaurants and hotels; (6) transport, storage and communication; and (7) other activities.[53][53], [54][54] The proposed project targets the manufacturing industry, which is also known as secondary industry. Manufacturing includes any industry that makes products from raw materials by the use of manual labor or machinery and that is usually carried out systematically with a division of labor.[55][55] To measure a sector?s contribution to an economy, value added[56][56] to gross domestic product (GDP) is widely used.[57][57] Figure 5 below shows the value added to South Africa?s GDP by economic activity in 2018.

Figure 5: Value added to South Africa's GDP by economic activity in 2018, billion US dollars, at constant 2015 prices



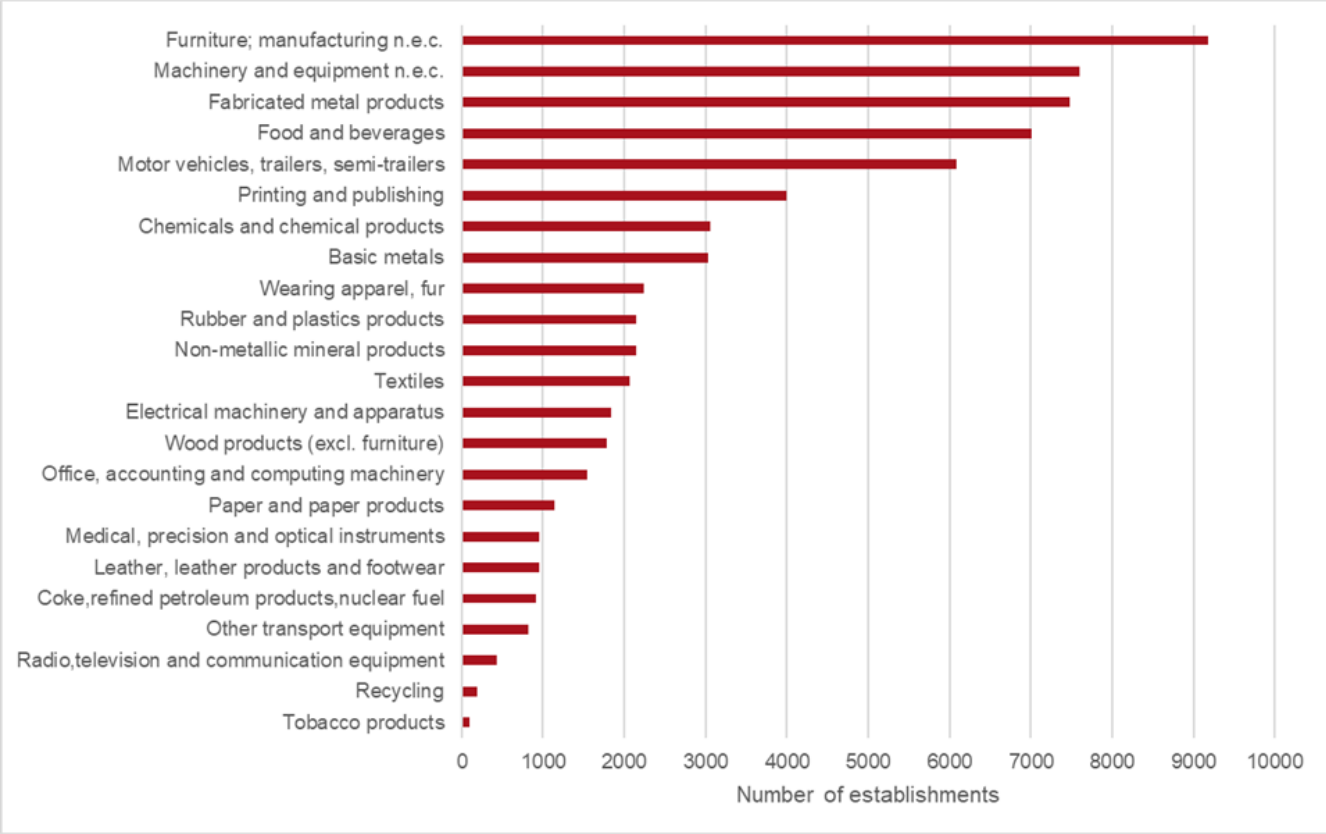
Source: Authors, based on UNSD (2022b): National Accounts - Analysis of Main Aggregates (AMA) - Basic Data Selection - Value Added by Economic Activity, at current prices - US Dollars ? South Africa - 2018. URL: https://unstats.un.org/unsd/snaama/Basic

The sector ?mining, manufacturing, utilities? is a major part of the South African economy as it accounted for approximately 25% of value added (82.3 billion US dollars) in that year.[58][58] Manufacturing alone contributed circa 12% of the value added (43.3 billion US dollars) to South Africa?s GDP.[59][59]

An overview of the industrial sector

Based on data from UNIDO, the South African manufacturing industry comprised of 66,658 establishments in 2014. Within the manufacturing sector the largest industrial sub-sectors in terms of numbers of industrial establishments include furniture manufacturing (9,179 establishments), machinery and equipment (7,595 establishments), fabricated metal products (7,471 establishments), and food and beverages (7,009 establishments).[60][60] Other significant industries include motor vehicles, trailers, semi-trailers; printing and publishing; chemicals and chemical products; and basic metals.[61][61] Figure 6 below provides more information on the number of industrial establishments by sub-sector in 2014.

Figure 6: Number of industrial establishments by sub-sector in 2014 (South Africa)

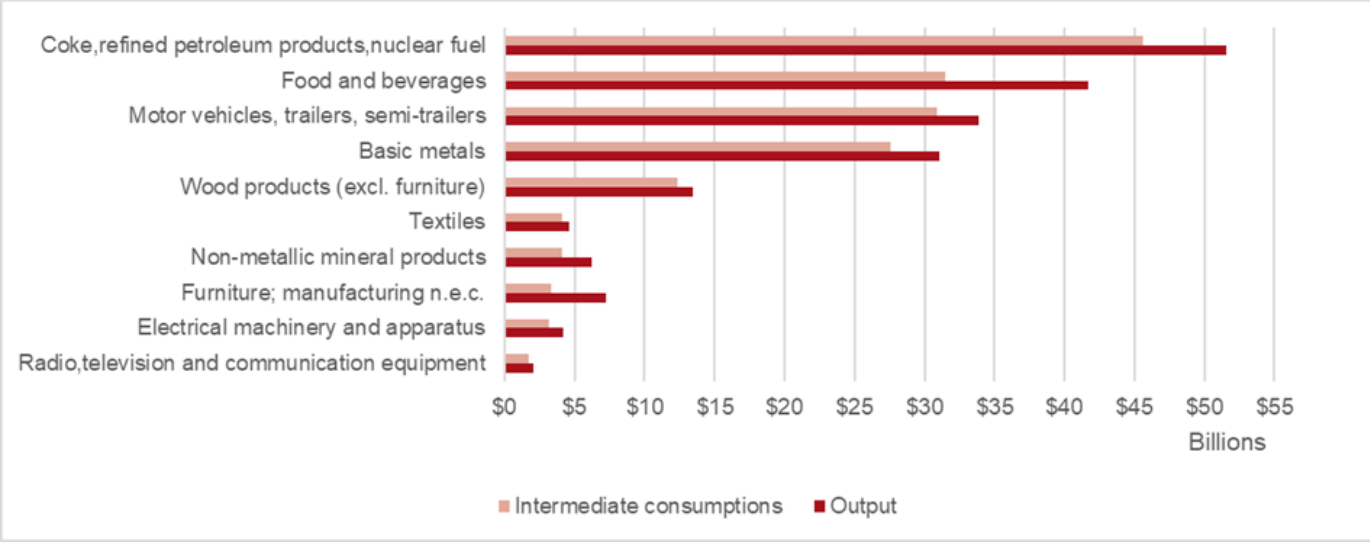


Source: Authors, based on UNIDO (2020): South Africa ? Industry sector statistics retrieved from INDSTAT 2 2020 Database, ISIC Revision 3

The composition of South Africa?s industrial sub-sectors in terms of number of employees differs slightly from the depiction above. The largest sectors in respect of the number of persons engaged in South Africa include food and beverages (246,303 employees), machinery and equipment (110,733 employees) and fabricated metal products (105,849 employees).[62][62] This is followed by other labour-intensive industries such as motor vehicles, trailers, semi-trailers; chemicals and chemical products; and furniture manufacturing.

A statistical indicator that relates to the volume of energy and resource consumption is the ?intermediate consumptions? of industries. It refers to the total consumption of raw materials, electricity, fuel, water and cost of industrial and non-industrial services. As such, the industries in South Africa with the largest intermediate consumptions include coke, refined petroleum products, nuclear fuels; food and beverages; motor vehicles, trailers, semi-trailers; and basic metals.[63][63] Figure 7 below shows the output and intermediate consumptions by South African industry sub-sector in 2018.

Figure 7: Output and intermediate consumptions by industry sub-sector in 2018 (South Africa)

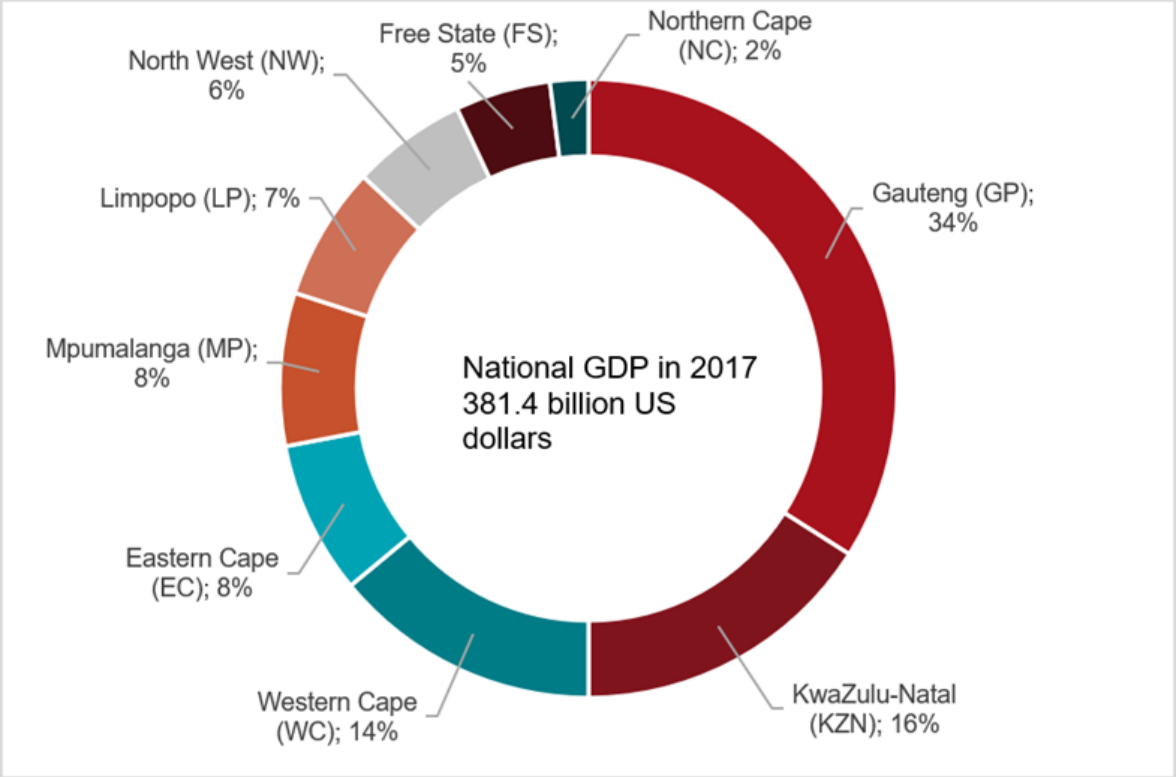


Source: Authors, based on UNIDO (2020): South Africa ? Industry sector statistics retrieved from INDSTAT 2 2020 Database, ISIC Revision 3

Provincial industry distribution

South Africa has quite diverse economic landscape and there are large differences in terms of how much the provinces contribute to the national economy (see Figure 8 below). Despite being the province with the smallest land area, Gauteng (GP) contributed more than a third of South Africa?s GDP, which amounted to 381.4 billion US dollars in 2017.[64][64], [65][65] KwaZulu-Natal (KZN) was the second biggest, responsible for 16 US$ of every 100 US$ generated by the national economy. Northern Cape (NC) had by far the smallest economic output, amounting to only 2% of national GDP.[66][66]

Figure 8: Contribution to South Africa's GDP by province in 2017 (current US dollars)

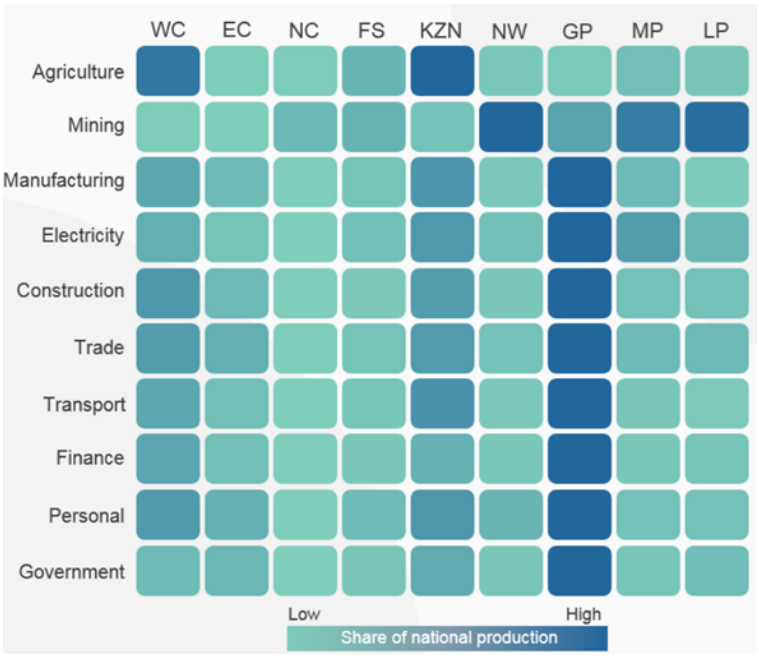


Source: Authors, based on Statistics South Africa (2019): Four facts about our provincial economies. URL: http://www.statssa.gov.za/?p=12056

As can be seen in Figure 9 below, in 2017 Gauteng dominated every sector of South Africa?s economy except for mining and agriculture. Mining was the main industry of Limpopo (LP), Mpumalanga (MP), North West (NW) and the Northern Cape. KwaZulu-Natal had the country?s largest agriculture sector, but the province?s major industry was manufacturing ? second in size only to manufacturing in Gauteng.[67][67]

In 2016, Gauteng?s biggest sector was finance, real estate and business services, which made up almost a quarter of the province?s economy, followed by general government services[68][68], and then manufacturing.[69][69] Government services made the biggest contribution to the economies of the Free State (FS) (followed by finance) and the Eastern Cape (EC) (followed by trade, catering and accommodation). The Western Cape?s (WC) largest industry was finance, followed by trade, catering and accommodation (a sector that roughly corresponds to shopping, leisure and tourism).[70][70]

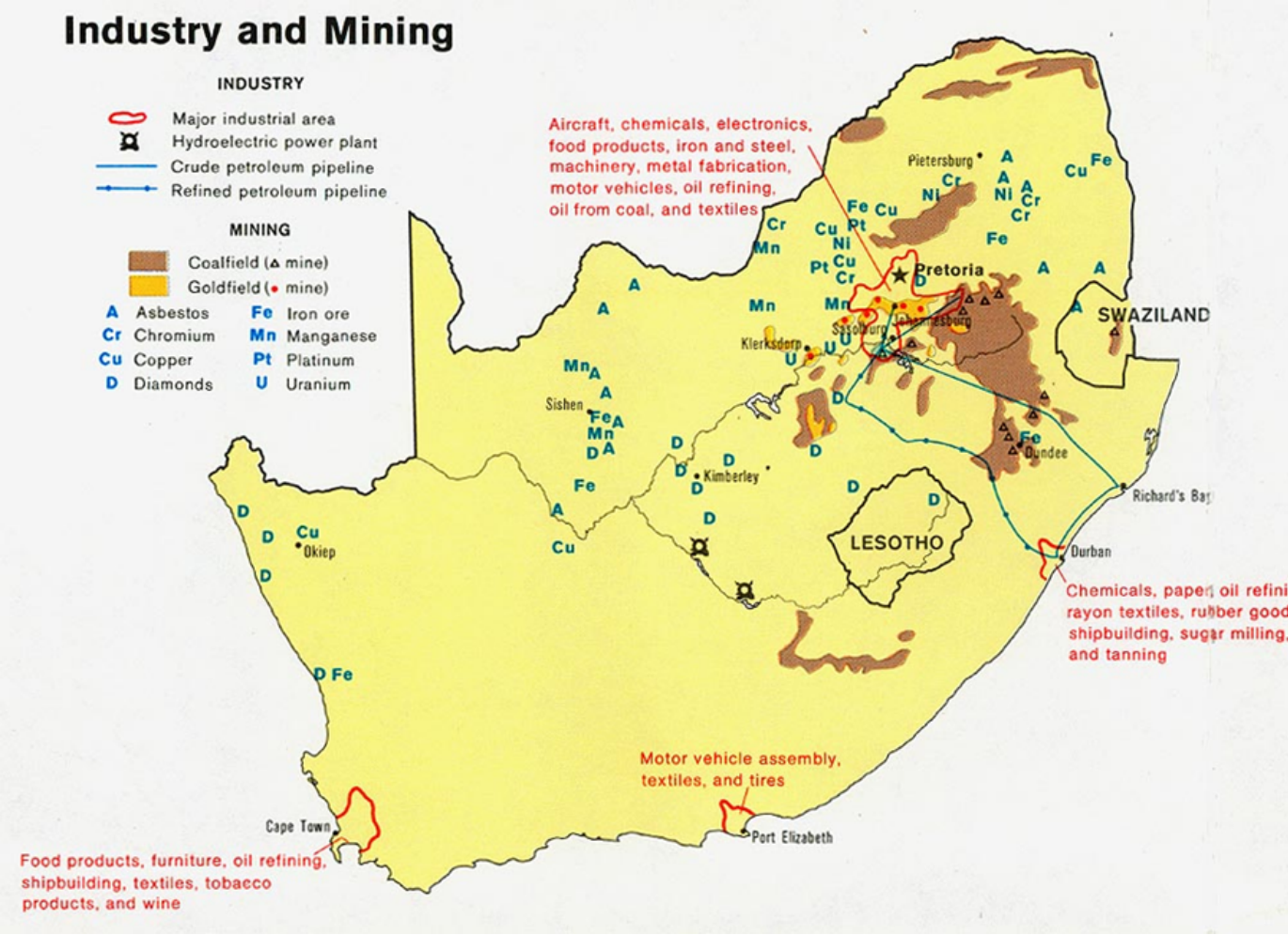
Figure 9: Distribution of economic activity across South Africa for each industry (2017)



Source: Statistics South Africa (2019): Four facts about our provincial economies

The following map shows the major industrial agglomerations and mining areas in South Africa. Most of the above-mentioned energy-intensive industries are located in these areas. It can be observed that the locations of the gold fields (and also many other metal mines) coincide with those parts of the country where the coal fields are located.

Figure 10: Industry and mining map of South Africa



Source: Central Intelligence Agency (CIA) (n.d.): SOUTH AFRICA INDUSTRY AND MINING MAP. URL: http://mapas.owje.com/maps/3758_south-africa-industry-and-mining-map.html

Industrial activities and agglomerations

With a share of 25% of the GDP and employing an estimated 23% of the country?s workforce, the industry sector serves as an important backbone of the South African economy. As mentioned above, major industrial sectors are mining (Platinum, Gold, Chromium), automobile assembly, metal-working and machinery. Manufacturing is contributing some 12% of the total GDP and 58% of the exports in 2018. The manufacturing activities are predominantly concentrated in the metropolitan areas of three provinces, namely Gauteng, Western Cape and Kwa-Zulu Natal, leaving many other parts of the country with low manufacturing capacity.[71][71] At the same time, South Africa has experienced limited economic growth over the last years as a result of global dynamics, political uncertainties, corruption,

labour and social aspects, as well as unstable electricity supply, leading to an associated decline in manufacturing in the country.

In this regard, for manufacturing and industrial production, the approximately 450 South African industrial parks play an important role as hubs for business and centres of employment. Those parks are categorized as industrial parks, industrial development zones (IDZ) and special economic zones (SEZ), as summarized below, and accommodate a broad spectrum of the country?s industrial and manufacturing production capacity.[72][72] Currently 27 government owned industrial parks and 15 SEZs operate in South Africa. In addition, approximately 300 smaller privately-owned industrial parks exist, while some 100 municipality-owned industrial parks operate in South Africa. Apparently, no inventory exists for of these private and municipal-owned parks in South Africa. This information is only available at the municipality level.[73][73]

Table 1: Defining industrial parks and zones in South Africa

Category	Managing entity	Specific features / Definition
Industrial Parks	Private as well as Government funded	An industrial park as defined in South Africa generally exists to support, manage and administer industrial activities within a specified area in order to facilitate socioeconomic benefits for the surrounding area, its tenants and the country as a whole.
Industrial Development Zone / Special Economic Zone	National Government / Government owned	An Industrial Development Zone (IDZ) is a purpose-built industrial estate linked to an international seaport or airport and which is capable of leveraging fixed direct investments in value-added and export-orientated manufacturing industries. All IDZs have, or are in process of, transition to become SEZs. Special Economic Zones (SEZs) are geographically designated areas set aside for specifically targeted economic activities. They are supported through special arrangements (that may include laws) and systems that are often different from those that apply in the rest of the country. The Special Economic Zones Act 16 of 2014 provides for the designation, promotion, development, operation and management of SEZs.

Source: adapted from UNIDO (2020), Global Eco-Industrial Parks Programme - South Africa: Country level intervention Project Document

While certainly not being representative, taking a closer look at the country?s SEZs and IDZs provides a fair overview of the broad composition and specialization of industrial park settings in South Africa. The table below illustrates the spectrum of production activities, ranging from manufacturing such as automotive or renewable energy plants, over electronics and agro-processing to air transport and logistics services.

Table 2: Overview SEZs and IDZs in South Africa

Name	Production Focus	Municipality
Atlantis SEZ	Greentech / Renewable Energy	City of Cape Town
Coega IDZ	Automotives	Nelson Mandela Bay
Dube Trade Port	Agro-processing and electronics	eThekwini
East London IDZ	Automotives	Buffalo City
Ekandustria	Food&Bev, Metals, Clothing, packaging	Tshwane Metropolitan
Maluti-A-Phofung SEZ	Automotive logistics, agro-processing, pharmaceutical	Maluti a Phofung
Mthatha SEZ	Agro-processing	King Sabata Dalindyebo
Musina Makhado SEZ	Logistics, petrochemicals and trade hub	Makahdo / Musina
Nasrec SEZ	ICT and electronics	City of Johannesburg
Nkomazi SEZ	General Logistics	Nkomazi
OR Tambo International Airport IDZ	Air transport	Ekurhuleni
Platinum Valley SEZ	Platinum Group Metals	Moses Kotane
Phuthaditjahaba Industrial Park	Textiles, retail, furniture, construction, chemicals (petroleum and gas), logistics & warehousing, food & beverages	Maluti-a-Phofung
Richards Bay IDZ	Beneficiation of natural resources	uMhlathuze
Saldanha Bay IDZ	Marine Engineering, with a focus on oil and gas	Saldanha Bay
Tubatse SEZ	Platinum Group Metals	Greater Tubatse
Umbogintwini Industrial Complex	Chemicals, food manufacture (human and animal), warehousing and logistics	Maluti-a-Phofung
Upington SEZ	Solar Corridor	Khara Hais

Source: adapted from TIPS (2016)[74][74]

As highlighted above, when it comes to decarbonizing the industry sector, South Africa faces considerable challenges to curb its GHG emission levels. The dependency of fossil-fuel based energy (particularly from the state utility Eskom) is still predominant.

While limited data on the use of energy in individual IPs / SEZs is available, it appears that sustainable energy aspects of industrial activities are insufficiently integrated into the operation of parks and the urban development planning of municipalities. In general, municipalities in South Africa are expanding in a resource-intensive and inefficient manner, in part because of the challenges with integrated

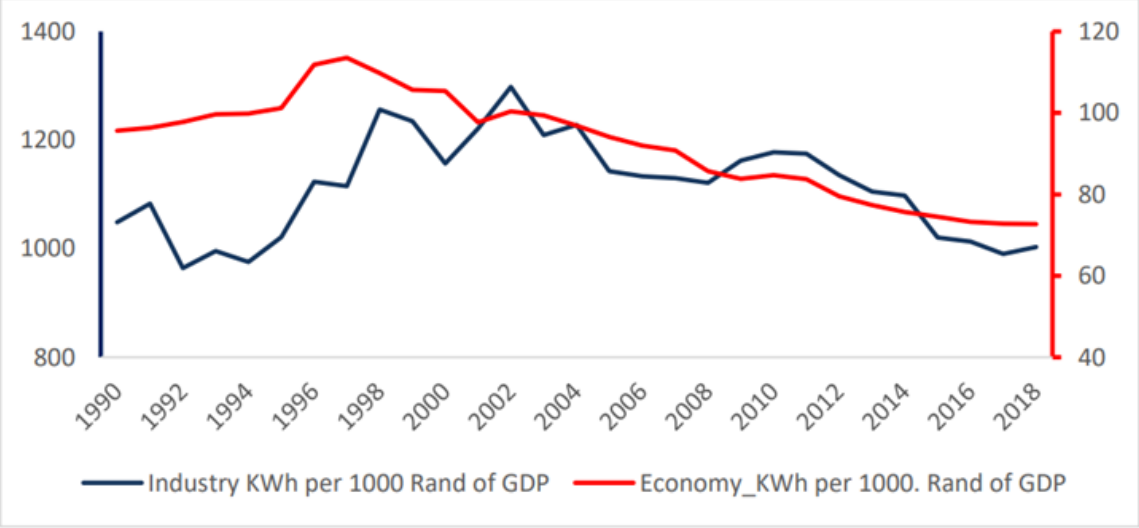
planning within the institutions. Sustainability needs to be embedded into municipal development agendas and seen as central to service delivery, not as a separate ?green agenda?. As municipalities and industrial parks/zones are truly interconnected entities, IPs / SEZs have the potential to contribute significantly to the development of more sustainable municipalities by providing joint infrastructures and industrial urban synergy options (?urban-industry nexus?). In South Africa, the development of industrial parks is intended to integrate with local and regional development activities. As they form part of a greater ecosystem, it is important that the impact and benefits of interventions in industrial parks have positive downstream effects on the community, city/town and municipality.[75][75]

Given the relevance of manufacturing and industrial production for the country?s energy demand, understanding and unlocking the huge potential for sustainable energy consumption and supply at IPs / SEZs is thus of core importance. There is a clear need for ongoing support to IPs / SEZs in South Africa, including support with implementation of priority ?eco-industrial park? (EIP) opportunities as well as the identification and prioritization of EIP opportunities in other parks. This includes the promotion of sustainable energy.[76][76]

Status quo of sustainable energy systems in the industrial sector

In the light of the above, one might ask: How much progress has South Africa made in greening its industry and economy? Some commendable progress has indeed been realised. Figure 11 shows a sustained reduction in the energy intensity of production.

Figure 11: Energy intensity of production (kWh/1000 rand of GDP)



Source: Gwatidzo, T.; & Simbanegavi, W. (2021): Building a competitive and dynamic green industrial sector in South Africa after COVID-19, p. 23. URL:

https://www.econrsa.org/system/files/publications/policy_papers/policy_paper_28.pdf

Owing to advancements in technology, policy support and rapid declines in costs, renewable energy technologies have been adopted widely around the world, and are widely cost competitive compared to fossil-fuel-based technologies. In terms of new investments globally, renewable energy beats all forms of fossil fuel investments combined.[77][77] South Africa has taken advantage of these positive developments in the global energy technologies space, with some appreciable diversification of the energy pool in the recent time period. To date, approximately 6.4 GW have been procured from more than 100 independent power producers, of which 3.8 GW is already feeding into the national grid.[78][78] As mentioned further below in the document, a shift in the energy mix towards renewables supports the greening of production, particularly with respect to manufacturing, since manufacturing in South Africa is energy intensive.

Two of the six industrial zones, that were pre-selected as pilot sites within the scope of the proposed project (detailed profiles are provided in Appendix IV), already implemented sustainable energy solutions on their premises. The Coega Special Economic Zone (located close to Port Elizabeth) has a mix of wind farm investment projects planned with an overall capacity of 183 MW, a 12 MW solar PV farm, with bioenergy projects in the pipeline. Their Coega Solar Rooftop Projects entails the installation of solar solutions on the industrial buildings.[79][79] Furthermore, two tenants of the Umbogintwini Industrial Complex[80][80] (namely Anchor Yeast and Acacia Operations Services) jointly implemented a heat recovery system for industrial processes in 2019. Acacia provides onsite companies with steam for use in their industrial processes and guarantees continuity of supply. Anchor Yeast consumes 45% of the current UIC steam demand in the manufacture process of its yeast products. In 2018, the board of a third tenant (Lallemand) approved a project to install an anaerobic digester wastewater treatment plant (AD plant). The AD plant extracts energy from the organic components present in Anchor?s wastewater, in the form of biogas, significantly reducing chemical oxygen demand (COD) levels in the final wastewater.[81][81] In addition, a feasibility study for the use of renewable energies at the Atlantis SEZ has been conducted in 2021 by CSIR. The SEZ is focused on greentech solutions, including renewable energy, energy storage, resource efficient clean production, electric/renewable vehicle technology, water and wastewater, recycling and waste, advanced materials and packaging, air and environment, and agriculture.

What has the South African government done to support energy efficiency by firms (and households) and thus reduce the country?s carbon footprint? The answer is that the government has done quite a bit, though there still is a long way to go. The Industrial Energy Efficiency Project (IEE) is the flagship thus far and is world pioneering.

Hosted by the National Cleaner Production Centre of South Africa (NCPC-SA), the project was established in 2010 in collaboration with UNIDO, the Swiss Secretariat for Economic Affairs and the United Kingdom?s Department for International Development (which is now the Foreign,

Commonwealth & Development Office). The project contributes to the sustainable transformation of industrial energy usage practices in South Africa by, among other things, formulating and implementing an enabling policy framework that supports energy efficiency; creating institutional capacity to implement the energy management standards; raising awareness around the importance and impact of industrial energy efficiency; and energy audits. Six major industrial sectors were targeted for the pilot project on account of their potential to bring about a reduction in energy consumption and thus emissions: namely, agro-processing; chemicals and liquid fuels; metals processing and engineering; the automotive industry; and mining.[82][82]

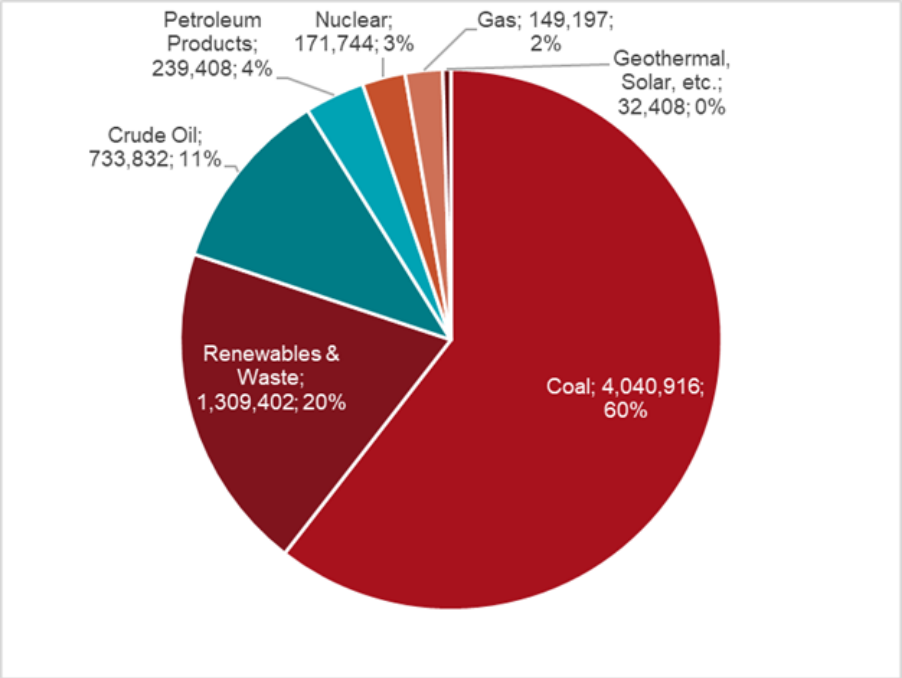
According to the NCPC-SA, the benefits of the IEE up to 2020 include a saving of 6.5 TWh of energy, mitigation of 6.4 MtCO2e and a saving of ZAR 5.3 billion (approx. US$ 354 million) in energy costs for the participating companies. In addition, nearly 6,500 engineers, technicians and managers were trained in energy efficiency while over 200 experts were trained in energy management standards and energy systems optimisation. The IEE won the International Energy Award 2020 in recognition of its achievements.[83][83]

2.3 The energy sector

An overview of the sector

In 2017, South Africa?s total primary energy supply (TPES) stood at 6.658.369 TJ.[84][84] The country?s energy supply is dominated by coal which constituted 60% of the primary energy supply in 2017, followed by renewables and waste[85][85] with 20%, crude oil with 11% and petroleum products with 4%. Nuclear contributed 3% while natural gas contributed 2% to the TPES during the same period. The shares of hydro and geothermal and solar were both below 1%. The TPES (see Figure 12 below) in this case includes indigenous production and imported sources less exported quantities.

Figure 12: Total primary energy supply (in TJ), South Africa 2016



Source: Authors, based on Department of Energy (2017): Aggregated Historical Energy Balances ? 2017

In 2017, South Africa imported nearly 100% of its crude oil requirements (mostly from Saudi Arabia, Nigeria and Angola).[86][86] The total primary crude oil supply was used by refineries during transformation process for liquid fuels production. This reflects the country?s vulnerability and dependence on imports for its petroleum requirements. Almost all the imported crude oil is used for the production of liquid fuels, with a small percentage used towards lubricants, bitumen, solvents and other petrochemicals. [87][87]

According to the 2016 Energy Balances, 72% of the total petroleum products supply was produced locally. Imports amounted to 18% to make up for the local production shortfall while exports amounted to 10%.[88][88]

Currently, natural gas is imported into South Africa by Sasol Gas via an 865 km pipeline from the Temane and Pande gas fields in Mozambique. Reserves in the Temane and Pande are estimated around 2.6 trillion cubic feet (TCF). The pipeline has a capacity of 240 million gigajoules (GJ) per annum.[89][89]

South Africa has the 5th largest recoverable coal reserves in the world, estimated at 66.7 billion tons.[90][90] Consequently, South Africa?s indigenous energy-resource base is dominated by coal. By international standards, South Africa?s coal deposits are relatively shallow with thick seams, which make them easier and cheaper to mine. At the present production rate, it is estimated that there is more

than 50 years of coal supply left. In addition to the extensive use of coal in the domestic economy, 24% of South Africa?s coal was exported in 2016 and only 1% imported.[91][91]

South Africa supplies approximately 30% of Africa?s electricity.[92][92] The electricity sector (for a detailed overview of the sector please refer to Table 3 below) in South Africa is dominated by the national utility Eskom, a primary electricity supplier and generates approximately 90% of the electricity used in the country. The balance is supplied by municipalities and redistributors as well as private generators.[93][93]

The utility sells power directly to some 2,700 industrial, 52,000 commercial, 82,000 agricultural and 6 million residential customers. It owns and operates several coal-fired, gas-fired, hydro and pumped storage power stations, as well as one nuclear power station (Koeberg Nuclear Power Station). Total production amounted to 91% in 2016, while the country?s net exports and imports amounted to 6% and 3%, respectively.[94][94] According to IRENA, South Africa?s non-renewable capacity installed in 2020 amounted to 47,8 GW.[95][95] This includes inter alia 37.9 GW of coal, 3.4 GW of diesel (open cycle gas turbine), 2.8 GW of hydro (pumped storage)[96][96] and 1.9 GW of nuclear.[97][97], [98][98] Overall, 723 MW of coal-fired power plants were commissioned during 2020.[99][99]

On renewable energy, South Africa is regarded as a prime candidate for increased use of renewables with its abundant natural resources of sun and wind (see also ?Renewable energy potentials and current deployment? section below). The country is highly dependent on coal burning for power generation but given the ever-rising cost of traditional fossil fuels-based energy, renewable energy is becoming a viable option. South Africa is presently rated as the 12th most attractive investment for renewable energy.[100][100] In 2020, the total installed renewable energy capacity amounted to 9.6 GW. The shares of hydro/marine, solar, wind and bioenergy in total installed renewable energy capacity amounted to 8% (0.7 GW), 62% (6 GW), 27% (2.6 GW) and 3% (0.3 GW) respectively.[101][101] Overall, 415 MW of wind and 558 MW of solar PV were commissioned during 2020.[102][102]

Table 3: Overview of South Africa?s electricity sector

Total installed capacity	57.4 gigawatts (GW) (2020)
Total installed renewable energy (GW)	9.6 GW (2020)
Peak Demand	34.2 GW (2020) = 60% of total installed capacity

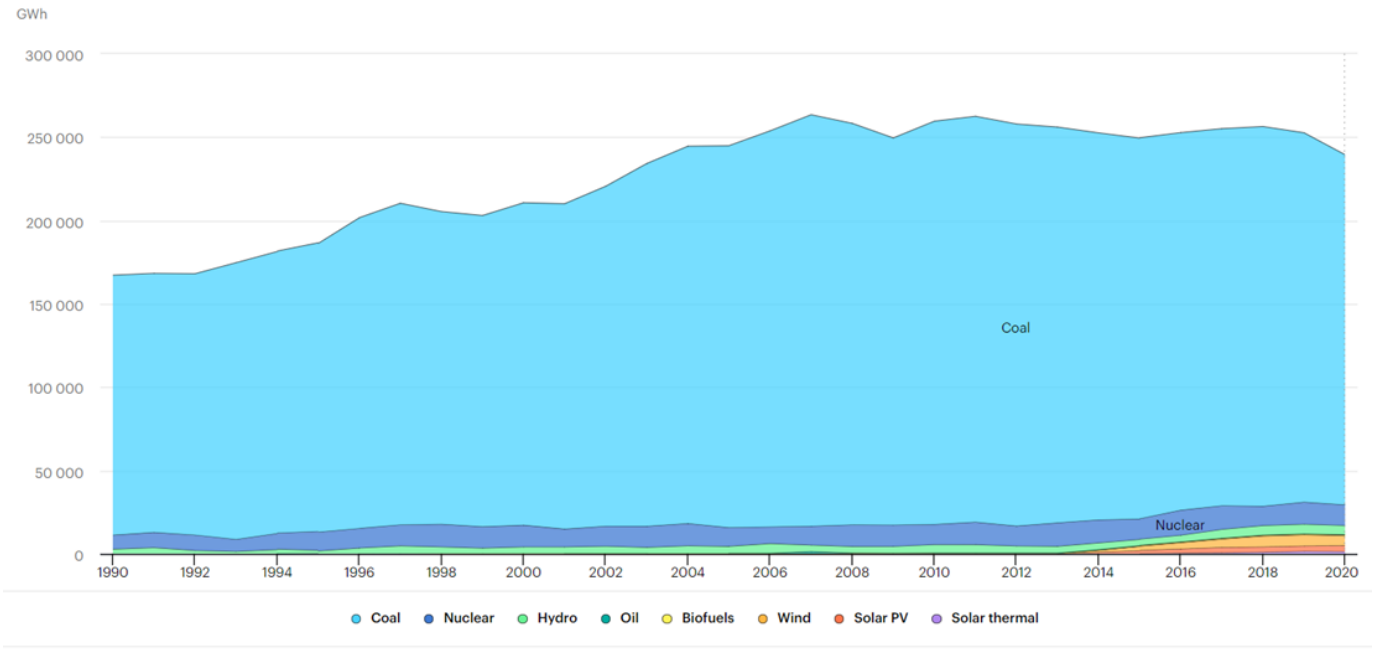
Total Generation (wholesale market, without self-consumption and embedded plants)	233.3 TWh (2020)	
Renewable energy (incl. non-pumped hydro and marine) as % of total installed generating capacity	16.7% (2020)	
Transmission and distribution losses	7.6% (2018)	
Electrification rate	84% (2019)	
Combined margin (CM) grid emission factor	0.950 tCO2/MWh	
Baseline projections for energy demand	308.3 TWh in 2030 (IRP2019 upper forecast)	
Average Electricity Tariffs (ZAR/kWh) as of March 2020	Residential	1.34 (~0.09 US$/kWh)
	Commercial	1.23 (~0.08 US$/kWh)
	Industrial	0.76 (~0.05 US$/kWh)

Adapted from Council for Scientific and Industrial Research (CSIR) (2017): Forecasts for electricity demand in South Africa (2017 ? 2050) using the CSIR sectoral regression model, p. 17,[103][103]

Electricity infrastructure comprises of three sub-sectors, namely: generation, transmission and distribution. In terms of generation, Eskom dominates the production of electricity. Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers in South Africa, and to municipalities, who in turn redistribute electricity to businesses and households within their areas. The utility also purchases electricity from Independent Power Producers (IPPs) in terms of various agreement schemes as well as electricity generating facilities beyond the country?s borders. Most of Eskom?s coal-fired power plants are located in Mpumalanga, except for Lethabo and Matimba which are located in the Free State and Limpopo provinces respectively.[104][104]

In 2020, the total electricity generation in South Africa was 233.3 TWh (wholesale market, without self-consumption and embedded plants).[105][105] The country?s electricity mix is still dominated by coal-fired power generation which contributed approximately 84% to system demand in 2020. Nuclear energy contributed 5%, while renewables (both dispatchable and variable RES) accounted for 16% of South Africa?s power mix in 2020. The remaining 1% came from diesel.[106][106] The electricity generation by source in South Africa (between 1990 and 2020) dominated by coal burning can be seen in Figure 13 below.

Figure 13: Electricity generation by source, South Africa 1990-2020



Source: IEA (2022): Data and statistics ? Electricity generation by source, South Africa 1990-2020. URL: https://tinyurl.com/32nw4xx9

South Africa?s electric power transmission comprises the 28,000 km of high voltage lines that transport electricity at high voltage levels (such as 400 kV or 765 kV) to cities and towns. There, it branches out to 325,000 km of lower-voltage lines that distribute electricity to homes and businesses. In comparison, New Zealand has 150,000 km for a tenth of South Africa?s population and the UK has over 800,000 km.[107][107]

In 2019, electrification rates in South Africa were reported to be 88% in urban areas and 79% in rural areas,[108][108] leading to an overall electrification rate of 84%. The Integrated National Electrification Programme (INEP) targets to achieve universal access (defined as 97%) by 2025 through grid connection (90%) and Solar Home Systems (SHS) or other cost effective, non-grid RE technologies (7%) and has thus identified 300,000 households to be electrified with off-grid technologies.[109][109]

The electricity demand forecast for South Africa for the years 2017 to 2050 (developed by the CSIR as part of the IRP2019), which rests on the assumptions that GDP will grow with an average of 3% per annum and that the current economic sectoral structure will remain the same in the future, resulted in an average annual electricity demand growth of 2% by 2030 and 1.5% by 2050.[110][110] Under these baseline projections, South Africa?s electricity demand would amount to 308.3 TWh in 2030.[111][111]

South Africa experiences widespread rolling blackouts as supply falls behind demand, threatening to destabilise the national grid. It began in 2007 and continues to this day.[112][112] Eskom and the South

African Government attributed these rolling-blackouts to insufficient generation capacity.[113][113] With a reserve margin estimated at 10% or below,[114][114] such "load shedding" is implemented whenever generating units are taken offline for maintenance, repairs or refuelling (in the case of nuclear units). According to Eskom and government officials, the solution requires the construction of additional power stations and generators. Despite the construction of new generation capacities, Eskom is often facing severe difficulties to meet the country?s peak demand. If unplanned outages occur, it may result in the installed capacity of Eskom's coal fleet (which is normally 37.9 GW) being cut in half (down to about 20 GW). The operating reserve (roughly 2 to 2.2 GW) maintained by the utility is not sufficient to adequately meet peak demand. On some occasions, Eskom even has to deal with a negative operating reserve margin.[115][115] International practise indicates that for a predominantly steam-based power system, such as that in South Africa, a reserve margin between 15% and 20% is appropriate.[116][116]

As of December 2019, Eskom has published 8 stages of load shedding, each stage representing the removal of 1000 MW demand by controlled shut down on sections of the supply grid based on a predetermined schedule. Schedules may vary by location. Stage 6 (6000 MW reduction) was implemented for the first time in December 2019.[117][117]

Table 4: Stages of load shedding and what they mean for the end user

Stage	Energy load removed from the national grid	Typical impact	Percentage of grid users without power
Stage 1	1000 MW	customers disconnected 2-4h at a time, totalling 6h over 4 days (6/96h)	~6% without power
Stage 2	2000 MW	customers disconnected 2-4h at a time, totalling 12h over 4 days (12/96h)	~12.5% without power
Stage 3	3000 MW	customers disconnected 2-4h at a time, totalling 18h over 4 days (18/96h)	~19% without power
Stage 4	4000 MW	customers disconnected 2-4h at a time, totalling 24h over 4 days (24/96h)	~25% without power

Stage 5	5000 MW	customers disconnected 2-4h at a time, totalling 30h over 4 days (30/96h)	~31% without power
Stage 6	6000 MW	customers disconnected 2-4h at a time, totalling 36h over 4 days (36/96h)	~37% without power
Stage 7	7000 MW	customers disconnected 2-4h at a time, totalling 42h over 4 days (42/96h)	~44% without power
Stage 8	8000 MW	customers disconnected 2-4h at a time, totalling 48h over 4 days (48/96h)	~50% without power

Source: Authors, based on Kahla, C. (2021): Load shedding stages explained: Here?s what you need to know. The Citizen.

According to the CSIR, 2021 was the worst year on record for load shedding with 1,169 hours of outages and 2.5 TWh of energy shed. Also 2022 is already off to a poor start with 261 hours of outages to date and 554 GWh of energy shed.[118][118]

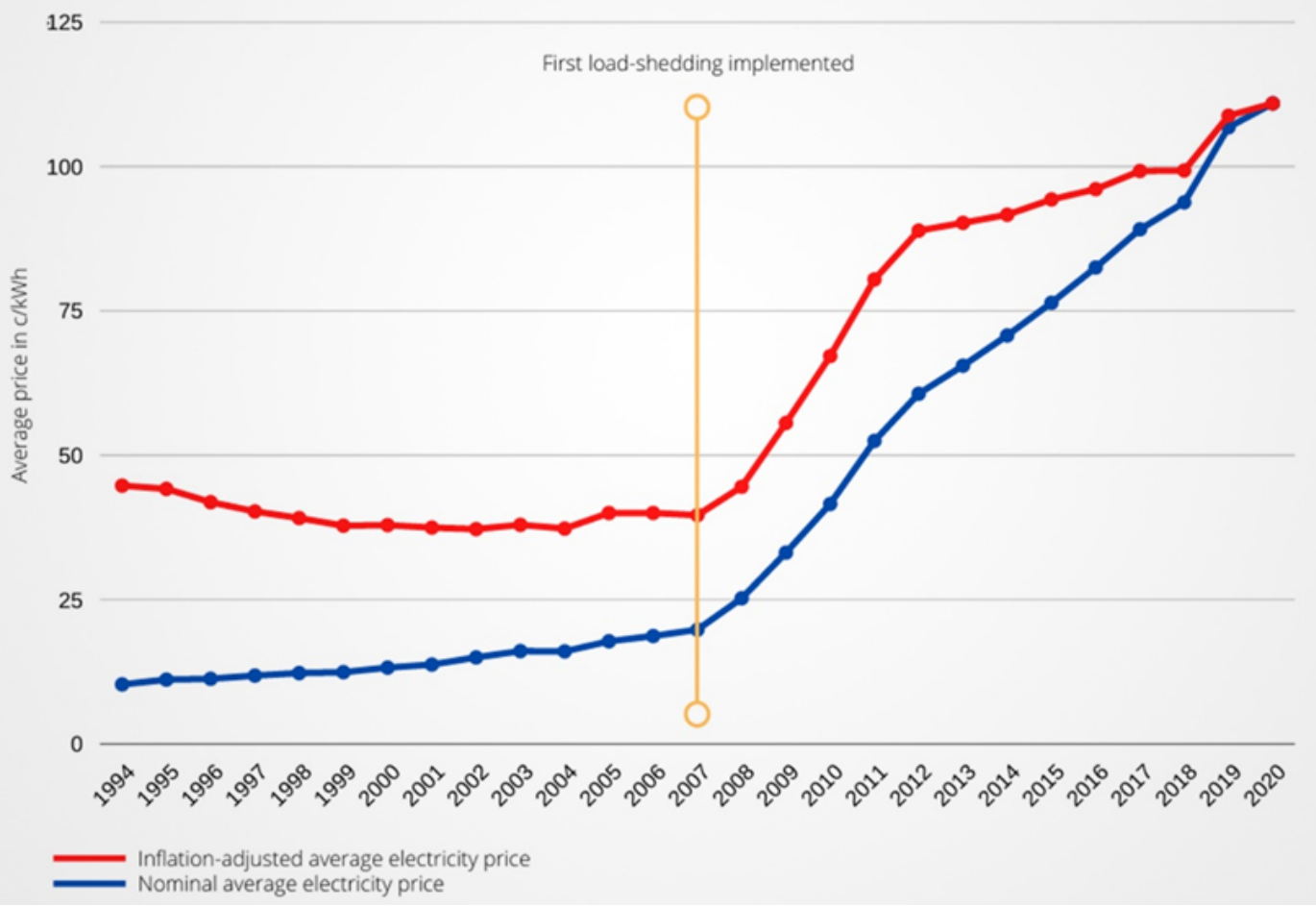
One of the levers that Eskom has to keep its systems online is Open Cycle Gas Turbines (OCGTs) which rely on diesel supplies to operate. Data from the CSIR shows that increased usage of diesel-fired peaking power plants cost the South African power system an additional ZAR 10.8 billion (approx. US$ 717 million) in 2021 alone. Considering Eskom?s operating costs of ZAR 196 billion (approx. US$ 13 billion) in 2021, these additional costs equate to a 7.5% increase in operating expenditure.[119][119]

In the first ten years of democratic South Africa, Eskom's average electricity prices were among the lowest in the world. Between 1994 and 1999, the annual price increase never exceeded the annual inflation rate, which meant that the real price of electricity was actually declining. In the early 2000s, prices remained relatively constant and even dropped slightly in 2004. However, after the introduction of load shedding in 2007, prices skyrocketed. In 2008, the average electricity price climbed from 0.19 to 0.25 ZAR/kWh (0.013 to 0.017 USD/kWh), a hike of 28%. The biggest increase to date followed in 2009, with a rise of 31%. The following three years saw additional increases of around 25%.[120][120]

Looking at inflation-adjusted prices, South Africans had the cheapest electricity prices from 1999 to 2004 - between 0.37 and 0.38 ZAR per kilowatt hour in today's terms (which equals approx. 0.025 US$/kWh). However, between 2007 and 2020, Eskom's average electricity price has increased by about 460%, excluding inflation. If we take inflation into account at around 100% from July 2007 to July 2020, the average price is still 180% more expensive.[121][121]

Figure 14 below compares the average nominal electricity price and inflation prices over the period 1994 to 2020. It shows a steep increase in both the nominal and inflation-adjusted price of electricity starting in 2007.

Figure 14: Eskom average electricity price - 1994 to 2020



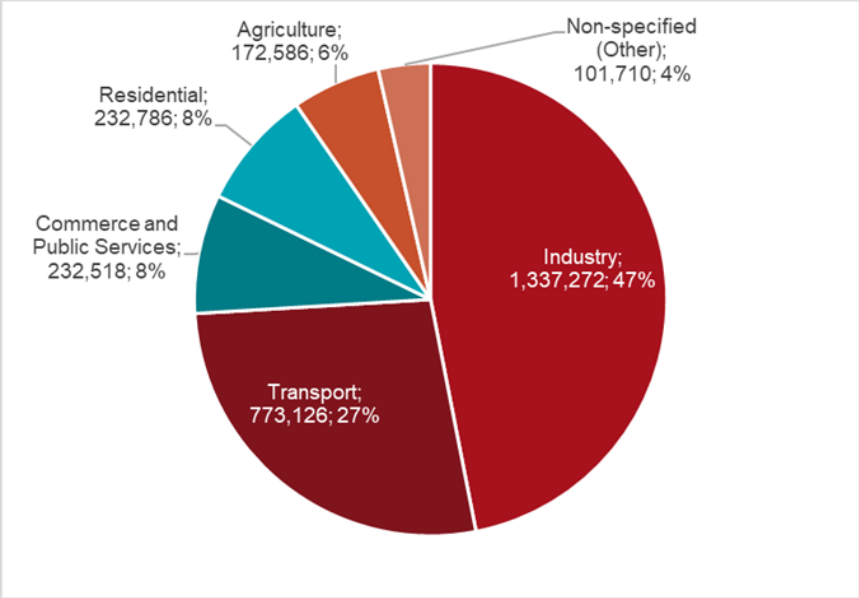
Source: Labuschagne, H. (2020): Eskom electricity prices ? 1994 to 2020. MyBroadband

As mentioned above, the South African economy is extremely energy intensive compared to international standards, with only a few countries having higher intensities. In addition, South African industrial energy efficiency is on average significantly lower than in other countries. This is an important factor, given that at the moment industry and mining consume over 50% of the electricity produced in the country, and the inclusion of commerce takes this figure beyond the 70% mark.[122][122]

South Africa?s GDP is the 30th highest in the world, but in primary energy consumption South Africa is ranked 17th in the world. The country?s energy intensity is high mainly because the economy is dominated by large-scale, energy-intensive primary minerals beneficiation industries and mining industries.[123][123] This becomes even more evident when considering the percentage shares of energy consumed by different sectors in the South African economy (see Figure 15 below). In 2017, total final consumption (TFC) in South Africa stood at 2.867.441 terajoules (TJ). With a consumption of 1.337.272 TJ (which equals 47% of TFC) in 2017, Industry is by far the largest energy consuming

sector in South Africa. This is followed by Transport (27%), Commerce and Public Services (8%), Residential (8%), Agriculture (6%), and Non-specified (Other) (4%).[124][124], [125][125]

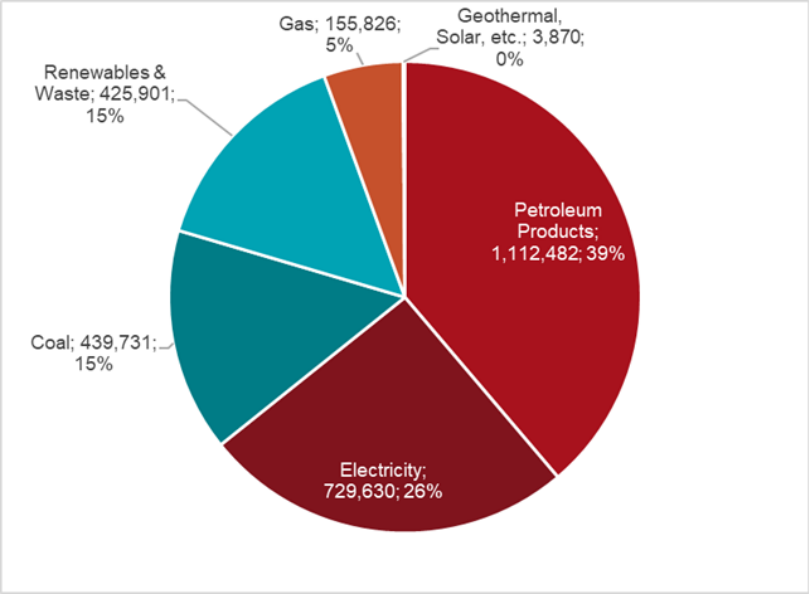
Figure 15: Energy consumption by sector (in TJ), South Africa 2017



Source: Department of Energy (2017): Aggregated Historical Energy Balances ? 2017

The composition of South Africa?s TFC by fuel type for the year 2017 is depicted in Figure 16. It is striking that the most consumed energy source in the country are petroleum products with a share of 39% of TFC. This is followed by electricity, coal, renewables and waste, and natural gas with 26%, 15%, 15% and 5% of TFC, respectively. Hence, the shares of South Africa?s coal-based electricity and the coal consumed in other sectors account for 41% of TFC.

Figure 16: Energy consumption by fuel type (in TJ), South Africa 2017

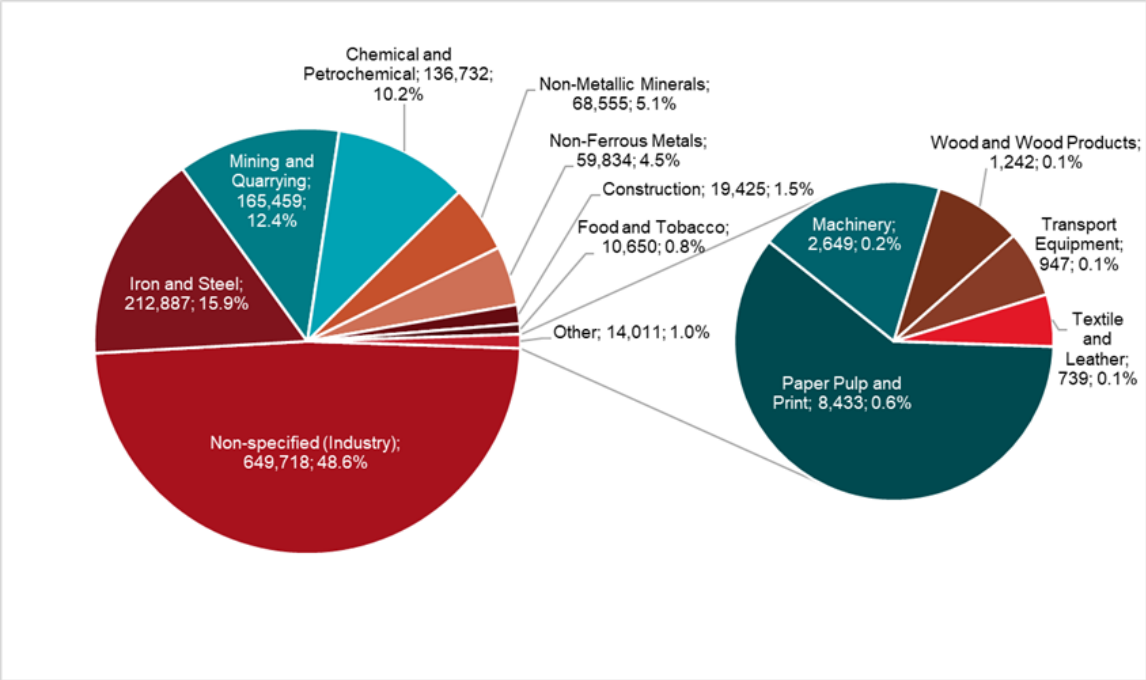


Source: Department of Energy (2017): Aggregated Historical Energy Balances ? 2017

Analysis of the South African industrial sector?s energy consumption profile

Within the industrial sector, the sub-sectors Non-specified (Industry) (49%), Iron and Steel (16%) as well as Mining and Quarrying (12%) were the largest consumers of energy in 2017 as depicted in Figure 17 below. Chemical and Petrochemical accounted for 10% of the industrial consumption while Non-Metallic Minerals and Non-Ferrous Metals accounted for 5% and 4%, respectively. The remaining sub-sectors had minor energy consumption of 2% or less. In total, the industrial sector consumed 47% of the final energy supplied in 2017.[126][126]

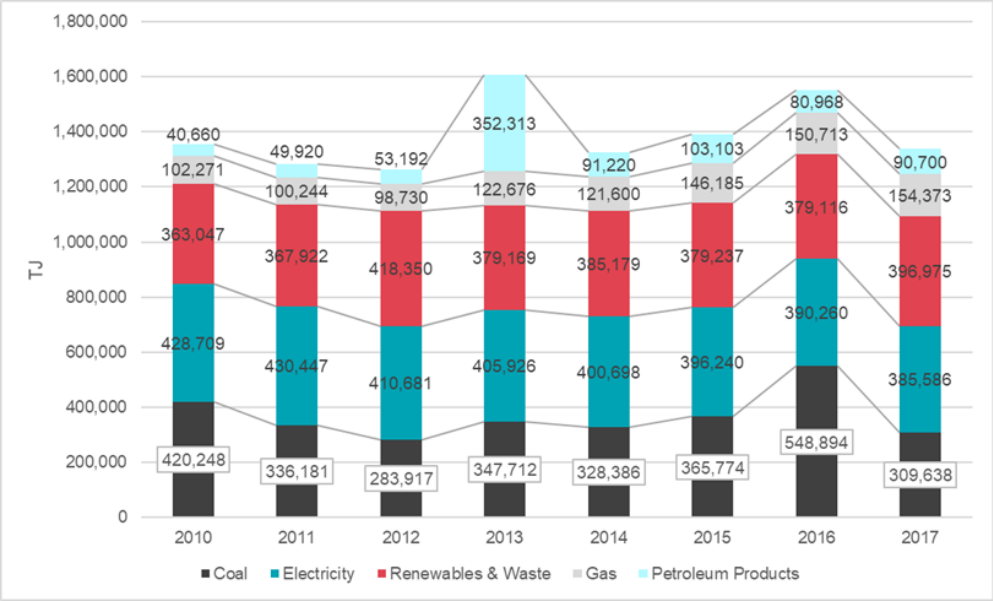
Figure 17: Energy consumption by industrial sub-sector (in TJ), South Africa 2017



Source: Authors, based on Department of Energy (2017): Aggregated Historical Energy Balances ? 2017

As depicted in Figure 18 below, coal and electricity were the most consumed sources of energy in the industrial sector in the past years. This was followed by renewables and waste and relatively small shares of natural gas and petroleum products. Only in 2013 the consumption of petroleum products peaked remarkably due to a higher demand in the Non-specified (Industry) sub-sector.[127][127]

Figure 18: Industrial energy consumption by fuel type, South Africa 2010 - 2017



Source: Authors, based on Department of Energy (2017): Aggregated Historical Energy Balances ? 2010 - 2017

Most of the industry sub-sectors in South Africa have a dominant commodity as energy source. The major energy consumers often display this characteristic, as it can be observed in the following diagram (see Figure 19 below). The dominance of a commodity can be significant, such as in the Iron and Steel, Chemical and Petrochemical and the Non-Ferrous Metals sub-sectors. The dominance seems to be related to the sector?s process energy needs, as these sectors are said to be energy-intensive industries. It is interesting to note that the dominant energy sources for these industries are electricity and coal. A different characteristic is observed on Non-specified (Industry) from 2005 onwards, where nuclear and renewable energy (biomass) are included in the energy sources. The Non-specified (Industry) sub-sector shows an ability to diversify energy sources.[128][128] Non-specified (Industry) is a grouped industry sub-sector that can be defined in general terms as a manufacturing consumption where no further breakdown to specific sub-sectors can be achieved. For most countries this sector contributes no more than 2% of the total consumption, and is therefore deemed insignificant.[129][129] In South Africa, however, we observe that in some years this sector can contribute more than 20% consumption to the total final consumption (see South Africa?s Aggregated Historical Energy Balances for the year 2017 available under http://www.energy.gov.za/files/media/Energy_Balances.html for comparison).[130][130]

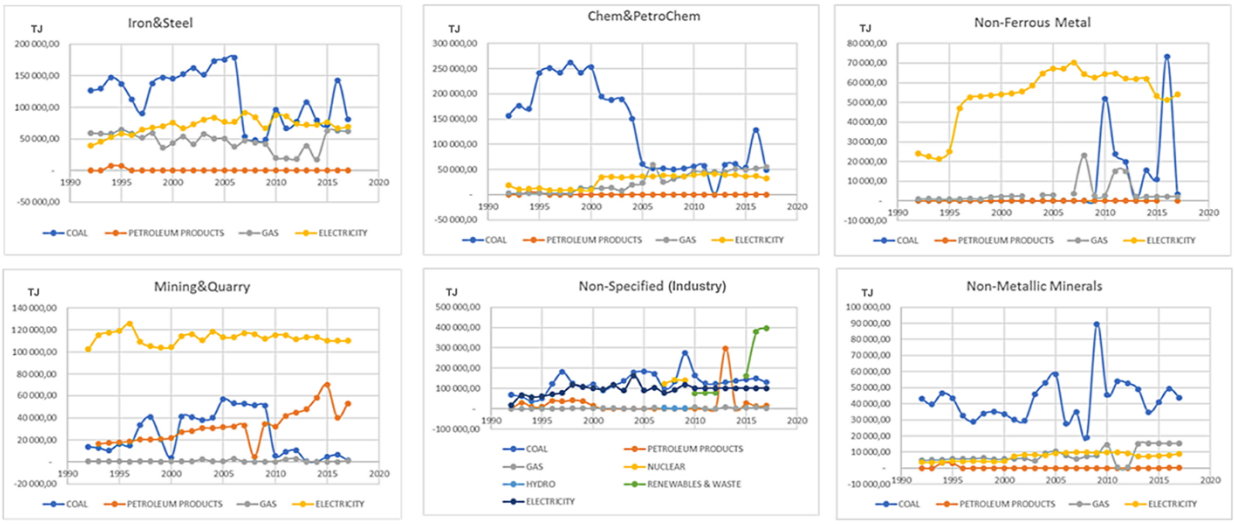
The coal consumption in South African industry sub-sectors was steady prior to 2008. However, during and post the economic decline of 2008 the coal consumption showed a decline and became erratic. This was not the case with gas and electricity consumption, which was steadier before and after the economic decline of 2008. The biggest consumers of coal in industry are Chemical and Petrochemical industries followed by the Iron and Steel and Non-specified (Industry).[131][131] With time Petrochemical and Steel industries are displaying a reduction in consumption of coal. Recent publications have cited two major factors that may affect these industries, namely demand and carbon footprint.[132][132] The factors appear to impact the same industries in a similar manner globally. When consumption of these two major industries (Chemical & Petrochemical and Iron & Steel) declined, the Non-specified (Industry) sub-sector showed an increasing consumption trend.[133][133]

Besides coal, electricity is one of the most widely used sources of energy in the South African industry sub-sectors. Despite the changes in energy policies in recent years, which impacted the cost of electricity sales, the consumption of electricity has remained relatively steady. There is a noticeable drop in consumption in the mining industry from the year 1996, after which the consumption was steady. There seems to be no indication of major changes to the consumption.[134][134]

Electricity as an energy source, though unreliable, remains the energy source of choice. Coal remains the most affordable source of energy to this day; however environmental effects have hampered global consumption greatly. Trends on local coal consumption however seem to hint a continued and even slight increase to the consumption in 2018 to 2020.[135][135] The fact that electricity and coal are the most used energy sources in South Africa?s energy-intensive industry sub-sectors contributes to the same environmental problem, as electricity is mainly generated by burning coal and thus two of the most commonly used energy sources have the same (very high) emission factor. Therefore, the local

industrial sector needs to pursue ways of reducing its energy intensity. This may promote energy savings and allow for the use of renewable energy as alternative sources.

Figure 19: Energy consumption by fuel types in South Africa?s industrial sub-sectors, 1990 - 2017

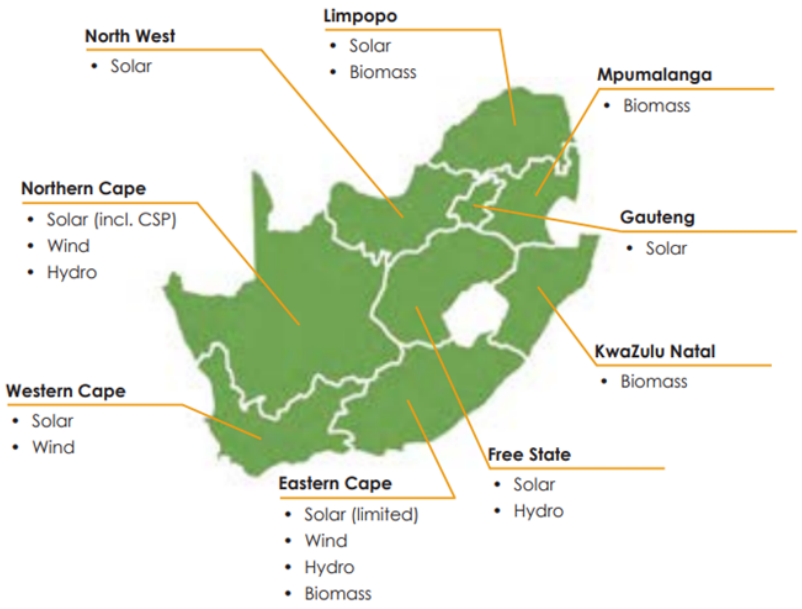


Source: Danisa, N.C.; Thopil; G.A. (2020): Analysis of the South African Industrial sector?s energy consumption profile, p. 4.

Renewable energy potentials and current deployment

To address the energy crisis in the country, the inadequate supply of electricity to residents of rural and remote areas, and the problem of environmental degradation due to over-dependence on coal, South Africa has put in place policy frameworks to increase the share of renewable energy in the national energy mix (for more details please refer to the ?Institutional and policy framework? section below).[136][136] The feasible resources of renewable energy in South Africa are: solar, wind, biomass, geothermal, hydropower, waste to energy, and the tidal (wave) energy. Their potential varies from one province to another. With the exception of KwaZulu-Natal and the Mpumalanga provinces which have the highest potential for biomass, other seven provinces have the highest potential for solar energy. Wind has the second highest potential in the three Cape provinces, biomass has the second highest potential in the Limpopo province, and hydro has the second highest potential in the Free State.[137][137] Figure 20 below shows the distribution of renewable energy resources across South Africa?s nine provinces.

Figure 20: Provincial distribution of RE resources



Source: Department of Energy (2015): State of Renewable Energy in South Africa, p. 54. URL: https://www.gov.za/sites/default/files/gcis_document/201510/state-renewable-energy-south-africas.pdf

South Africa receives a high degree of sunshine with rainfall about half of the global average. Most regions receive an average of 8-10 hours of sunshine per day, with nationwide average of 2,500 hours per year, and 4.5 to 6.6 kWh/m2 of radiation level. According to the Solar Energy Technology Roadmap (SETRM), it is estimated that 40 GW of solar PV and 30 GW of CSP (Concentrated Solar Power) can be developed in South Africa by 2050.[138][138] Furthermore, it is estimated that up to 4 GW

of solar water heating can be installed in the country by 2050.[139][139] In 2020, the installed capacity of solar power plants in South Africa amounted to approx. 6 GW, which generated 6.8 TWh of electricity (3% of total generation).[140][140]

Over 80% of South Africa?s land area has wind resources to support development of economic wind farms with annual load factors greater than 30% and total technically feasible wind power potential of 6.7 TW, which is competitive with solar potential.[141][141] Currently, South Africa requires about 250 TWh/y of electricity which could all be generated from wind farms of a combined capacity of 75 GW over 0.6% of the country?s land area.[142][142] The economically feasible wind energy potential amounts to 6 GW.[143][143] In 2020, the installed wind energy capacity in South Africa amounted to approx. 2.6 GW, which generated 0.3 TWh of electricity.[144][144]

The technically feasible hydropower potential of South Africa is about 14 TWh/year, of which about 90% has already been developed. 3.6 GW of hydropower including 2.8 GW of pumped storage capacity produce some 4.75 TWh of electrical energy per year, about 2% of national supply. Feasibility studies for new pumped storage power are now ready and some 100 MW of small hydropower could also be developed.[145][145] Furthermore, there is the potential to harness marine energy along the coast; for wave power in the south and southwest, and for current tidal turbines in the east.[146][146]

South Africa does not have large scale geothermal resources to generate electricity or use for direct heat. Only heat pump technology can be viably used depending on location and demand for heating and cooling. Currently, ground or ground water heat pumps are very rare in South Africa.[147][147]

According to the Bioenergy Atlas for South Africa, the potential of biomass as an energy source in the country is limited due to restrictions caused by cultivable land, rainfall and food security challenges. However, the bioenergy atlas also revealed that despite the aforementioned constraints, the use of all accessible domestic organic wastes coupled with the development of communal digesters in rural areas will contribute about 1,600 megawatt electric (MWe) capacity.[148][148] In 2020, the installed capacity of bioenergy in South Africa amounted to approx. 0.3 GW, which generated 0.4 TWh of electricity.[149][149]

In total, the economically feasible potential of renewable energy sources in South Africa (for electricity generation) amounts to a staggering 80 GW. It is thus more than sufficient to cover the country?s future energy needs.

According to Meridian Economics, the levelized costs of electricity (LCOE) of utility-scale solar PV and CSP plants, and wind energy in South Africa in 2020 were estimated to be 0.04, 0.14 and 0.05 US$

per kWh, respectively.[150][150] To put this in perspective, the 2020 electricity tariff for industrial electricity consumers in South Africa is approximately 0.05 US$/kWh[151][151] and IRENA?s global weighted average levelized cost of energy (LCOE) in 2020 for solar PV, CSP and onshore wind was 0.07, 0.18 and 0.05 US$/kWh, respectively.[152][152] In other words, between 2015 and 2020, utility-scale solar PV plants and wind turbines reached 'grid parity' in South Africa, as these two renewable energy technologies are now able to generate electricity at a LCOE that is less than or equal to the price of power from the electricity grid operated by Eskom.

In the beginning of 2022, South Africa?s energy availability factor (EAF)[153][153] once again fell below the 60% mark. The South African Wind Energy Association (SAWEA) advocated that the increased electricity generation from renewables needs to be accelerated, as this will help the country reduce the occurrence of load shedding (and thus also blackouts).[154][154]

Eskom announced that towards the end of 2022 an auction process will be launched that will unlock and make land alongside its power stations in the Mpumalanga province available to private investors for renewable power plants. This will remove significant barriers and increase the country?s energy availability factor quicker than alternative options, as it will drive the production of much-needed new clean power in a corner of the country that has not been looked at as a feasible destination for renewable energy in the past. With this option, renewable energy IPPs, will have the opportunity to work alongside Eskom to get more clean power on the grid, relatively quickly as the maximum amount of electricity generation capacity per project will be capped at 100 MW, thereby negating the need for additional licensing.[155][155]

In June 2021, President Ramaphosa announcement that the electricity generation threshold for private energy producers will be increased from 1 to 100 MW.[156][156] This announcement enables private producers to generate up to 100MW of power capacity without needing to obtain a licence from the National Energy Regulator of South Africa (NERSA). The 100MW rule change will significantly reduce ?red tape? for many IPPs and could mean increased privatisation of electricity generation in South Africa. It is regarded as a gamechanger for South Africa?s energy industry, businesses and everyday South Africans.[157][157]

According to the CSIR, an ambitious commitment to building 5 GW of renewable energy per annum for decades is urgently required ? this equates to the generating capacity of two-and-a-half Koeberg nuclear power stations.[158][158] This is needed to replace South Africa?s ageing coal-fired power stations and could unlock nearly ZAR 500 billion (approx. US$ 33 billion) worth of investment over the next 10 years, creating 50,000 jobs per annum in construction and operation of wind and solar plants.[159][159]

2.4 Institutional and policy framework

Key plans and strategies

To address the business-as-usual scenario for its electricity generation and industry sub-sectors, South Africa has begun to introduce a series of ambitious targets and policy measures.

In 2012, the South African Government launched its first National Development Plan (NDP). The NDP provides a ?Vision 2030? to guide the country?s sustainable development trajectory where poverty is eliminated, and inequalities are reduced by 2030.[160][160] Furthermore, the plan underlines the importance of South Africa?s transition to a low-carbon, resilient economy and just society.[161][161] According to the plan, South Africa can achieve this by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society.[162][162] The implementation of the 2030 NDP vision is further elaborated in South Africa?s climate policy.

South Africa submitted its Intended Nationally Determined Contribution (INDC) in September 2015, which was later passed and adopted as its first Nationally Determined Contribution (NDC). The first NDC was based on extensive stakeholder consultations and background studies.[163][163] It was formulated in the context of the NDP, the 2011 National Climate Change Response Policy, the National Sustainable Development Strategy and sector plans that involve climate considerations such as the integrated energy and electricity plans (these plans and strategies will be presented at the end of this sub-section).[164][164] The mitigation contribution type presented in the first NDC is an economy-wide GHG target (which covers all sectors), more precisely a peak, plateau and decline (PDD) trajectory range.[165][165] The country committed to reducing its GHG emissions in the range of 398 to 614 MtCO2e until 2025 and 2030.[166][166] The first NDC, however, did not set out a precise (fixed-level) emission reduction target nor financial need.[167][167] South Africa?s 2025 and 2030 emission reduction targets are partially conditional on external financial resources, development and transfer of technology, and capacity building.[168][168] The first NDC mentions an unspecified mix of domestic and international financial resources South Africa will draw on for the implementation of the mitigation measures proposed in the document.[169][169] These mitigation activities include:[170][170]

a. Expanding the existing Renewable Energy Independent Power Producer Procurement Programme,

b. Decarbonised electricity

c. Carbon capture and storage (CCS),

d. Electric/hybrid vehicles.

For the mitigation component of its first NDC, South Africa highlighted concrete policy instruments (already under development in 2016) that were to be implemented and probed during the period up to 2020, namely: a carbon tax, desired emission reduction outcomes for sectors, company-level carbon budgets, as well as regulatory standards and controls (more information on the current status of implementation of these measures follows later in the text).[171][171] With respect to the adaptation component, South Africa?s first NDC listed different long-term goals and actions for the period 2020-2030, as well as the necessary adaptation investment.[172][172]

In 2021, South Africa submitted its second NDC to the UNFCCC.[173][173] In this documents South Africa raised its ambition, strengthened clarity, transparency and understanding, and stated clear its just transition approach to implement its NDC and what is needed to achieve it.[174][174] The highlights of the mitigation component of the updated NDCs are:[175][175]

South Africa reduced the target emission range from 398 ? 614 MtCO2e in 2025 and 2030 to 398 ? 510 MtCO2e in 2025 and 350 ? 420 MtCO2e in 2030. From the upper end of the range of the first NDC, this represents a 17% reduction for 2025 and 32% reduction for 2030. This range also shifts from an original target against BAU based to a fixed target emission range. Hence, the updated NDC of 2021 no longer refers to a peak-plateau-decline (PPD) trajectory.[176][176]

The lower end of the 2030 updated target emission range is consistent with a 1.5 degree pathway; the upper end of the range is consistent with a 2 degree pathway (based on CAT and CERC assessments).

Consistent with the National Inventory Report, the updated NDC is economy wide, covering Agriculture, Forestry and Other Land Uses (AFOLU), Energy, Industrial Processes and Product Use (IPPU) and Waste and 5 gases (CO2, CH4, N2O, HFCs and PFCs). The land sector is included, excluding emissions from natural disturbances.

On adaptation, the updated NDC includes South Africa?s first adaptation communication, detailing plans for the country?s contribution to global goals on adaptation, as well as the country?s risks and vulnerabilities, in priority sectors, including: water, agriculture, health, biodiversity, and human settlements.[177][177]

South Africa?s envisaged long-term low-carbon growth trajectory is detailed in the 2050 Low Emission Development Strategy (LEDS). Submitted to the UNFCCC in 2020, the LEDS aims at advancing the national climate change and development policy in a more coordinated, coherent and strategic manner. It provides mitigation measures focusing on four key sectors of the economy: energy; industry; agriculture, forestry and land use; and waste. The LEDS states that South Africa commits to ultimately moving towards a goal of net zero carbon emissions by 2050.[178][178]

Moreover, South Africa prepared a National Climate Change Response Policy of 2011 (NCCRP), which includes recommendations on GHG mitigation, namely a commitment to reduce national GHG emissions to ?make a fair contribution to the global effort to stabilise GHG concentrations 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?.[179][179] The NCCRP also introduced the carbon tax on direct emissions and the ?Desired Emission Reduction Outcomes? (DEROs) setting effective sectoral GHG emission limit caps. Furthermore, the NCCRP established eight ?Near-term Priority Flagship Programmes? that target climate change response in public works, water conservation and demand management, renewable energy, energy efficiency, and energy demand management and transportation, among others.[180][180]

Another key public strategic document is South Africa?s overarching National Strategy for Sustainable Development and Action Plan (NSSD). The NSSD was approved by Cabinet in 2011 and is the anchor for South Africa?s sustainable development agenda. The strategy regards sustainable development as a long-term commitment, which combines environmental protection, social equity and economic efficiency with the vision and values of the country. Included in its five strategic objectives are priorities related to a sustainable energy transition in the urban-industrial nexus:[181][181]

Priority 3: Towards a green economy;

Priority 4: Building sustainable communities; and

Priority 5: Responding effectively to climate change.

Key institutions

The main institution that is responsible for the governance of South Africa?s energy sector is the Department of Mineral Resources and Energy (DMRE). Besides its responsibility for the energy industry, the DMRE oversees the mining industry and the exploitation of other mineral resources. In the past, the DMRE was divided into the Department of Mineral Resources and the Department of Energy. However, in June 2019 President Cyril Ramaphosa announced that the two departments were to be reunited under the current name.[182][182] The DMRE is responsible for energy planning, policy formulation and implementation (relevant sub-sectors include power generation, transmission/distribution, energy efficiency and electrification). It is within its mandate to draft the Integrated Resource Plan (IRP), which determines the generation capacity required and distinguishes between the capacity to be implemented by Eskom and the IPPs.[183][183] In 2010, the DMRE (together with the National Treasury (NT) and the Development Bank of Southern Africa (DBSA)) established the IPP Office, which was entrusted with the task to manage the public procurement programme for IPP projects based on coal, gas and renewable energy generation. Following the unprecedented number of contracts signed with IPPs, a formal Independent Power Producer Office was created to manage the obligations under these contracts in a more structured manner.[184][184]

The electricity, gas, and oil pipeline industries are regulated by National Energy Regulator of South Africa (NERSA), an independent regulatory agency established in 2004 by the National Energy Regulatory Act. Among other things, NERSA issues generation licenses and enforces compliance with them, regulates all rate increases proposed by Eskom, provides national grid codes, develops regulatory rules for the relevant industries, and sets applicable standards.[185][185] The regulator is funded by

money appropriated by Parliament, by levies imposed by or under separate legislation, by money collected under separate legislation, by fees for dispute resolution and other services provided under the National Energy Regulator Act, and by a license fee.[186][186]

The South African electricity sector is dominated by the national utility Eskom, which is responsible for the majority of generation, transmission and distribution of electricity to industrial, mining, commercial, agricultural and residential customers and redistributors. Eskom is a single purchaser of electricity produced by numerous IPPs and oversees all network operations, including connecting new customers and providing a continuous service.[187][187]

South Africa is also home to Africa?s biggest IPPs market, which is envisioned to contribute 30% of South Africa?s future generation capacity. 137 municipal power companies, that are buying 40% of electricity generated by Eskom to supply end users, hold negligible generation capacity.[188][188] These municipalities are distributing electricity in certain areas of the country where Eskom is not directly supplying electricity to end-users. Historically more than 500 municipalities were engaged in electricity distribution. Certain municipalities also hold coal, gas and pumped storage generation capacity.[189][189]

The South African National Energy Development Institute (SANEDI) is a state-owned entity that was established as a successor to the previously created South African National Energy Research Institute (SANERI) and the National Energy Efficiency Agency (NEEA). The main function of SANEDI is to direct, monitor and conduct applied energy research and development, demonstration and deployment as well to undertake specific measures to promote the uptake of Green Energy and Energy Efficiency in South Africa.[190][190]

The Department of Trade, Industry and Competition (also known as the dtic; before June 2019 the Department of Trade and Industry or the dti) is the department of the South African government with responsibility for commercial policy and industrial policy. The dtic and its subsidiary agencies are involved in promoting economic development, Black Economic Empowerment,[191][191] implementing commercial law, promoting and regulating international trade, and consumer protection.[192][192] In 2015, the dtic launched its industrial park revitalisation programme (IPRP) throughout South Africa, primarily within historically disadvantaged areas. The implementation of the programme is divided into five progressive phases: (1) Security infrastructure upgrades, top structures, critical utility infrastructure; (2) compliance to regulatory requirements, renewable energy, and resource efficient operations; (3) new infrastructure development; (4) capacity building, business expansion, and investment promotion; and (5) Development of sustainable industrial clusters and parks.[193][193]

The Industrial Development Corporation (IDC) (in full: Industrial Development Corporation of South Africa Ltd.), is a state-owned company in South Africa for financing the development of industrial structures and guiding investment by private partners as part of the country's industrial policy.[194][194]

The National Treasury is one of the departments of the South African government. The Treasury manages national economic policy, prepares the South African government's annual budget and manages the government's finances. Along with the South African Revenue Service and Statistics South Africa, the Treasury falls within the portfolio of the Minister of Finance.[195][195]

The National Cleaner Production Centre of South Africa (NCPC-SA) is a national programme of government that promotes the implementation of resource efficiency and cleaner production (RECP) methodologies to assist industry to lower costs through reduced energy, water and materials usage, and waste management. It is hosted by the CSIR on behalf of the dtic.[196][196] The NCPC-SA is a member of UNIDO and UNEP?s global resource efficiency and cleaner production network (RECPnet) and plays a leading role in the African Roundtable on Sustainable Production and Consumption (ARSCP).[197][197]

Industry policy and regulation

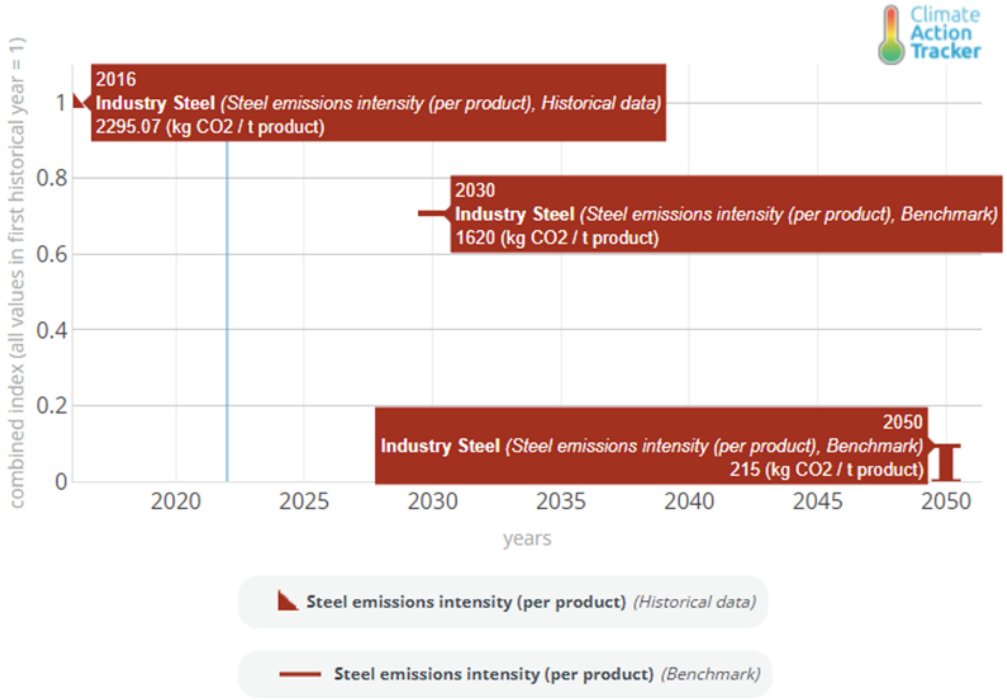
Policy and planning documents for South Africa's industrial sector generally deal with sustainable industrial economic development, but rarely mention reduction targets for the industrial sector or concrete measures for implementation. The post-2015 draft National Energy Efficiency Strategy (NEES) proposes industry sector targets that would reduce the weighted average specific energy consumption in manufacturing by 16% by 2030, realising a total of 40 petajoule (PJ) in cumulative annual energy savings by 2030, resulting from specific energy saving measures implemented by mining companies.[198][198] Energy consumption in the mining and quarrying sector amounted to 185 PJ in 2015.[199][199]

The South African government intends to achieve these targets through the implementation of several proposed measures such the National Cleaner Production Centre South Africa (NCPC-SA), which promotes energy efficiency measures, its associated Industrial Energy Efficiency Project (IEE)[200][200], which promotes energy management systems, or the Green Fund South Africa,[201][201] which financially supports green technology research and implementation. However, these measures may only induce small emissions reduction impacts.

For emissions-intensive sub-sectors such as steel production and mining, there are no signs of policy-driven emissions reductions in the near future. A recent analysis by Climate Action Tracker (see Figure

21) shows that the emissions intensity of the steel industry would need to be reduced by around 30% by 2030 and by around 90% to 100% by 2050 to be compatible with the Paris Agreement.[202][202]

Figure 21: Historical steel emissions intensity in South Africa in 2015 in comparison to Paris Compatible benchmarks for South Africa



Source: Climate Action Tracker (2021): South Africa ? Policies & action

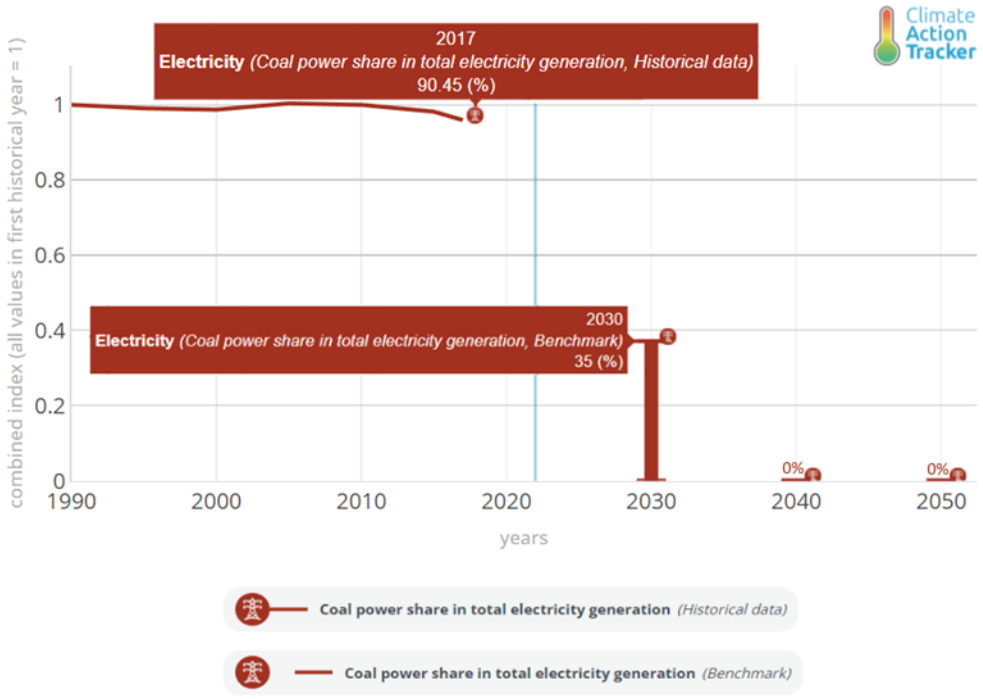
Energy policy and regulation

Aiming to improve on the country?s electricity sub-sector, the South African government first initiated the Integrated Resource Plan (IRP) in 2010. The IRP (2010-2030) aimed to develop and improve the overall capacity of the energy sector, with target capacities set for each source, inclusive of, however not limited to renewable sources.[203][203] Furthermore, the IRP set an overall emissions constraint of 275 MtCO2/year for electricity generation after 2024. Towards that end, South Africa?s development in the renewable energy sector is fundamentally a resultant of one of its key policies; the reduction of emissions by improvement of the renewable energy capacity, which by 2020, reached 9.6 GW.[204][204]

The IRP was revised in 2019 which is viewed as a positive indication of the country?s dedication to its energy sector. The revision indicated a decommissioning up to 35 of 42 GW of its coal-based generational capacity by 2050, with intermediate goals being 5.4 GW in 2022, and 10.5 GW nearing 2030.[205][205] An additional 7.2 GW of coal-based energy capacity was also indicated by 2030 which

comes in conflict with the decarbonization target set forth by the Paris Agreement in terms of the energy sector (for comparison see 16).[206][206]

Figure 22: Historical share of unabated coal in electricity generation in comparison to Paris Compatible benchmarks for South Africa



Source: Climate Action Tracker (2021): South Africa ? Policies & action

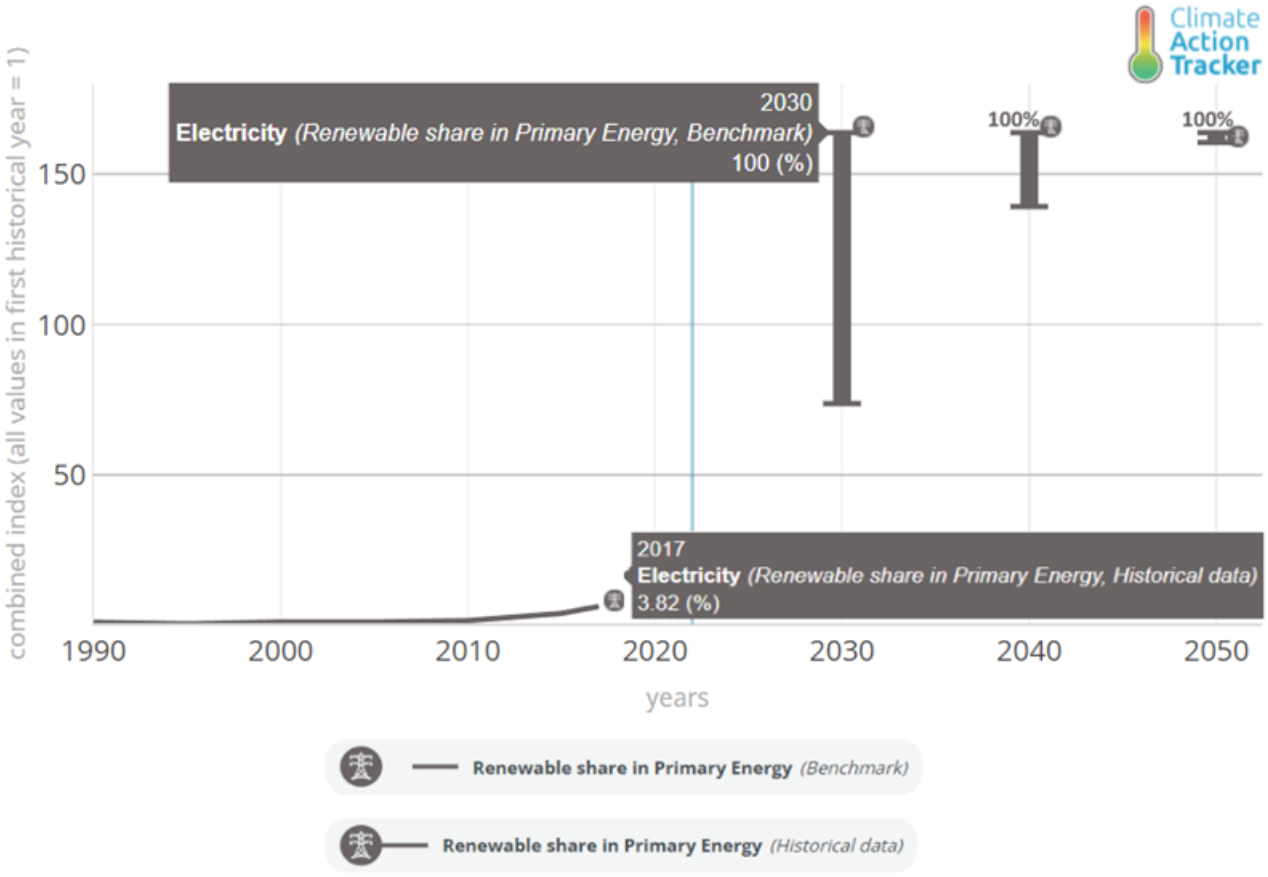
The lack of planning towards new nuclear energy establishments is also a primary observation in the IRP update, however, an operational-life extension of the existing Koeberg Nuclear Power Station by a period of up to 20 years has been indicated. Towards that end, the South African government also initiated a Request for Information (RFI)[207][207] in terms of a new nuclear facility in 2020.

The 2019 revision to the IRP fundamentally aims to enhance the renewable energy capacity of the nation by 500%. This is inclusive of a combined 24.6 GW of energy capacity from wind and solar based sources. The plan to 2030 is to add additional 6.8 GW of solar and 17.8 GW of wind, which combined, will add 24.6 GW of renewable energy capacity. In 2030, the envisaged share of wind and solar capacity of the overall energy mix will be 33% (which is five times of today?s amount).[208][208]

South Africa shifted its energy policy from a feed-in tariff scheme to a Renewable Energy Independent Power Producer Procurement Program (REIPPPP) nearing the third quarter of 2012 which saw rapid success in the form of 6.4 GW of various renewable energy projects by 2021.[209][209] Despite this success, connection of the aforementioned projects to the national grid do face considerable delay, and fiscal solvency issues at Eskom?s terminal manifests a degree of uncertainty towards REIPPP?s

possible future. An initiative for refinancing renewable energy projects has also been put in motion to lower electricity costs on at the wholesale level.[210][210] The final bid of renewable energy projects having been cleared at 2.6 GW[211][211], and the purchase of an additional 2 GW emergency capacity[212][212] in 2021, the country still faces considerable delay in the connection of the projects to the national grid which may extend up to a timeline of 6 years,[213][213] aside from which, the Department of Mineral Resources and Energy also awaits an increased licensing limit for embedded generation plans from an existing 1 MW to up to 100 MWs[214][214] which would lead to an improved distributed production capacity, particularly in case of solar farms. Under planned statistics, a summation of the country?s renewable energy capacity would reach 45% of the total capacity by 2030, a respectable 85% nearing 2040, and in line with the Paris Agreement, 98% nearing the end of 2050 (see Figure 23).

Figure 23: Historical share of renewables in primary energy in comparison to Paris Compatible benchmarks for South Africa



Source: Climate Action Tracker (2021): South Africa ? Policies & action

The challenges faced by Eskom, be it fiscal (where the organisation has been receiving bailouts from the government and is under a debt amounting to 27 billion US Dollars),[215][215] structure-based, or operational pose a threat to the nation?s energy sector and were required to be addressed, towards which end, a Sustainability Task Team was appointed.[216][216] The team was to assess critical points of failure and present remedial measures to rectify the complications that Eskom faced. They were to assess Eskom?s existing business model and company structure and make recommendations on how to improve the company?s fiscal situation, as well as an ideal path forward for current complications put the organisation?s, rather the country?s transition towards clean, renewable energy. Even apart from the debt, the company faces an electricity generation capacity deficit of a notable 4 GW.[217][217] A revision on the 2005 National Energy Efficiency Strategy (NEES) is under process (NEES - 2015) that aims to reduce energy consumption in 2030 by 29% of 2015 consumption statistics.[218][218]

2.6 On-going and planned projects

A variety of initiatives and activities that respond to the need of modernizing and revitalising industrial parks is already in place or planned. In 1997, the South African Government introduced the Industrial Development Zones (IDZ) programme that aimed to attract foreign direct investment and to promote the export of value-added commodities. After a policy review the Special Economic Zones (SEZ) policy was formulated, with the SEZ programme starting in 2007[219][219]. The new SEZ policy provides a clear framework for the development, operations and management of SEZs, including addressing challenges of the past IDZ programme. Under the Industrial Park Revitalisation Programme (IPRP) of the dtic, a number of existing industrial parks[220][220] are being revitalized to allow them to serve as catalysts for broader economic and industrial development in their host regions (townships and rural areas). The IPRP?s objectives include: removing barriers related to infrastructure, market access and supporting firm level competitiveness, assisting regions to build, strengthen and develop strategic, industrial capabilities as well as developing sustainable industrial clusters on the back of the old industrial assets and estates ? including to a minor extent promotion of renewable energy. Eventually, it is envisaged that all industrial parks (this includes the ones operated by local governments as well as privately owned IPs) will operate under the IPRP and its legal framework.

Textbox 1: The Industrial Park Revitalisation Programme (IPRP)

The Industrial Park Revitalisation Programme (IPRP) currently to address 30 parks by firstly renovating or upgrading infrastructure and security features, and secondly improving operating conditions and supporting investment promotion and branding of parks. These parks were typically established in pre-1994 apartheid South Africa to provide employment to local communities. The parks are currently owned by provincial governments and operated on their behalf by the relevant provincial development agencies. SEZs are governed by an SEZ Act with specific incentives provided therein, while industrial parks have no current incentive or support mechanisms for companies, outside of the standard industry support provided through Department of Trade, Industry and Competition (dtic) incentives. SEZs are furthermore subject to much more stringent operating conditions and compliance requirements, but it is planned to bring all government-owned industrial parks into a similar operating framework. The first eleven industrial parks in the IPRP provide employment to approximately 55,000 people and occupancy ranges from SMEs to large multinationals. The dtic has been implementing the Industrial Park Revitalisation Programme in the period 2015 to 2020 and onwards. The rationale for the program is that the revitalization of industrial parks and cluster development are critical mechanisms in supporting the objective of industrial decentralization and the diversification of the manufacturing industry in South Africa. Industrial clusters offer a means to overcome the various market and institutional barriers faced by firms. Eco-industrial parks can accelerate economic development by attracting innovative businesses and new technologies, leading to accelerating inclusive industrial development and creating more jobs while enhancing competitiveness. They support start-up companies, new enterprise incubations, and the development of knowledge-based industries. Successful industrial parks offer the opportunity for regional development where the clusters can facilitate innovation and advanced technologies, creating high growth in the regions and attracting investment.

In summary, the objectives of the IPRP are:

- ? Accelerate economic development in the lagging regions by attracting business investments to locate in the areas;
- ? Support job creation in manufacturing and related sectors to arrest negative externalities associated with urban congestion;
- ? Remove barriers related to infrastructure and market access, and support firm-level competitiveness;
- ? Provide new opportunities and support high growth in the townships, rural and distressed peri-urban areas;
- ? Assist regions to build, strengthen and develop strategic industrial capabilities; and
- ? Develop sustainable industrial clusters on the back of the old industrial assets in those regions.

The IPRP consists of five phases, namely:

- ? Phase 1: Security infrastructure upgrade, and providing fencing, street lighting, top structures and critical electricity requirements;
- ? Phase 2: Compliance with regulatory requirements ? landfill sites; waste and water treatment plants; fire, health & safety requirements; and renewable energy initiatives;
- ? Phase 3: Engineering designs, construction of new and maintenance of existing roads, bulk water supply and sewage treatment plants or industrial effluent control;
- ? Phase 4: Upgrading electricity infrastructure, and building new top structures in line with the expansion programme of the parks; and
- ? Phase 5: Development of sustainable industrial clusters in the parks.

There has been 30 parks identified for revitalisation in 2021, with 12 IPs completing Phase 1 revitalisation, 5 parks in progress of Phase 2 revitalisation and 6 new applications being prepared for Phase 1 revitalisation.

Source: UNIDO 2020[221][221]

In 2021, the IPRP accommodates 30 industrial parks and 15 SEZs in the country[222][222]. But so far, the programme does not appear to have a significant effect on reducing the energy intensity of production and thus reducing GHG emissions from the industrial sector. Further enhanced action towards fostering sustainable energy in industrial production (and thus industrial parks) is therefore eagerly required.[223][223]

In this respect, and besides the IPRP, a number of other regulatory developments as well as existing programmes and initiatives are likely to impact of the future development of industrial parks in the country. Those include the following:

Table 5: Relevant programmes and initiatives

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
National Climate Change Response Policy	Government of South Africa	The National Climate Change Response Policy is a comprehensive plan to address both mitigation and adaptation in the short, medium and long term. The NCCPR includes recommendations on GHG mitigation, namely a commitment to reduce national GHG emissions to ?make a fair contribution to the global effort to stabilize GHG concentrations 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?. The NCCRP also introduced the carbon tax on direct emissions and the ?Desired Emission Reduction Outcomes? (DEROs) setting effective sectoral GHG emission limit caps.[224][224]	2004-	No information available	Guiding policy document for mitigation and adaptation related actions in South Africa.

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)	Government of South Africa	REIPPPP was scaled up as part of a Renewable Energy Flagship Programme.	2011-2030	No information available	REIPPP is a competitive tender process that was designed to facilitate private sector investment into grid-connected renewable energy generation in South Africa.
South African Renewable Energy Master Plan (SAREM)	Department of Trade, Industry and Competition (dtic)	SAREM represents an opportunity to identify jobs and investment in the renewable energy sector linked to the Integrated Resources Plan (2018), as well as to articulate how job creation and investment might be optimised and maximised if various impediments were removed, or new supportive policy was designed.[225][225]	2021-	No information available	In terms of renewable energy generation, the South African Renewable Energy Master Plan (SAREM) may become a relevant instrument (roll out expected for 2021).

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
Resource Efficient and Cleaner Production (RECP)	Department of Trade, Industry and Competition (dtic)	A national programme of government that promotes the implementation of resource efficiency and cleaner production (RECP) methodologies to assist industry to lower costs through reduced energy, water and materials usage, and waste management. It is hosted by the CSIR on behalf of the Department of Trade and Industry.[226][226]	2002-	No information available	Concerning green industries, the RECP activities implemented by the National Cleaner Production Centre of South Africa (NCPC-SA) are of importance for the project
Industrial Energy Efficiency (IEE) Project	NCPC-SA	The Industrial Energy Efficiency (IEE) Project was established in 2010 in response to the growing need to improve the energy efficiency of South Africa. The IEE aims to demonstrate the positive impact of energy management as a means of reducing GHG emissions and to demonstrate the effectiveness and financial impact of in-plant energy management.[227][227]	2010-2021	No information available	IEE Project concluded in December 2021, but the work continues through the NCPC-SA offering companies support to realise energy related cost savings.

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
Global Eco-Industrial Parks Programme (GEIPP) in South Africa	NCPC-SA	GEIPP demonstrates the viability and benefits of greening industrial parks by improving resource productivity and economic, environmental, and social performance of businesses and thereby contributing to inclusive and sustainable industrial development in the participating developing and transition economies.	2021 - 2023	US$ 993,371	Collaboration with this project will be important, as the same or similar beneficiary groups will be addressed.

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
Cities Support Programme	Government of South Africa	The Cities Support Programme (CSP) is located within the inter-governmental relations (IGR) division of the National Treasury (NT). Acting as a change agent and a vehicle for collaboration and integration, the CSP aims to improve the capacity of cities and create an enabling intergovernmental fiscal system and policy environment to support city-led transformation. The CSP supports metros directly and works across divisions in NT, with other national departments and broader stakeholders to enhance the enabling policy environment fiscal frameworks to make it easier for cities to work more efficiently.	2013-2018 (Phase I) 2018-2023 (Phase II)	No information available	The CSP for instance is implementing an Industrial Park Revitalisation programme in partnership with the eThekwini, Ekurhuleni, Tshwane and Johannesburg metropolitan municipalities. The focus industrial zones include Jacobs, Wadeville, Babelegi (IP) and Devland[228] [228]

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
Equity Fund for the Small Projects Independent Power Producer Procurement Programme (SP-IPPPP)[229] [229]	DBSA	A funding facility for small scale renewable energy projects in South Africa. In a bid to address barriers to accessing financial resources by small and medium enterprises (SMEs) for the installation of renewable energy technology	2017-2021	US$ 15,000,000	The programme ended but important lessons and information for the project can be derived from it through the implementing partner, DBSA.
Cities-IAP: Building a Resilient and Resource-efficient Johannesburg: Increased Access to Urban Services and Improved Quality of Life	DBSA/ UNEP	The project fosters city-level resilience, resource efficiency, emission reductions, and other co-benefits through area-based pilot demonstrations, systems analysis (food), and improved integrated planning	2017-2022	US$ 8,093,171	Collaboration with this project is important, as similar beneficiary groups will be addressed
Embedded Generation Investment Programme (?EGIP?)	DBSA	The GCF-DBSA Embedded Generation Investment Programme (?EGIP?) supports the implementation of renewable energy projects with a capacity of 330 MW, which is comprised of 280 MW Solar PV and 50 MW Wind.	2020-2043	US$ 100,000,000	The EGIP has been identified as co-finance source as a suitable financial support scheme(s) to support the uptake of measures in additional IPs / SEZs.

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
DBSA Climate Finance Facility	DBSA	The Climate Finance Facility (CFF) is designed based on the model of a ?Green Bank? and operating within the Development Bank of Southern Africa (DBSA). The CFF aims to address the lack of access to finance and lack of innovative funding models, addresses market constraints, playing a catalytic role with a blended finance approach to increase climate related investment in South Africa and Rand-based economies (Swaziland, Namibia, Lesotho)	2019-2024	US$ 55,620,000	The CFP has been identified as co-finance source as a suitable financial support scheme(s) to support the uptake of measures in additional IPs / SEZs.
Energy Efficiency Low Carbon Transport (LCT-SA) Project	SANEDI	The objective of the Project is the promotion of the widespread use of electric vehicles (EVs) and non-motorized transport (NMT), and the development of the necessary infrastructure, as part of the Green Transport and Green Cities initiatives of South Africa.	2014-2021	US$ 1,260,946	While the project has already been completed, its results and lessons learnt will be considered in the implementation of this project.

Project Name	Implementing Agency	Description	Execution Period	Estimated budget	Relevance to project
AFD Green Energy Fund	IDC	The AFD Green Energy Fund of IDC provides finance to renewable energy and energy efficiency projects of smaller scale and manufacturing of Green products in South Africa. The funds size is approx ZAR 1 billion and investment cost not higher that 25% of the Facility (ca R250 million per project) can be applied for.[230][230]	2019-	ZAR 1,000,000,000 (approx. US$ 66,000,000)	The AFD Green Energy Fund has been identified as co-finance source as a suitable financial support scheme(s) to support the uptake of measures in additional IPs / SEZs.

COVID-19 recovery efforts by the Government

As a response to the impact of the COVID-19 pandemic, the Government of South Africa has released its ?South African Economic Reconstruction and Recovery Plan? in October 2020[231][231]. The Plan has three phases:

1) Engage and Preserve, incl. comprehensive health response to save lives and curb the spread of the pandemic;

2) Recovery and Reform, incl. interventions to restore the economy while controlling the health risks; and

3) Reconstruct and Transform, entailing building a sustainable, resilient and inclusive economy.

The following priority interventions are mentioned in the Plan:

- ? Aggressive infrastructure investment;
- ? Employment orientated strategic localization, reindustrialization and export promotion;
- ? Energy security;
- ? Support for tourism recovery and growth;
- ? Gender equality and economic inclusion of women and youth;

? Green economy interventions;

? Mass public employment interventions;

? Strengthening food security; and

? Macro-economic interventions

The project will in particular support the government target and interventions related to infrastructure investment, employment orientated strategic localization, re-industrialization and export promotion; as well as energy security and green economy (see also section on COVID-19 risks and opportunities below).

To conclude, industrial and commercial activities in South Africa cause a high energy demand, which is mostly met with fossil fuel energy sources. In light of this it appears that sustainable energy aspects of industrial activities are insufficiently integrated into the operation of IPs / SEZs and the urban development planning of municipalities. The current and ongoing regulatory developments as well as existing programmes and initiatives still lack to address this fact in a comprehensive and transitional fashion.

3) Proposed alternative scenario with a brief description of expected outcomes and components of the project

This project aims to support South Africa accelerate the transition to sustainable energy investments and practices at industrial production facilities with a focus on Industrial Parks(IPs) and Special Economic Zones (SEZ). South Africa is at the early stage of such a transition but has outlined its ambitious targets in its NDC. The industry-sustainable energy nexus in the country is only addressed to a limited extend, the decentralisation of the energy supply is still uncoordinated, and lacks proven successful on-the-field experiences for an accelerated up-scale. Despite changing economics on a global market financial incentives and access to finance limits this transition in South Africa. The penetration shares of renewable energies in the country and in the supply of IP / SEZ is still low compared to the potential of renewable energy sources. The project aims to address this situation by a series of actions that together will accelerate processes to introduce sustainable energy solution at IPs / SEZs in the country.

In order to address the barriers and root causes for industrial park development identified above and to achieve the project objective of reducing GHG emissions and accelerating the decarbonization of industrial parks, an integrated, holistic approach is envisaged for the project for complementing and aligning existing measures. Eventually, the full potential of sustainable energy in industrial parks will only be harnessed and lead to a significant impact, if the majority of parks becomes active in this regard. Hence, supporting stakeholders in overcoming barriers requires an integrated approach. The foreseen approach is translated into three components:

The project?s Component 1 will support the country to create a governmental coordination mechanism between key governmental, industry and energy actors[232][232], develop an industry sector energy data mechanism, guide on local energy strategies and build the capacity of key stakeholders on technical, financial and social aspects of sustainable energy solutions. As part of the strategy development, comprehensive energy analyses and profile will be undertaken to support the IPs / SEZ operators and municipalities with identification of priority investments for decarbonizing the energy supply. In this

way, the IPs / SEZ will take steps to transform to a low-emission energy supply based on an improved enabling environment.

Component 2 creates evidence amongst government, municipalities, IPs / SEZ operators, private sector (tenants and industrial establishments) and civil society stakeholders as to the technical, social and economic viability of sustainable energy solutions at local sides and conditions. With an absence of proven holistic approaches, local stakeholders are unsure as to whether the energy technology and infrastructure can function in local conditions (e.g., energy demand level, load curves and profiles etc.). This component will address this barrier by piloting sustainable energy solutions at government owned IPs / SEZs (?innovators?), as a steppingstone for future scale-up in additional industrial zones, as well as in private IPs / SEZ (?early adopters?).

Component 3 establishes the foundations for an economy-wide upscaling of measures through a supportive strategic framework. The framework should be aligned to the country?s Integrated Resource Plan (IRP)[233][233], the renewable energy masterplan developed by the dtic for the renewable energy industry sector, the national electricity utility?s (Eskom) plans, various other initiatives such as the Presidential Climate Change Commission, the environmental regulatory framework and the Just Transition, among others. The framework should also address avenues of support to accelerate scaling up and that may include an attractive financing mechanism. Through regulation and incentives for decentralized energy solutions, including renewable energy and energy efficiency and management, this component focuses on levelling the playing field for the evolution of further low-carbon EIPs. Under the component an additional project pipeline for investment replicating the IP / SEZ sustainable energy pilot approaches will be identified. This will be supported by the establishment of corresponding business and financing models. The project will target pre-existing IPs / SEZs, which will be upgraded to Eco-Industrial Parks (EIPs) with regard to low-emission energy solutions and will not engage in any land acquisition/change, etc. or green field developments.

The project is fully aligned with and seeks to support the achievement of South Africa?s nationally determined contribution (NDC). It aims to accompany the country?s steps to decarbonize its industry and energy sector (see baseline) through the uptake of sustainable energy solutions in industries which can also serve to reduce load shedding and enhance energy supply security. Combined with other national actions, successful execution of this GEF project will kick-start South Africa?s transition to sustainable energy solution in industries (Just Energy Transition) and support it with achieving broader decarbonization objectives. This also has the potential to unlock additional value chains and opportunities for employment, SME and supplier development, as well as localization and support industrialization of the country. Understanding the opportunities of sustainable energy solutions and decarbonizing industrial parks is imperative for gaining the required economy-wide momentum that can drive the industrial energy transition in South Africa. In this respect, each component aims to educate stakeholders about opportunities and challenges, existing activities and approaches to engage in low-carbon development.

Theory of change

The Project aims to reduce GHG emissions and accelerate the decarbonization of industrial parks through providing support to IP / SEZ managements, tenants, municipalities and other core stakeholders. Through the project interventions the Government and local authorities will be enabled to ensure an aligned and coordinated IP / SEZ-associated policy and regulatory environment is established, especially with regard to energy generation and consumption (long-term outcome). Municipalities, IPs / SEZs and industrial establishments will have sufficient information for individual

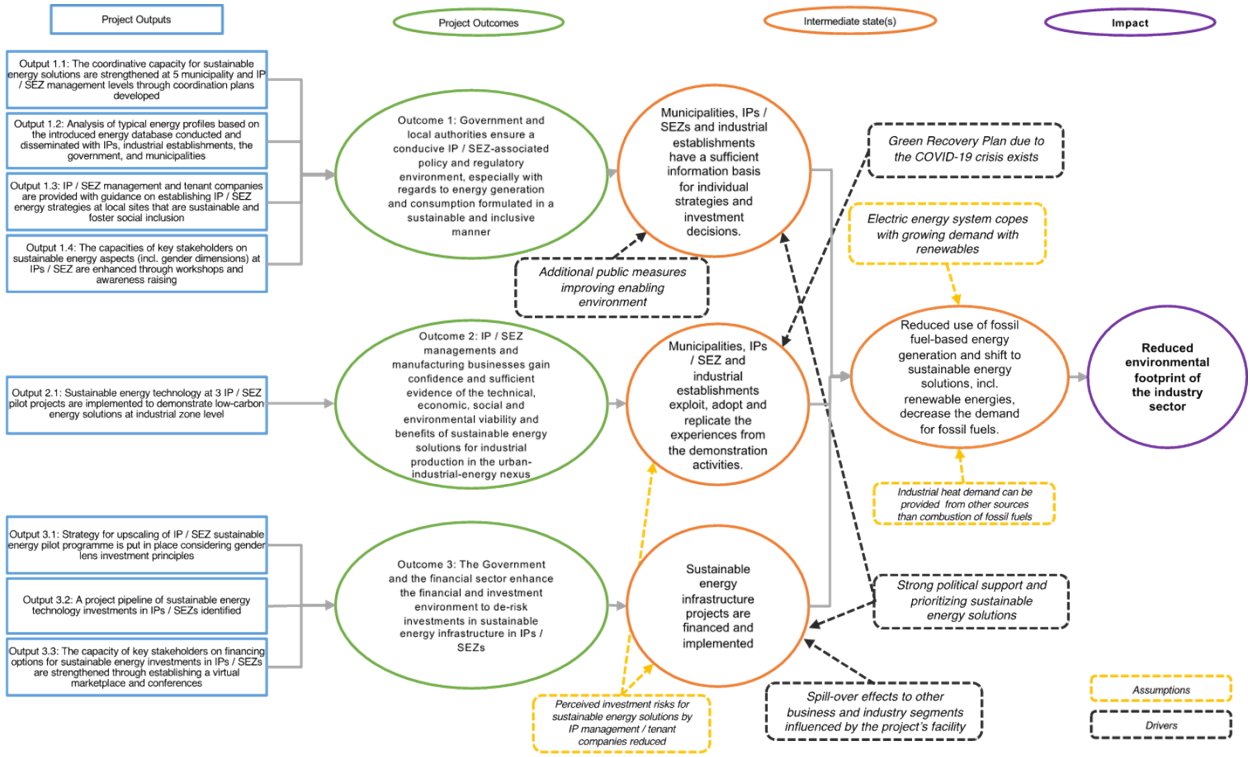
strategies and investment decisions. This and low-carbon and sustainable energy demonstration projects for dissemination of experiences will allow IP / SEZ managements and manufacturing businesses to gain confidence and sufficient evidence of the technical, economic, social and environmental viability of sustainable energy solutions for industrial production in the urban-industrial-energy nexus. As a result, municipalities, IPs / SEZs and industrial establishments exploit, adopt and replicate the experiences from the demonstration activities. In addition, the project preparation facilitation will help the Government and the financial sector to enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IPs / SEZs. Hence, if the perceived investment risks for sustainable energy solutions by IP / SEZ management / tenant companies is reduced, sustainable energy infrastructure projects are financed and implemented. These aspects will set up a supporting / enabling environment for IPs/SEZs to implement the necessary action towards decarbonization and sustainable energy. As a result, the use of fossil fuel-based energy generation is reduced and shifts to sustainable energy solutions, including renewable energies, which decreases the demand for fossil fuels. Eventually, this leads to a reduced environmental footprint of the industry sector, which is expressed in mitigated GHG emissions (tCO2e/a) and renewable energy capacity installed (MW). This also has the added benefit of a cleaner and healthier working environment and reducing the impact of emissions on the health of the surrounding environment and community.

The industry sector can be transformed to a sustainable low-emission system with a dominance of renewable energy usage. South Africa has established a Green Recovery Plan due to the COVID-19 crisis as a vehicle to transform society by investing in profitable infrastructure which creates economic, environmental and social benefits, short-term creation of jobs and long-term greening of the economy. Renewable and sustainable energy solutions and infrastructure are thereby a core feature. The detailed illustration of the theory of change is given in Figure 24.

The result framework for the project includes beside the GEF Core Indicator 6 Greenhouse gas emissions mitigated (metric tons of carbon dioxide equivalent) the following two contextual sub-indicators at outcome level: Energy saved (GEF Core Indicator 6.3 ? in MJ) and Increase in installed renewable energy capacity per technology (GEF Core Indicator 6.4. - in MW).

The figure below illustrates the logical framework of impact, objectives and outcomes of the project along the three components:

Figure 24: Theory of change for the project


Project Outputs
Project Outcomes
Intermediate state(s)
Impact
Output 1.1: The coordinative capacity for sustainable energy solutions are strengthened at 5 municipality and IP / SEZ management levels through coordination plans developed
Output 1.2: Analysis of typical energy profiles based on the introduced energy database conducted and disseminated with IPs, industrial establishments, the government, and municipalities
Output 1.3: IP / SEZ management and tenant companies are provided with guidance on establishing IP / SEZ energy strategies at local sites that are sustainable and foster social inclusion
Output 1.4: The capacities of key stakeholders on sustainable energy aspects (incl. gender dimensions) at IPs / SEZ are enhanced through workshops and awareness raising
Output 2.1: Sustainable energy technology at 3 IP / SEZ pilot projects are implemented to demonstrate low-carbon energy solutions at industrial zone level
Output 3.1: Strategy for upscaling of IP / SEZ sustainable energy pilot programme is put in place considering gender lens investment principles
Output 3.2: A project pipeline of sustainable energy technology investments in IPs / SEZs identified
Output 3.3: The capacity of key stakeholders on financing options for sustainable energy investments in IPs / SEZs are strengthened through establishing a virtual marketplace and conferences
Outcome 1: Government and local authorities ensure a conducive IP / SEZ-associated policy and regulatory environment, especially with regards to energy generation and consumption formulated in a sustainable and inclusive manner
Outcome 2: IP / SEZ managements and manufacturing businesses gain confidence and sufficient evidence of the technical, economic, social and environmental viability and benefits of sustainable energy solutions for industrial production in the urban-industrial-energy nexus
Outcome 3: The Government and the financial sector enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IPs / SEZs
Municipalities, IPs / SEZs and industrial establishments have a sufficient information basis for individual strategies and investment decisions.
Municipalities, IPs / SEZ and industrial establishments exploit, adopt and replicate the experiences from the demonstration activities.
Sustainable energy infrastructure projects are financed and implemented
Additional public measures improving enabling environment
Perceived investment risks for sustainable energy solutions by IP management / tenant companies reduced
Green Recovery Plan due to the COVID-19 crisis exists
Electric energy system copes with growing demand with renewables
Reduced use of fossil fuel-based energy generation and shift to sustainable energy solutions, incl. renewable energies, decrease the demand for fossil fuels.
Industrial heat demand can be provided from other sources than combustion of fossil fuels
Strong political support and prioritizing sustainable energy solutions
Spill-over effects to other business and industry segments influenced by the project's facility
Reduced environmental footprint of the industry sector
Assumptions
Drivers

Component 1: Fostering the coordination towards sustainable energy transformation of IPs /

SEZs by creating a conducive enabling environment under consideration of social equity

This component provides support on regulation, planning and coordination, in order to pave the way for stakeholders towards integrated, sustainable energy solutions (incl. energy demand and supply). Since further regulation, programmes and initiatives that serve to improve enabling conditions are planned or operational, in particular for sustainable energy, coordination between those activities is imperative to derive a transparent overview of opportunities and challenges. Hence, the component will form part of dtic?s plans to provide support to IPs/SEZs that addresses multiple aspects, including energy. Such support is planned centralized (nationally or by province) and involve public-private partnerships, support by other entities such as CSIR and World Bank and others. It would make available expertise and tools to assist park management and municipalities in the project in their planning and in so doing addresses the capacity constraints that are currently experienced. IPs / SEZs are in most cases not located in isolation but operate within an urban environment and boundary. Hence, an urban-industrial nexus exists, with particular relevance for energy, resources and related impacts (waste, emissions etc.). Again, coordination is key in this respect, especially coordination and alignment with plans and activities at municipal level. For enhanced coordination, an institutional setting will be created, with a steering committee as well as technical working groups that allow discussion amongst stakeholders and decision makers. This way, also lessons learned from lighthouse activities and related programmes can be harnessed (and duplication of efforts is avoided). Besides targeting IPs / SEZs, a particular focus of this component lies on public sector authorities (government and municipalities).

Outcome 1.1: Government and local authorities ensure a conducive IP / SEZ-associated policy and regulatory environment, especially with regards to energy generation and consumption formulated in a sustainable and inclusive manner

Output 1.1.1: The coordinative capacities for sustainable energy solutions are strengthened at 6 IP / SEZ municipality management levels through coordination plans

Barrier addressed by the output (as described in section 1.2): 1(a): Lack of coordination and consultation.

The project will promote sustainability and energy aspects as one priority area in urban/industrial area planning, i.e., regulatory issues and political agenda. Besides water management (GIZ project on Water Stewardship as a Standard Operating Procedure for IPs) and waste and resource management (GEIPP/ EIP interventions by dtic and NCPC-SA)), the project will help to put the sustainable energy demand and supply including environmental, socio-economic and technical aspects on the agenda of municipalities and IP management as part of the urban-industrial nexus. Hence, municipalities, IPs / SEZs and neighbouring communities as well as further key stakeholders are supported on integrated planning of low-carbon IP aspects. In up to six pre-selected industrial zones (Coega Special Economic Zone, East London Industrial Development Zone (ELIDZ), Ekundustria, Phuthaditjahab Industrial Park, Atlantis Special Economic Zone and Umbogintwini Industrial Complex) the project will ensure coordination and consultation with governmental and non-governmental stakeholders through development of dedicated coordination plans as mentioned in table 6 below. In addition, Atlantis SEZ for which feasibility studies on renewable energy have been conducted already will be part of the consultations to support the implementation of the investigated intervention and inform the coordination. The plans will specify the relevant stakeholders, routines of regular consultations and relevant topic. The plans will be shared with all relevant stakeholders at the industrial zone, incl. the IPs/ SEZ management, the municipalities, the industrial establishments (tenants) and interested

representatives of the civil society. The six pre-selected industrial zones[234][234] are summarized in the following table. Detailed profiles are provided in Appendix IV. A Letter of Commitment from the below short-listed IPs / SEZs are obtained to formalize their commitment to the project. Please find the Letters of Commitments in the annexes (please note that the letter from Umbogintwini IP is pending and expected to be received before the project implementation).

Table 6: Overview of short-listed IPs / SEZs

	Atlantis Special Economic Zone[235][235]	Coega Special Economic Zone	East London Industrial Development Zone (ELIDZ)	Ekandustria Industrial Park	Phuthaditjahaba Industrial Park	Umbogintwini Industrial Complex
Location	Western Cape	Eastern Cape	Eastern Cape	Gauteng	Free State	KwaZulu Natal
Municipality	Cape Town Metropolitan Municipality	Nelson Mandela Bay Metropolitan Municipality	Buffalo City Metropolitan Municipality	Tshwane Metropolitan Municipality	Maluti-a-Phofung Local Municipality	Ethekwini Metropolitan Municipality
Size	120 ha / 4 tenants	9003 ha / 42 tenants	263 ha / 33 tenants	230 ha / 78 tenants	260 ha / 185 tenants	220 ha / 11 tenants
Industries	Renewable Energy and Green Technology related	Agro-processing, automotive, aquaculture, energy, metals, logistics and business process services	Automotive, logistics, Plastics, Food & Beverage	Food & Beverage, metals, clothing, packaging	Textiles, retail, furniture, construction, chemicals (petroleum and gas), logistics & warehousing, food & beverages	Chemical manufacture, food manufacture (human and animal), warehousing and logistics

Source: dtic and information from IP / SEZ (incl. web presentation)

Coordinates of short-listed IPs / SEZs

Name of Pre-selected IP / SEZ	**Coordinates**
Atlantis Special Economic Zone	-33.59432, 18.47250
Coega Special Economic Zone	-33.79603, 25.6679
East London Industrial Development Zone (ELIDZ)	-33.04845, 27.85346
Ekandustria	-25.69627, 28.7023
Phuthaditjhaba Industrial Park	-28.52763, 28.8965
Umbogintwini Industrial Complex	-30.01657, 30.90392

As part of the coordination plan, four annual extended-stakeholder meetings will be arranged at each industrial zone, in which such stakeholders are given the opportunity to present their needs, experiences, ideas and concerns with regards to sustainable energy solutions. This will include dedicated sessions for:

? Sustainable electricity and power supply, cooling / Heat and process heat supply;

? Long-term planning on sustainable energy solutions at municipality and IP / SEZ level with local governments

? Regulatory aspects related to energy demand and supply, e.g., IPP licensing, feed-in regulation and potential regulations for public-private-partnerships (PPP).

Secondly, the dedicated roundtables (aligned and coordinated with the existing Eco-Industrial Park Roundtables executed by dtic) on energy aspects will be organised by NCPC-SA on a quarterly basis. The roundtables will be open to interested IPs / SEZ and municipalities.

The main recipient of the output are the municipalities, the IP/SEZ management of the six industrial zones, the tenants and civil society representatives, incl. NGOs. The outreach and coordination will be supported by SALGA as partner of the technical working group. Coordination with SALGA will include specific engagement with Cooperative Governance & Traditional Affairs (COGTA) and the dtic to ensure alignment with other inter-departmental initiatives that address local development. This can therefore contribute to building the relationships among these institutions, strengthening them and thereby breaking down silos and increasing coordination and impact of joint programmes. In addition, the project will be in close coordination with the 5 selected industrial zones, through the project manager, for preparing the IP / SEZ energy strategies at local sites (Output 1.3) and the demonstration pilots (Output 2.1).

#	Activities
1.1.1.1	Develop coordination plan for up to 5 selected municipalities, IPs / SEZs and neighbouring communities
1.1.1.2	Conduct minimum four annual extended-stakeholder meetings at each selected industrial zone
1.1.1.3	Conduct quarterly roundtables

Output 1.1.2: Analysis of typical energy profiles based on the introduced energy database conducted and disseminated with IPs, industrial establishments, the government, and municipalities

Barrier addressed by the output: 1(b): Lack of energy data mechanisms to collect related data collection at IP / SEZ.

Under the output the energy demand and consumption profiles of IPs / SEZs and representative tenants / industrial establishments will be investigated and summarised for South Africa. The project will make use of data and analysis of the up to 5 selected IPs / SEZ under Output 1.1 and under the demonstration pilot (Component 2). In addition, typical industries and production facilities will be categorised and characteristic energy profiles will be identified that are summarise in a data base. The data are sanitized so that no direct linkages to industrial establishments can be made for confidentiality reasons.

The energy profiles (load and supply, and energy balance) will be compared against international benchmarks and potential energy solutions will be illustrated. The output will deliver a baseline/benchmark database for South Africa[236][236] of typical energy intensities of relevant industrial activities in South Africa that can be further accomplish with further data in future. Also, existing data from studies and research project[237][237] shall be included on the database. Against these baseline/benchmarks (that shall be published by NCPC-SA) the IP / SEZ managers and tenants can compare their energy demand and identify potential enhancements related to the energy intensity. Information will be dynamically updated and may include for typical production processes:

? Thermal energy consumption per output

? Electricity consumption per output

? Required load per output and load curves

? Typical energy drivers per production process, e.g., machineries, thermal processes etc.

The database will help municipalities, IPs/ SEZs operators and industrial establishments to estimate their individual and integrated energy profile. The data will be published at NCPC-SA information portal (www.industrialefficiency.co.za) will house all existing industrial energy data and information in one location. The data will be designed in a way that is fit with the dtic?s plans to require industrial parks to report on their energy, water and other indicators as outlined in an current draft policy green paper[238][238].

Key activities to be undertaken in the design of the data base system, will include:

- Development of data system functions to, inter alia, facilitate presentation of typical energy profiles and data;
- Identification and proposal for incorporating the system into the webpage of NCPC-SA;

- Identification of system users and responsible entities and the development of user and operation protocols that also cover information integrity, verification and security;
- Identification of key data required (existing and not existing) and data owners;
- Identification of key indicators and development of an indicator platform for relevant analysis and decision makers;
- Specification of necessary resources (human and physical assets, including hardware and software, databases, source codes, design documents as applicable). The system will be developed through open-source programming and will be open source;
- Proposal including timeline for creating and operationalizing the data system during the project lifetime;
- Elaboration of data quality control and quality assurance processes;
- Cost estimate for the system?s annual operation and maintenance;
- Concrete stakeholder-consulted proposal on the sustainable financing and operation of the system post project;

To ensure the data system?s sustainability post-project, the output will abide by the key principle of ensuring the development of a relatively simple, low-maintenance and low-cost platform that can serve to enrich public policy processes by providing relevant energy data of industrial zones and producers, and not create an additional financial or human resource demand on the NCPC-SA and dtic. Ensuring this will lead to the development of database that responds to the NCPC-SA / dtic needs, leading to long-term sustainability through appreciation of the value the platform serves to ministry operations.

The data collection will be built on the available process level and typical sector specific baseline data (e.g., from ENCPC) on energy consumption, carbon intensity and energy intensity. This data collection would be important for benchmarking purposes.

#	Activities
1.1.2.1	Detailed design of the web-based data system, based on international good practices

1.1.2.2	Develop detailed data collection plan, including identification and mapping of data suppliers (including 5 selected IPs / SEZ and representative tenants / industrial establishments), data supply periodicity, formats of supplied data (identifying any data conversion required by the system for data uploading), and detailed roadmap and strategy for the generation and collection of unavailable or uncollected data
1.1.2.3	Data sharing agreements for furnishing the system finalized between key data suppliers and NCPC-SA / dtic
1.1.2.4	Data system operationalized on baseline/benchmark of typical energy intensities of relevant industrial activities in South Africa
1.1.2.5	Develop protocols for post-project management of the system and data collection and analysis submitted to the dtic for adoption
1.1.2.6	Produce annual online reports on data aggregated and processed by the system shared with the dtic (minimum 2 reports)
1.1.2.7	Organize two (2) training sessions for data suppliers and users of the system, including two (2) training reports

Output 1.1.3: IP / SEZ management and tenant companies are provided with guidance on establishing IP / SEZ energy strategies at local sites that are sustainable and foster social inclusion

Through consultations and guidance preparation under this output the project will support IPs / SEZ management and tenant companies to enhance the coordination on energy strategies, as well as the implementation of appropriate, inclusive and relevant energy planning with associated activities. The project will prepare guidance for best practices on how to approach energy analysis and strategies at the IP / SEZ levels. The guidance covers technical and financial aspects and provides a framework on how IP / SEZ management and tenants can prepare roadmaps towards low-carbon and sustainable energy practices in their facilities. These roadmaps shall help enhancing the coordination, facilitating the effective implementation and streamlining standards / criteria. This shall also be enabled with improved and established digital data management.

Using the guidance, the project will prepare an integrated energy planning strategies for up to 3 selected municipalities, industrial zones and communities until 2030, 2040 and 2050. Primary recipients of the strategies are the municipalities and the IPs / SEZ operators. Making use of the energy data and profile the strategy will investigate the energy saving potentials, the renewable energy generation capacity potential at the facilities and the gender-sensitive socio-economic impacts of its implementation. The strategy and implementation will comprise technical roadmap for reducing the energy demand and increasing the deployment of renewable energies as well as a policy roadmap to the municipalities to support and incentivise the energy transition. The strategy and implementation plan will inform dtic?s masterplan guide for IPs / SEZ on preparing energy plans. The dtic includes in its masterplan guide energy plans for IPs/ SEZs, which not only addresses energy demand and supply, but also efficiency, safety, monitoring, and management aspects. The results of the project will therefore inform the development of the energy plan by facilitate the inputs needed for the energy plan on energy demand and supply and where possible on other relevant aspects. Hence, the result will be part of the energy plan for the participating municipalities and IPs/SEZs. The strategies will be prepared by the technical implementation partner CSIR.

#	Activities
1.1.3.1	Recommendations for best practices on how to approach energy analysis and strategies at the IP / SEZ levels
1.1.3.2	Develop Technical Roadmap: Integrated energy planning strategies for up to 3 selected municipalities, IPs / SEZs and neighboring communities
1.1.3.3	Develop Policy Roadmap: The policy roadmap and/or relevant regulation including proposals for regulatory and financial aspects related to energy demand and supply, e.g., IPP licensing, feed-in regulation and potential regulations for public-private-partnerships (PPP) is developed and submitted to the Government for adoption

The project will develop and submit evidence-based inputs (in the format of roadmaps, recommendation, etc.) for relevant national policy-making bodies (e.g., the dtic and corresponding line ministries, including DMRE and similar.) to support them towards drafting policies and/or formulate future projects, rather than developing full-fledge policies. The implementation of these policies are subject to government?s adoption.

Output 1.1.4: The capacities of key stakeholders on sustainable energy aspects (incl. gender dimensions) at IPs / SEZ are enhanced through workshops and awareness raising

Barriers addressed by the output: 1(d) Lack of training, skills and knowledge on sustainable energy solutions on sustainable energy supply and demand side solutions, collective park level energy services as well as of sustainable energy logistics opportunities within industrial parks

This output builds the capacity of stakeholders on sustainable energy solution in three priority areas as identified during the project preparation grant phase:

i. Technical and financial aspects of sustainable energy solutions

   a. Enhance energy management on tenant and IP / SEZ level

   b. Decentralized renewable energy power generation, usage and storage

   c. Enhanced and accelerated energy efficiency adoption through DSM and digitalization

   d. Grid aspects such as wheeling, self-generation, grid connections, synchronizing issues

   e. Cleantech innovation, e.g., green hydrogen

ii. Business models and operational aspects for IPs and SEZs

iii. Financing and access to finance sustainable energy solutions

The project will train these stakeholders through a partnership with the CSIR. The output will also build upon capacity activities provided through UNIDO?s GEIPP and complement these activities. Capacity development activities on energy efficiency and renewable energy solutions will be offered for employees and managers of IP / SEZ tenant companies in form of trainings and stakeholder meetings at parks and municipalities level. IPs / SEZ management will be trained on potential energy services they can offer to tenants. ESCOs will be involved in the provision of the trainings and workshops. Knowledge about barriers for low-carbon IP / SEZ action, and opportunities to addressing those barriers (including a broad understanding of active projects and initiatives in South Africa) will be considered during the trainings, workshops and information material.

Knowledge products and information will be prepared and disseminated amongst IPs / SEZs, industrial establishment and municipalities and other stakeholders (including on the regulatory barriers). Besides the lessons learned from the pilot demonstration activities under Component 2, this will also generally comprise opportunities such as increasing renewable energy in industry, decarbonising the ?hard-to-abate? GHG emissions, increasing low-carbon infrastructure, and digitalisation. Within the private sector the focus will be on SMEs.

These knowledge products will be validated by the external experts and national stakeholders prior to publishing (e.g., on relevant national websites and UNIDO website). This will be done through a validating workshop or desk review if required.

The project will invite relevant stakeholders such as IP / SEZ managers, industrial establishments (tenants) and municipalities to participate at a Community of Practice (CoP). Knowledge about best practice examples for low-carbon IP / SEZ activities in South Africa and globally shall be disseminated amongst IP / SEZ managers through the CoP. National and international experts and representatives from the pilot IPs / SEZs will be involved in sharing their experiences on a peer-to-peer knowledge exchange. Representatives of the national, provincial and municipal government will be involved in order to strengthen their capacities in the areas of energy infrastructure planning, operation and management for industrial parks. The CoP will be organised at least twice a year in a conference style (with a virtual alternative scenario if required by COVID-19).

In addition, online resources on sustainable energy and the pilot activities will be offered through the NCPC website. Moreover, for registered IP / SEZ managers a help desk at NCPC will be established that will help clarifying incoming requests from IPs / SEZs and is able to facilitate for requested trainings.

With the awareness raising activities, the capacity and knowledge of IP / SEZ managers will be strengthened on sustainable energy infrastructure planning and management.

#	Activities
1.1.4.1	Conduct six (6) capacity development trainings on energy efficiency and renewable energy solutions are provided for employees and managers of IPs / SEZs and tenant companies as well as municipalities officials.
1.1.4.2	Develop three (3) knowledge products on sustainable energy solution aspects (technical, business models and operations, financing) addressed to IPs /SEZ, industrial establishment and municipalities and other stakeholders.
1.1.4.3	Community of Practice (CoP) for relevant stakeholders such as IP / SEZ managers, industrial establishments (tenants) and municipalities

1.1.4.4	Form up help desk to support clarifying incoming requests from IPs / SEZs and to facilitate for requested trainings

Component 2: Demonstration of low-carbon and sustainable energy interventions in target IPs / SEZ

This component aims to demonstrate the feasibility and attractiveness of low-carbon energy options for industrial parks. This includes the identification and selection of IPs / SEZs[239][239], identification of financial barriers and risks for an EIP programme, conducting stakeholder engagement & information activities, setting-up a financing approach with stakeholders, implementation of a pilot programme, as well as the evaluation of the pilot programme and identification of success factors / lessons.

Pilot activities in IPs will lead to an increased know-how of sustainable energy solutions in the urban-industrial nexus amongst the participants. The lessons learned and success factors identified during the preparation, financing and implementation of the pilot demonstration activity will be reflected by the project. In particular energy data and profiles, as well as energy performance will be scrutinised. These information and data will inform the replication and upscale though a potential financial mechanisms, potential energy services and business models. The pilot activities will, hence, lead to an increased understanding of financial viability and (required) de-risking instruments for the application of sustainable energy solutions. Gender dimensions of sustainable energy in IPs / SEZs will also be assessed, awareness of stakeholders on gender equality and women?s empowerment (GEEW) will be strengthened and knowledge about lessons learnt and best practices disseminated.

Outcome 2.1: IP / SEZ managements and manufacturing businesses gain confidence and sufficient evidence of the technical, economic, social and environmental viability and benefits of sustainable energy solutions for industrial production in the urban-industrial-energy nexus

Output 2.1.1: Sustainable energy technology at 3 IP / SEZ pilot projects are implemented to demonstrate low-carbon energy solutions at industrial zone level

Barrier addressed by the output: 2a): Lack of stakeholder awareness and confidence in sustainable energy and integrated solutions for serving industrial zones energy needs

This output will pilot sustainable energy solutions in government owned IPs / SEZs by preparing bankable investment project ready for investments. Through these demonstrations, a critical mass of decision-makers at municipalities, at IP / SEZ operators and at industrial establishments will be convinced of the viability of sustainable energy solutions, thus stimulating demand and the scaling-up of the technology in the country at other IPs / SEZs. The pilots, for which feasibility studies will be financed through the project, will be implemented by the IPs / SEZs and/or the industrial establishments with finance support of the co-finance facilities (e.g., IDC, DBSA). The pilots will provide key information and experiences for scaling up public and private investment and procurement, including through output 1.2. and 1.4. The project will consider during the design of the pilots the need for localization, i.e., the developing of local supply chain and support of SME development (see also Output 3.1). These are critical aspects for the scaling up approach and are also critical in the South African context. It also ensures greater benefit to the community and more integration with Local Economic Development (LED) plans at municipal level.

A. What and when

The project will undertake energy audits for up to 3 IPs / SEZs to identify potential fields of enhancements. Based on the audits a feasibility study for each demonstration project will be conducted, including technical and financial assessment, as well as environmental and socio-economics impacts. The feasibility studies will investigate the technical solutions for sustainable energy solutions in a systematic and comparable way, focusing rather on the park and urban-industrial nexus level, and not so much on individual tenant level. The scope of the feasibility study will explore localization and support for SMEs, by identifying possible procurement ways and business models. The pilot will start in the project?s second year and continue until the project?s termination.

B. Who and how

The NCPC-SA will support the technical design with support of energy auditors / consultant in close cooperation with the IP / SEZ management and the municipalities. The project will cover the incremental cost to compared to fossil fuel based alternative and isolated energy investments that are not implemented as an integrated approach at IP / SEZ level.

C. Additional details

Technical solutions evaluated are not limited to energy efficiency measures (e.g., efficient appliances, motors, lighting etc.) and the installation of renewable energies[240][240] and will identify interventions in the following areas:

Decentralized renewable energy power generation, usage and storage

? Deployment of renewable energies at IP / SEZ level and urban context

? Renewable heat production and district energy solution for cooling, heat and process heat demand within the park but also with potential connection to near urban surroundings.

? Storage of excess energy generated from renewable energies within the parks to meet the energy demand (load profiles of different single tenant and / or aggregated energy profiles) energy supply (intermitted energy sources such as wind and solar).

Enhanced and accelerated energy efficiency adoption through DSM and digitalisation

? Systematic improvement of the demand side (demand system management - DSM) based on different load profiles within the IPs / SEZs but also in the connection to the urban surroundings.

? Waste-heat-recovery (WHR) for power generation and / or proving (process) heat.

? Assessing the potential for 4IR technologies (data management, digitalization, industrial communication, and IoT), such as smart grid and micro grid solutions.

Introduction of cleantech innovation

? Use of green hydrogen produced from renewable energies (such as wind or solar).

? Low-emission cement and green steel production

Optional subject to co-finance contributions: Systemic impacts for sustainable cities, incl. electric mobility and waste management

? Coupling of energy supply and renewable energies with sustainable transport solutions, such as e-mobility or the production of hydrogen (such as envisioned for the Athlone power station in Cape Town).

? Waste-energy utilisation, i.e., closing or reducing capacity of landfilled close by IPs / SEZs for energy generation and supply.

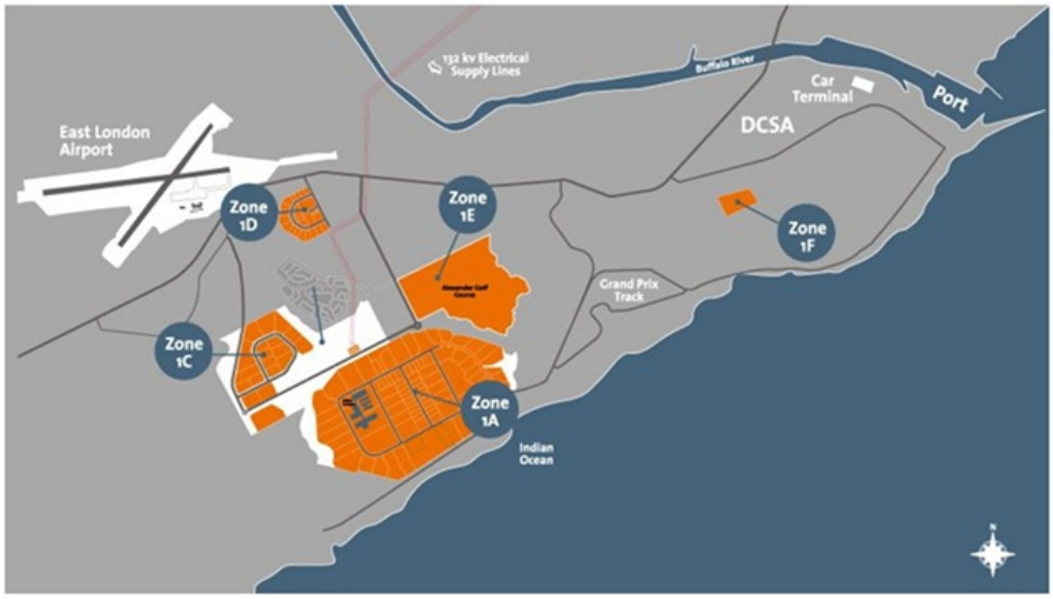
? Opportunities throughout the value chain and aspects of circular economy, such as enhanced production efficiency, extended product lifespans and increased end-of-life recycling will also be taken into consideration.

The output also comprises a strong stakeholder engagement, with focus on capacity development and financing approaches. Under the output the project will develop bankable investment projects together with the IPs / SEZ owners / management (and if applicable the tenants) for undertaking the investments for enhancing the energy demand and supply infrastructure. Based on preparatory work (pre-assessment and energy audits) and the feasibility study, state of the art energy solutions will be implemented at selected pilot IPs / SEZs for demonstrating the technical and economic feasibility. The demonstrations will be approached in a systematic manner, i.e., on IP / SEZ level with interconnection to the surrounding urban areas.

The identifying of suitable pilot demonstration at the six pre-selected IPs / SEZ (see output 1.1) is based on general GEF related criteria and park specific criteria and indicators, such as willingness and interest, mitigation impact, potential of replicability and political viability. In addition, experiences of ongoing activities and initiatives existing in South Africa have been considered for the selection. The industrial park revitalisation programmes with dtic and the National Treasury, as well as the GEIPP have for instance gathered important lessons and were consulted in the process of selecting pilot parks. Experiences at NCPC-SA show problems with owners / tenant relationship. Therefore, parks were selected that feel responsible for equipment and ideally also have operational control. Concerning the context of energy, selection considered relevant energy profiles of IPs / SEZ to achieve the project?s objectives and to ensure buy-in by IP / SEZ managements, tenants and municipalities. Here a certain experience of IP / SEZ managers with embracing sustainable energy concepts is helpful. In general, selected parks should be stable and well populated. For the pilot demonstration three investment project will be identified based on the technical energy roadmaps for the pre-selected IPs / SEZs: Atlantis SEZ, Coega Special Economic Zone, East London Industrial Development Zone (ELIDZ), Ekundustria, Phuthaditjahaba Industrial Park and Umbogintwini Industrial Complex (see Output 1.3).

Textbox 2: Energy and GHG inventory of exemplary IP / SEZ and potential sustainable energy solutions

The East London Industrial Development Zone (ELIDZ)[241][241] is a state-owned company and falls within the geographical boundary of the Buffalo City Metropolitan Municipality (BCMM). It is located in East London south of the Port of East London and adjacent the airport. The ELIDZ is hosting export-led manufacturing and processing as well as automotive industry. It is divided into six zones, which are shown below.



Source: Eastern Cape Freight Transport data bank[242][242]

? In Zone 1A there are five loose-standing manufacturing operations, two freight companies, two fish farms, as well as the Buffalo City Metropolitan Development Agency (BCMDA) which is an office complex. Zone 1A also has an Automotive Supplier Park (ASP).

? A major waste handling and recycling company operating within the ELIDZ is located in Zone 1B.

? Zone 1C is the Science and Technology Park (STP) which has several offices for tenants

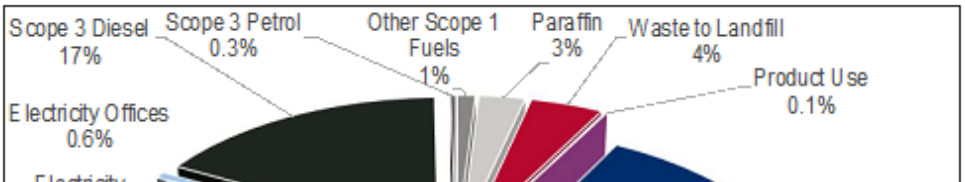
? Zone 1 D has one manufacturing operation and two freight operations

? Zone 1E is a golf course.

? Zone 1F has one manufacturing operation.

According to a study undertaken by USAID?s South African Low-Emissions Development (SA-LED) programme, the estimated GHG emissions in the ELIDZ were estimated to 59 ktCO2e in 2016.[243][243] The top contributions by source are electricity (75%), diesel for transporting goods/services (17%), solid waste to landfill (4%), paraffin (3%) and on-site diesel usage (1%). In terms of GHG categorization, approximately 96% of emissions occur off-site (Scope 2 and Scope 3 due to electricity consumption and transportation).

Figure 25: GHG emissions in the ELIDZ by source



IP / SEZ pilots will lead to an increased understanding of sustainable energy solutions in the urban-industrial nexus. The lessons learned and success factors identified during the preparation, financing and implementation of the pilot demonstration activity will be reflected. In particular energy data and profiles, as well as energy performance will be scrutinized. These information and data will inform the Outputs under Component 1 related to the database (Output 1.2) and Component 3 that relate to financial mechanisms, potential energy services and business models. The pilot activities will, hence, lead to an increased understanding of financial viability and (required) de-risking instruments for the application of sustainable energy solutions. Gender dimensions of sustainable energy in IPs / SEZs will also be assessed, awareness of stakeholders on gender equality and women?s empowerment (GEEW) will be strengthened and knowledge about lessons learnt and best practices disseminated. The result framework for the project will monitor the GHG emissions mitigated from the pilots which are estimated based on the related contextual sub-indicators on Energy saved (in MJ) and Increase in installed renewable energy capacity per technology (in MW).

The output will be supported by the Technical Working Group. For instance, for identifying sustainable district energy potentials and solution for the IPs / SEZs incl. their urban surrounding UNEP?s District Energy in Cities Initiative will support the assessment, e.g., through rapid-assessments and pre-feasibility studies.

#	Activities
2.1.1.1	Energy audits and rapid assessment for up to 3 IPs / SEZs to identify potential fields of enhancements
2.1.1.2	Feasibility studies for each demonstration project, including technical and financial assessment, as well as socio-economics impacts
2.1.1.3	State of the art energy solutions implemented at selected pilot IPs / SEZs for demonstrating the technical and economic feasibility
2.1.1.4	Conduct before and after energy user questionnaires based on the monitoring methodology
2.1.1.5	Monthly and annual operation reports on the pilot, including pilot performance and net environmental, social and economic benefits compared to baseline, uploaded to the data system
2.1.1.6	Develop and disseminate three (3) case studies incl. lessons learned, social and equity impacts, contributing to an increased understanding of financial viability and (required) de-risking instruments for the application of sustainable energy solutions in IPs / SEZs

Component 3: De-risking scheme for upscaling and replication of sustainable energy solutions in IPs / SEZs

As investment barriers play an important role, this component serves to identify opportunities for de-risking investments in low-emission IP / SEZ activities and develop concepts for an investment friendly strategic framework. Considering the lessons learned under the low-emission IP / SEZ pilot programme in Component 2, the formulation of strategic partnerships with investment partners from the financial sector is foreseen. The project will provide guidance on a financial instrument (i.e., incentive) and a mechanism that would support the development of bankable investment projects.[244][244]

Outcome 3.1: The Government and the financial sector enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IPs / SEZs

Output 3.1.1: Strategy for upscaling of IP / SEZ sustainable energy pilot programme is in place considering gender lens investment principles

Barrier addressed by the output: 3a): Absence of strategies and regulation which incentivizes adoption of sustainable energy solution

Based on the IP / SEZ pilot demonstrations undertaken in Component 2 and the lessons learned with regards to financial viability and de-risking instruments for the acquisition of sustainable energy technologies, this Output will prepare a strategy for the upscaling and roll out to other IPs / SEZ in South Africa. The strategy will cover both, a technology and policy roadmap (building upon results of Output 1.3 for the pre-selected IPs / SEZ). The technology roadmap will outline technology deployment scenarios towards a decarbonisation of industrial activities and IPs / SEZ. This will include the systematic view on parks and their urban surroundings. The policy roadmap will comprise the necessary steps for municipalities and the government to be undertaken from a policy and regulatory point of view in the mid- to long-term perspective (next decade) to provide the required enabling environment, including financial incentives and promotion schemes. This aims to reduce the incremental cost difference between conventional energy supply and alternative sustainable solutions through regulation and financial incentives. The strategy for upscaling the decarbonisation of industrial activities in South Africa will also help the government in reaching and formulating targets in its NDC and long-term strategy towards the Paris Agreement and UNFCCC. The preparation will be supported by the technical Working group and the main recipient are dtic / NCPC-SA and relevant municipalities.

The strategy shall be underlined with a guidance to the government regarding requisite training and support to SMEs and ESCOs. This guidance will provide a proposal on how SMEs and ESCOs can be supported and incentivised to scale up there services contributing to the creation of additional value chains and to localisation efforts. The guidance will involve recommendations and a framework for addressing these important aspects to mobilise the local resourcing. This framework will have a specific focus on gender aspects and support female owned businesses.

The project will support dtic, Department of Forestry, Fisheries and the Environment (DFFE) and the Department of Mineral Resources and Energy (DMRE), in investigating if and how total industrial energy use is covered by mandatory energy efficiency standards or overall performance targets. This will include the recommended procedures for regular and mandatory energy audits at all IPs / SEZs. International benchmarks can be used for this, such as from Europe, China and India that have introduced energy saving targets for industries. In additional, data from the data base (Output 1.3) can

be used to derive and complement such a benchmark setting. This will also cover the introduction and enforcement of energy efficiency policies, such as the application of the ISO 50001 certification for industrial energy management.[245][245]

Main recipients of the output are dtic and corresponding line ministries, including National Treasury and Department of Mineral Resources and Energy (DMRE). [246][246]

#	Activities
3.1.1.1	Develop upscaling strategy (1) of IP / SEZ sustainable energy pilot programme, including a technology roadmap and a policy roadmap as key element of the strategy for implementation until 2030
3.1.1.2	Guidelines report (1) to the government regarding requisite training and support to SMEs and ESCOs to contribute to scaling up and servicing additional value chains and contributing to localisation efforts.
3.1.1.3	Recommendations report (1) on introduction procedures for regular and mandatory energy audits at IP / SEZs

Output 3.1.2: A project pipeline of sustainable energy technology investments in IPs identified

Barrier addressed by the output: 3b): Gap between project ideas and access to adequate finance

The project will identify suitable financial support scheme(s) to support the uptake of respective measures in additional IPs / SEZs (public and private) across the country and list those in a database. A small number (<10) of IPs / SEZs will be supported with the pre-assessment and initial preparation of bankable projects for the introduction of systematic sustainable energy solutions at the park level considering the urban-industrial nexus. Recommendations will be derived based on eligibility and investment criteria of the respective finance scheme / facility, such as the DBSA?s Climate Finance Facility, IDC?s special financing schemes on green energy or funding from the International Finance Corporation. The pipeline projects will cover, as mentioned above, renewable energy supply for electricity and heat, DSM, aspects of 4IR such as smart infrastructure (e.g., grids), etc. Importantly, the project will enable a structured dialogue of project proponents and relevant stakeholders (IP / SEZ managers, tenants, municipalities etc.) with financial sector institutions to identify financing opportunities. The potential for the dtic to offer support through a specific incentive or as part of its IPRP support programme will also be explored and associated recommendations for such a financial incentive or equivalent instrument will be provided.

The following schemes / facilities have been identified as potential support mechanisms for the project's interventions:

AFD Green Energy Fund / SUNREF by IDC
The AFD Green Energy Fund and AFD?s green finance label SUNREF channeled through IDC provides finance to renewable energy and energy efficiency projects of smaller scale and

manufacturing of green products in South Africa. The funds size is approx. ZAR 1 billion and investment cost not higher that 25% of the Facility (ca R250 million per project) can be applied for.

Climate Finance Facility by DBSA
The Climate Finance Facility (CFF) is designed based on the model of a ?Green Bank? and operating within the DBSA. The CFF aims to address the lack of access to finance and lack of innovative funding models, addresses market constraints, playing a catalytic role with a blended finance approach to increase climate related investment in South Africa and Rand-based economies (Swaziland, Namibia, Lesotho). The CFF implements two main instruments: subordinated debt / first-loss and credit enhancements such as tenor extension and other kinds of credit support to projects that are commercially viable but not bankable in the private sector. These instruments will de-risk and increase the bankability of climate investment, and crowd in significant private sector capital. The CFF provides USD 170 million for bankable projects. The CFF focuses on relevant sectors including off-grid projects, micro-grid/urban solar farm projects, industrial and commercial solar for self-generation and wheeling on the grid to MSMEs, industrial and commercial water projects, and residential and commercial energy efficiency investments.

Embedded Generation Investment Programme by DBSA
The GCF-DBSA Embedded Generation Investment Programme (?EGIP?) is supporting the implementation of renewable energy projects with a capacity of 330 MW, which is comprised of 280 MW Solar PV and 50 MW Wind (USD 537 million). The underlying projects are funded through a combination of Senior Debt (48% of the total project cost, US$260 m), Subordinated Debt (22%, US$116 m) and Equity (30%, US$161 m). The total GCF funding contribution to the Programme will be US$100 million. Under Component 1 of the programme DBSA will provide credit support to private sector solar and wind IPPs established as special purpose vehicles (each, a ?Project SPV?) and backed by Non-sovereign Off-takers in order to enhance bankability of such RE projects. DBSA, acting as Executing Entity and lender of record, will use a part of the GCF Loan (as defined in the term sheet) on a concessional basis, together with DBSA?s own Co-financing, on the same terms, in a ratio of 1:1, to finance blended. Component 2 of the programme provides credit support to special purpose vehicles which are established and owned by Local Community Trusts (LCTs) and/or SMMEs (?Shareholder SPVs?).
Main recipients of the output are IPs / SEZs operators and corresponding tenants. Implementing partners are DBSA, potentially IDC as well as potential addition funding opportunities that may arise during the project duration.

#	Activities
3.1.2.1	Facilitate structured dialogue of project proponents and relevant stakeholders with financial sector institutions for identifying financing opportunities
3.1.2.2	Develop 10 IPs / SEZs pipeline projects through technical assistance on suitable financial support scheme(s) at the park level to support the uptake of respective measures in additional IPs / SEZs (public and private) across the country

Output 3.1.3: The capacity of key stakeholders on financing options for sustainable energy investments in IPs / SEZs are strengthened through establishing a virtual marketplace and conferences

Barrier addressed by the output: 3c): Lack of adequate business and operation models for sustainable energy solution at IPs / SEZ

The project will facilitate a matchmarking platform (marketplace) for bringing together IP / SEZ managers, municipalities, and tenants with investors, financial institutions, ESCOs and potential IPPs. The platform will provide information and room for virtual exchange, e.g., through a webpage and webinars. In addition, 3 annual dedicated conferences will be organised for bringing together all interested and relevant stakeholders, in which successfully implemented best practice examples can be presented and new projects ideas can be pitched (with a virtual alternative scenario if required by COVID-19). The output aims to increase the capacity within industrial parks and enterprises to access capital for environmental performance improvement. As government owned IPs / SEZs are limited by the Public Finance Management Act (PFMA)[247][247] to obtain loan or equity funding, access to finance is a challenge. Hence, the project will explore in close consultation with the National Treasury potential solution, such as Public-Private-Partnerships models etc. The regular exchange will increase awareness of financial institutions of investment opportunities on the one side and help IP / SEZ managers and industrial / commercial enterprises to grasp the potential financial, economic and climate change mitigation and environment benefits of sustainable energy enhancement within the parks and communities, on the other side.

Main recipients of the output are IPs / SEZs operators and corresponding tenants as well as financial institution providing funding opportunities for sustainable energy solutions at industrial zones.

#	Activities
3.1.3.1	Develop an online matchmarking platform (marketplace) for bringing together key stakeholders
3.1.3.2	Organize and conduct three annual dedicated conferences for bringing together all interested and relevant stakeholders
3.1.3.3	Technical assistance to link the pipeline projects with financial support mechanism

Component 4: Monitoring and evaluation

Component 4 will focus on the effective monitoring and evaluation (M&E) of the project during implementation and after completion. The result framework for the project and its monitoring will include the GHG emissions mitigated, energy saved and installed renewable energy capacity per technology as well as policy and regulatory documents. PMU will routinely monitor implementation of the gender mainstreaming action plan and environmental and social management plan. PMU will provide data and input to to PIR reports. UNIDO will be responsible to submit the final version of the PIRs to the GEF.

All monitoring and evaluation tools and documents, such as the monitoring plan, progress reports, final evaluation report, and thematic evaluations (e.g., training needs assessment), will include gender dimensions, and report with respect to an established baseline for gender related targets. When data collection or assessments are conducted, gender dimensions will be considered. This will include in particular collection of sex-disaggregated data.

NCPC-SA (Project Executing Entity) will undergo financial audits as part of annual CSIR/NCPC-SA audit according to their internal rules and regulations. The cost of the audits is considered to be in-kind contribution of NCPC-SA. The financial audit report will be submitted to UNIDO annually.

Outcome 4.1: The project?s achievements and impact effectively monitored and evaluated

Output 4.1.1: Mid-term review

At the mid-point of the project (i.e., year 2), UNIDO will conduct an independent mid-term review to identify the achievements to date, make recommendations as needed to revisions of the project, and identify lessons learned to be disseminated within UNIDO as per UNIDO and GEF guidelines. The MTR will include stakeholder interviews and site visits including IPs. The PMU will be responsible for collecting and providing the required quantitative and qualitative data including mobilized co-financing required for the MTR.

Output 4.1.2: Terminal evaluation

UNIDO will facilitate a final evaluation by independent evaluators within 4 months of project closure to verify achievements to date, make any final suggestions for the closing period of the project, and identify lessons learned as per UNIDO and GEF guidelines.

See M&E Section for further details.

4) Alignment with GEF focal area and/or Impact Program strategies

The proposed project is aligned with Objective 1 of the GEF?s Climate Change Focal Area on ?Innovation and technology transfer for sustainable energy breakthroughs?:

- ? CCM-1-1: Promote innovation and technology transfer for sustainable energy breakthroughs for decentralized power with energy usage (i.e., through promotion of renewable energies deployment in IPs / SEZs etc.)

- ? CCM-1-3: Promote innovation and technology transfer for sustainable energy breakthroughs for accelerating energy efficiency adoption (i.e., through promotion of energy management (DSM) at IP / SEZ level etc.)

- ? CCM-1-4: Promote innovation and technology transfer for sustainable energy breakthroughs for cleantech innovation (i.e., through promotion of innovative energy solutions, such as digitalisation of manufacturing processes, green hydrogen, green steel etc.)

In addition, through the urban-industrial-energy nexus approach the project potentially contribute through mobilising additional co-finance resources to the GEF-7 Sustainable Cities Impact Program through urban-related GHG emissions avoidance. This is achieved though activities being related to the following focal area sub-targets:

- ? CCM-1-2: Promote innovation and technology transfer for sustainable energy breakthroughs for electric drive technologies and electric mobility (i.e., through promotion of e-mobility using renewable energies and / or green hydrogen in IPs / SEZs etc.)

- ? CCM-2-5: Demonstrate mitigation options with systemic impacts for sustainable cities impact program (i.e., through addressing the urban-industrial-energy nexus).

5) Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing

Incremental elements of the project are related to the upscale of activities at IP / SEZ level. The demonstration project will cover only incremental costs associated to required feasibility studies and project preparation. The envisaged project are going to have potential higher upfront costs compared to less efficient or conventional energy solutions, e.g., RE supply vs. electricity supply from the grid. In addition, services that are currently not available will be supported by the project so the executing entity can offer them to IPs / SEZ and their tenants, such as energy audits and the matchmarking of ESCOs and IPs / SEZs. The cost per tonne reduction for GHG mitigated has been calculated at 8.4 USD (based on total direct emissions only).

The project will build on activities and programmes of NCPC-SA, dtic, UNIDO and other actors (see baseline section) and extend the scope and raise the ambitions of these activities towards sustainable energy solutions for IPs/SEZs. This shall in particular be achieved through upscaling demonstrations at specific IPs/SEZs to all IPs/SEZs in the country. Compared to ongoing projects and programmes, the proposed project will include the urban surroundings beside the IPs/SEZs in its scope and boundary, i.e., apply an urban-industrial-energy nexus. In other words, the activities go beyond the boundary of the IPs/SEZs themselves. In addition, the project tries to promote the localisation of energy production and utilisation as well as local supply chains and services.

The additionalities of the project are further summarised in the table below:

Table 7: Incrementality of the project

Components	**Business as usual**	**Incremental cost reasoning**	**Main out**comes expected

1. Fostering the coordination towards sustainable energy transformation of IPs / SEZs by creating a conducive enabling environment	Missing coordination between national, provincial, and municipal level and horizontal coordination across ministries / departments leads to insufficient integration of sustainable energy strategies, policies and regulation for IPs / SEZs at government level. Municipal planning (on energy aspects and related infrastructure) is disconnected from IPs / SEZs and neighbouring communities. Responsible institutions, e.g., municipalities and IP / SEZ management as well as parks tenants have limited awareness of potential energy solutions. On IP / SEZ level, limited coordination efforts amongst IP / SEZ management and tenant companies regarding the IP?s / SEZ?s energy strategy lead to unsustainable energy supply and demand.	The coordinative capacities for sustainable energy solutions are strengthened at 6 IP / SEZ municipality management levels through coordination plans. For municipal and IP / SEZ level planning analysis of typical energy profiles are made available to IPs / SEZs, industrial establishments, the government and municipalities supported by introduced energy audits. IP / SEZ management and tenant companies are provided with guidance on establishing IP / SEZ energy strategies at local sites. Key stakeholders are aware and trained on sustainable energy aspects at IPs / SEZs	Policy and regulatory environment, especially with regard to energy generation and consumption in IP / SEZ, is enhanced
2. Demonstration of low-carbon and sustainable energy solutions through IP / SEZ pilots	National experiences and understanding of sustainable energy technology and solutions will remain stagnant in immediate term. Limited priority of sustainable energy aspects in IPs / SEZs on management and tenant level will continue. Energy supply will continue to rely on fossil fuels. There are still insufficient baseline and energy data (energy profiles of tenants and IPs / SEZs)	Project will demonstrate application of sustainable energy solution fort IPs / SEZs. Lessons learned from the sustainable energy pilot demonstration activity in the urban-industrial-energy nexus are derived. Knowledge about best practice examples for low-carbon IP activities in South Africa and globally are disseminated amongst IP managers through a Community of Practice.	Benefits and application of innovative, sustainable energy solutions are understood and considered in decision making and planning of energy system. IP / SEZ managements and manufacturing businesses gain confidence and sufficient evidence of the technical, economic, social and environmental viability of sustainable energy solutions for industrial production in the urban-industrial-energy nexus

3. De-risking scheme for upscaling and replication of sustainable energy solutions in IPs / SEZs	Perceived investment risks for sustainable energy solutions by IP / SEZ management / tenant companies will persist. Lack of service providers and business models for ESCOs and IPPs still exist. Challenging technical aspects of energy supply are not addressed with innovation and sustainable solution.	Strategy for upscaling of IP / SEZ sustainable energy pilot programme is in place. A project pipeline for investment replicating the IP / SEZ sustainable energy pilot approaches is identified. The understanding of key stakeholders on financing options for sustainable energy activities in IP / SEZ are strengthened through establishing a marketplace.	The Government and the financial sector enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IP / SEZ
4. Monitoring and evaluation	Lessons from implementation are not captured and project risks not meeting its objectives	Effective monitoring and evaluation of project is completed	Project achieves objectives with lessons learned for improving future projects

Co-financing was identified and confirmed through project/barrier assessments and discussions with ministries and implementing partner. The following co-finance source for mobilising investment have been confirmed:

●

●Loans by the DBSA through its finance facilities under the Green Climate Fund (GCF)

●

●FP098[249][248]: DBSA?s Climate Finance Facility (supporting infrastructure projects that mitigate or adapt to climate change (USD 170 million for bankable projects in South Africa and Rand-based economies ? Swaziland, Namibia, Lesotho). The Climate Finance Facility (CFF) is designed based on the model of a ?Green Bank? and operating within the DBSA. The CFF aims to address the lack of access to finance and lack of innovative funding models, addresses market constraints, playing a catalytic role with a blended finance approach to increase climate related investment. The CFF implements two main instruments: subordinated debt / first-loss and credit enhancements such as tenor

extension and other kinds of credit support to projects that are commercially viable but not bankable in the private sector.

- o FP106[250][249]: The GCF-DBSA Embedded Generation Investment Programme (?EGIP?) will support the implementation of renewable energy projects with a capacity of 330 MW, which is comprised of 280 MW Solar PV and 50 MW Wind (USD 537 million). The underlying projects are funded through a combination of Senior Debt (48% of the total project cost, US$260 m), Subordinated Debt (22%, US$116 m) and Equity (30%, US$161 m).

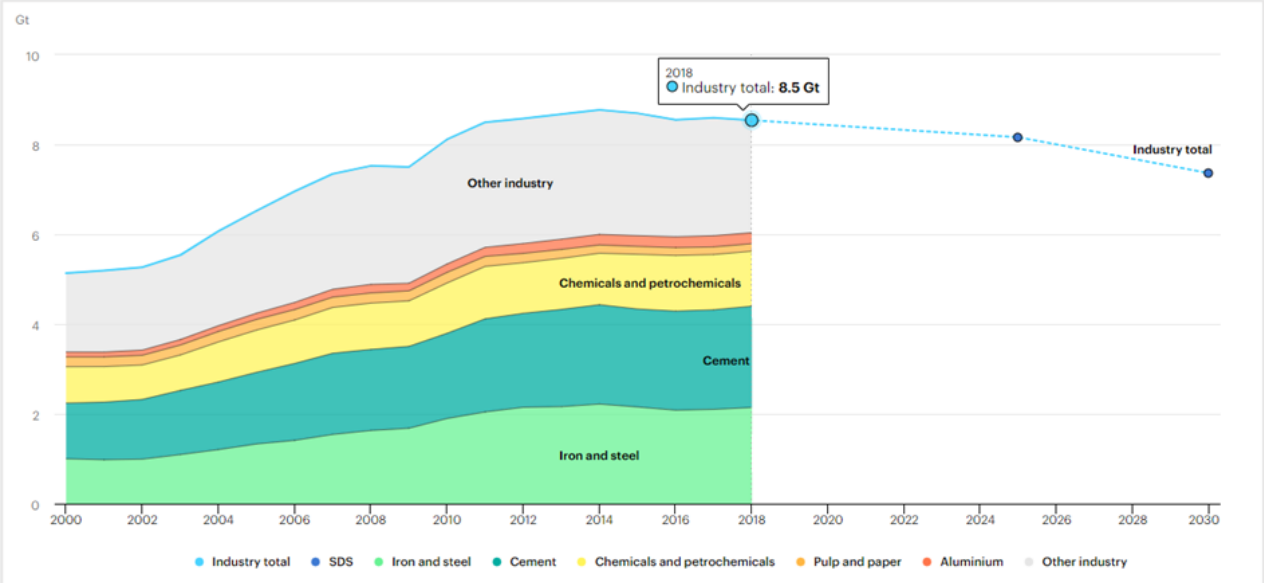
In addition, NCPC-SA as Executing Agency will provide in-kind contribution worth USD 900,000 and a co-financing contribution in form of grants amounting to US$ 300,000 over the period of the project. Co-finance will be provided in-kind by the dtic, and UNIDO.

The project will seek during the project implementation co-financing from IDC?s AFD Green Energy Fund that provides finance to renewable energy and energy efficiency projects of smaller scale and manufacturing of green products in South Africa. The funds size is approx. ZAR 1 billion and investment cost not higher that 25% of the Facility (ca R250 million per project) [248][250] can be applied for.

6) Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)

According to a report from the International Energy Agency (IEA), direct industrial CO2 emissions declined in 2018 by 0.6% to 8.5 GtCO2, following relatively flat emissions levels in the years before.[251][251] Although this appears to be a promising development, there has been an ongoing long-term trend of rising production in energy-intensive industry subsectors (i.e. chemicals, iron and steel, cement, pulp and paper and aluminum), especially in India and the ASEAN countries, and the industry sector?s energy mix has remained relatively unchanged for the past decade.[252][252] The fossil fuel share of the energy mix decreased from 73% to 69%, while electricity rose only from 18% to 21%. With the energy sector still accounting for around a quarter of global CO2 emissions and much untapped potential of decarbonization, innovative low-carbon solutions should be supported in the upcoming years. Following the Sustainable Development Scenario (SDS) designed by the IEA, industry emissions must fall by 1.2% annually to 7.4 GtCO2 by 2030.[253][253]

Figure 26: Industry direct CO2 emissions in the Sustainable Development Scenario (SDS), 2000-2030



Source: IEA 2020a

The project will contribute to the transition within the industry sector towards a low-carbon development. Given the lack of available data on energy supply and demand in industrial parks, exact calculations cannot be undertaken at this stage, but will be part of the feasibility study of Output 2.1. What can be assumed is certainly a significant potential for energy efficiency and renewable energy supply, and hence a significant decline of fossil fuel-based electricity generation in the country in the longer term. In South Africa the production of electricity is mainly based on domestic coal generated in coal fired power plants of Eskom as the leading utility. The grid emission factor in the national grid currently amounts to approx. 0.950 tCO2/MWh[254][254]. Hence, with every MWh saved due to energy efficiency gains or replacement with clean renewable energy sources 0.950 tCO2 could be reduced. For instance, at an IP / SEZ renewable energy can be generated through solar PV with an installed capacity of 1 MWp and supply the tenants with clean power of 1,460 to 2,045 MWh/a (depending on the region and solar Irradiation) up to 1,400 - 2,000 tonnes of CO2 emission can be reduced[255][255].

At the pilot activities a potential emission reduction of at least 275,000 tCO2eq for the duration of the project (i.e., 4 years) is estimated (assuming 3 pilot IPs / SEZs equivalent to the size and GHG emission balance of the ELIDZ). See Textbox under Output 2.1). There is a strong potential for an indirect uptake at additional 10 IPs / SEZs through the Outputs under Component 3 (e.g., scaling up strategy and policies). In the long-term it is assumed that this number can gradually increase to 20 due to the spill-over effect and continuing policies and accelerating climate action (e.g., funds available through GCF). Thus, the indirect GHG emission potential is calculated as 5,100,000 tCO2eq.

The result framework for the project includes the GEF Core Indicator 6 Greenhouse gas emissions mitigated (metric tons of carbon dioxide equivalent) and the related contextual sub-indicators on increase in installed renewable energy capacity per technology (GEF Core Indicator 6.4. - in MW).

Please see GHG calculation sheet annex for further details.

7) Innovativeness, sustainability, and potential for scaling up

Innovation: Sustainable and systematic energy service solutions for industry parks are rarely implemented in South Africa. In particular comprehensive planning and cooperation at IP / SEZ level is an innovative aspect for addressing the energy management and supply challenges in the future. In addition, the project will promote new and innovative technologies for adoption at IP / SEZ levels, such as: 1) Decentralized renewable energy power generation, usage and storage, 2) Enhanced and accelerated energy efficiency adoption through DSM and digitalisation, 3) Cleantech innovation (e.g., green hydrogen), and 4) Systemic impacts for sustainable cities.

Sustainability: The sustainability of the coordination after the project will be guaranteed by the NCPC-SA and the dtic. As described under Component 2 and 3, the NCPC-SA will work with dtic and the private sector (IPs / SEZs and tenants) to integrate energy into investment planning with the ultimate goal of ensuring a sustained support to sustainable technologies even after the completion of the GEF-7 project and until the market is able to advance without any further support.

Potential for scaling up: The policy, coordination, regulatory work and replicability will be achieved under Component 1 and Component 2, leading to scaling up potential by setting-up the national and sub-national coordination structures and rules that allow a market to operate at scale. The support under Component 3 to de-risk investments will encourage and enable local authorities and private sector IPs / SEZs and tenants to undertake the development stages of sustainable energy solutions at IP / SEZ levels. This will help unlocking investments on sustainable energy projects across the country.

The project will be an important contribution to the transformation of industrial spaces through its interventions at park level and factory level whereas the factory level is likely to focus on interventions such as energy management systems, energy systems optimization and similar. The project will translate the outcomes from both park and factory levels, such that they can be generalized to a certain extent to other IPs to support scale-up. The outcomes, such as lessons learnt will be crucial inputs for replication and scale-up.

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[36] Otherwise, solutions for sustainable energy cannot be harnessed effectively; this includes identifying energy saving potentials and systematic energy approaches (including demand side management, and decentralised energy sources, waste-heat recovery, local renewable energy deployment, potential coupling between tenant sites and the neighbouring communities etc).

[37] In general, renewable energy and energy efficiency measures come with higher upfront costs and have a rather long-term economic viability. Financial support to cover the upfront cost at IPs / SEZs are currently not sufficiently available. In addition, many tenants and IP / SEZ managements are not aware to the overall economics of the investment and perceive an investment risk.

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[219] http://www.thedtic.gov.za/wp-content/uploads/Policy_SEZ.pdf

[220] 27 Industrial Parks are part of the programme, funding for the first 10 Industrial parks in Phase 1 was approved in 2020.

[221] UNIDO (2020): Promoting Low Emission Industrial Parks through Low Carbon Infrastructure and Practices in South Africa. Concept Note for GEF Trust Fund

[222] NCPC, dtic and UNIDO (2019). Eco-Industrial Park (EIP) Baseline Assessment Report for South Africa.

[223] Compare also TIPS (2017): Making the Industrial Parks Revitalisation Programme work for employment and firm growth. Available from https://www.tips.org.za/policy-briefs/item/3285-making-the-industrial-parks-revitalisation-programme-work-for-employment-and-firm-growth

[224] Compare https://climate-laws.org/geographies/south-africa/policies/national-climate-change-response-policy-white-paper-nccrp

[225] See also: https://www.greencape.co.za/content/first-industry-working-group-hosted-for-south-african-renewable-energy-masterplan/

[226] See http://ncpc.co.za/about-ncpc

[227] See http://ncpc.co.za/energy-efficiency/2015-06-23-11-53-02

[228] See https://csp.treasury.gov.za/csp/Pages/project.aspx?itemID=34

[229] https://www.dbsa.org/case-studies/small-ipp-programme

[230] https://www.idc.co.za/afd-green-energy-fund

[231] https://www.gov.za/sites/default/files/gcis_document/202010/south-african-economic-reconstruction-and-recovery-plan.pdf

[232] Incl. municipalities, IPs / SEZ operators, industrial establishments and energy service providers

[233] This addresses the country?s energy space, its long-term strategy and also implementation of energy interventions.

[234] Criteria for the selection of demonstration IP/SEZ within the framework of the project ?Sustainable energy systems for urban-industrial development in South Africa?: 1) General GEF related factors and criteria: Mitigation Impact, Potential of replicability; Political viability, Potential for sensitization of stakeholders; Financial viability; Alignment with Project narrativity; Incrementality of GEF funds; Gender, Financing; Ministry/National priority

2) Specific IP / SEZ selection criteria: Willingness and interest; Involvement in previous activities related to EIP; Gender criteria; Energy profile, relevance and typical loads and associated mitigation impact; Availability of financially viable alternative energy sources; Presence of a management entity that is active and open to the project, incl. a good owners / tenant relationship

[235] Feasibility study on the use of renewable energy sources as an alternative revenue generation option for the Atlantis Special Economic Zone already prepared by CSIR

[236] Country specific for South Africa, if data are sufficiently available. In addition, international data may be used.

[237] For instance, the CSIR?s is undertaking an energy baseline study in the Atlantis SEZ in 2022. In 2021, the CSIR conducted a feasibility study (FS) on the use of renewable energy sources as an alternative revenue generation option for the Atlantis SEZ. The study contains park-level load profiles. The FS conducted by CSIR also contained information on the renewable energy potential at the local site / region:

- Under the model assumptions, rooftop solar PV is deployed to the maximum allowable capacity of 19.6 MW in the base case, and 39.2 MW in the solar-ready building design case.

- The addition of 3 MW of wind, through either 1-2 large scale turbines, or several smaller turbines is economically viable, resulting in a further decrease in the reliance on the grid compared to the use of solar PV only.

- The economic viability of biogas is highly dependent on the feedstock costs. If the feedstock can be sourced at minimal costs, then biogas is deployed up to the 5 MW constraint in the case of limited solar PV and wind deployment.

[238] Under preparation by dtic, expected for mid-2022

[239] Selection of pilot general GEF criteria and Specific IP / SEZ selection criteria prepared by NCPC-SA and dtic during the PPG phase.

[240] Including solar PV and Concentrated Solar Power (CSP), Solar thermal, geothermal energy, wind, tidal / wave etc.

[241] https://www.elidz.co.za

[242] Retrieved from (February 2021): http://www.safiri.co.za/ec/east_london_idz_(elidz)_in_east_london.html

[243] Chemonics International for USAID/South Africa (2017). Greenhouse Gas Emissions Inventory for the East London Industrial Development Zone. For the USAID South Africa Low Emissions Development Program.

[244] More detailed information on how this will be executed will be included in the agreement with the PEE to be developed during the PPG phase.

[245] Building on previous initiatives, such as the Industrial Energy Efficiency (IEE) Project supported by UNIDO.

[246] The project will develop and submit evidence-based inputs (in the format of roadmaps, recommendation, etc.) for relevant national policy-making bodies (e.g., dtic and corresponding line ministries, including DMRE and similar.) to support them towards drafting policies and/or formulate future projects, rather than developing full-fledge policies. The implementation of these policies are subject to government?s adoption.

[247] https://www.gov.za/documents/public-finance-management-act

[248] Approx. USD 68 million (in 2022)

[249] https://www.greenclimate.fund/project/fp098

[250] https://www.greenclimate.fund/project/fp106

[251] IEA 2020a

[252] Ibid.

[253] Ibid.

[254] IGES List of Grid Emission Factors, "Combined Margin EF (Average), IGES sheet "Grid Summary", January 2019 (Data basis 2017)

[255] Most areas in South Africa average more than 2,500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5 kWh/m2 in one day, equivalent to 4.0 to 5.6 kWh/kWp daily or 1,460 ? 2,045 kWh/kWp yearly. See: https://globalsolaratlas.info/download/south-africa

1b. Project Map and Coordinates

Please provide geo-referenced information and map where the project interventions will take place.

Name of Pre-selected IP / SEZ	Coordinates
Atlantis Special Economic Zone	-33.59432, 18.47250
Coega Special Economic Zone	-33.79603, 25.6679
East London Industrial Development Zone (ELIDZ)	-33.04845, 27.85346
Ekandustria	-25.69627, 28.7023
Phuthaditjhaba Industrial Park	-28.52763, 28.8965
Umbogintwini Industrial Complex	-30.01657, 30.90392

1c. Child Project?

If this is a child project under a program, describe how the components contribute to the overall program impact.

n/a

2. Stakeholders

Select the stakeholders that have participated in consultations during the project identification phase:

Civil Society Organizations Yes

Indigenous Peoples and Local Communities

Private Sector Entities Yes

If none of the above, please explain why:

Please refer to the report: ?Summary of stakeholder consultation meetings and validation workshop?,

contained in Stakeholder Engagement Plan for information on the engagement of stakeholders during

the development of the CEO Endorsement document.

The project stakeholder engagement activities will be robust, and disclosure of information will be made to promote better awareness and understanding of its strategies, policies and operations. During disclosure, the project will: (1) identify people or communities that are or could be affected by the project as well as other interested parties; (2) ensure that such stakeholders are appropriately engaged on environmental and social issues that could potentially affect them, through a process of information disclosure and meaningful consultation; and (3) maintain a constructive relationship with stakeholders on an on-going basis through meaningful engagement during project implementation. The stakeholder consultations will be an on-going process taking place during the project life and will ensure that stakeholders are informed about environmental and social consequences of the project implementation and ensure the opportunity for feedback.

Identification of stakeholders for engagement and methods of communication

To ensure inclusive participation and consultation, the following stakeholders have been identified for consultation. The list includes the identified social groups that are associated with the project in different ways: those directly or indirectly engaged in the outcomes of project implementation; those directly or indirectly participating in the project, and those with a capacity to influence and decide on project implementation and outcomes.

During its planning stage, the project has organised an inception workshop in January 2022 with approximately 30 participants form different institutions. Numerous interviews with relevant stakeholders identified have taken place during the PPG in order to identify their concerns and priorities and to integrate their know-how. As a result, the project is taking appropriate responsive measures throughout its lifespan to consolidate and maintain the wide current support built up during

the planning stage. The existing activities already undertaken or envisaged by key stakeholders are identified in the table below. Based on this information, their potential contributions to the project components are also identified.

Table 8: Project Stakeholders

Stakeholder main group	Stakeholder name / Agency	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government and National Agencies	Department of Trade, Industry and Competition of South Africa (dtic)	dtic is responsible for the SEZs and the IPRP and is coordinating various processes with relevance for industrial parks.	The leading national counterpart will be the dtic. It is responsible for co-ordination with ministries and national agencies in executing the project activities. dtic will be part of the project steering committee and the project management unit.
	Department of Environment, Forestry and Fisheries of South Africa (DEFF)	DEFF is inter alia responsible for regulations, administration and protection of the environment.	DEFF will be a partner in the execution of the project and will assist the project especially for policies targeting environmental management of industrial parks/zones under Component 1-3
	Department of Mineral Resources and Energy (DMRE)	DMRE is responsible to regulate and transform the sector for the provision of secure, sustainable and affordable energy and the promotion and regulation of minerals and mining. Power generation-related matters fall within the ambit of the DMRE.	DMRE will support the project with respective regulatory and coordinative issues concerning energy under Component 2 and 3.
	Industrial Development Corporation of South Africa Limited (IDC)	National development finance institution to promote economic growth and industrial development under the supervision of the dtic.	IDC provides financing instruments such as loans, debt and guarantees to IPs / SEZs and tenants. IDC can potentially support Component 2 and 3.

Stakeholder main group	Stakeholder name / Agency	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
	Development Bank of Southern Africa (DBSA)	Development Bank of Southern Africa is a development finance institution wholly owned by the Government of South Africa that seeks to "accelerate sustainable socio-economic development and improve the quality of life of the people in SADC. It is a GCF accredited entity.	Co-financier of the project and member of financial working group. Supporting Component 2 and 3.
	National Treasury (NT)	The National Treasury is experienced in funding urban development activities, including in 8 municipalities through its City Support Programme. NT is conducting baseline surveys in selected parks.	The National Treasury will consult the project regarding (domestic) public and private sector funding opportunities and technical support in identifying, approaching and working with municipalities and IPs / SEZs. Also, NT will support baseline data collection during the initial project phase. Component 1-3.
	Department of Cooperative Governance and the Department of Traditional Affairs (COGTA)	Responsible for the relationship between the national government and the provincial governments and municipalities, and for overseeing the traditional leadership of South Africa's indigenous communities.	Will be involved and consulted in cooperation with SALGA and SACN to facilitate access to municipalities and support the information dissemination
Implementing Agency	UNIDO	With South Africa being one of UNIDO?s priority partner countries, UNIDO has in-depth experience of five national environmental and infrastructure priority areas of: Energy, 4IR technologies (digitalization, industrial communication, and IoT) and sustainable commercial transport. With respect to industrial parks, UNIDO serves as implementing agency for the GEIPP.	UNIDO will serve as the GEF Implementing Agency for the project, through its Department of Energy in Vienna, supported by the UNIDO Regional Office in South Africa. Component 1-4.

Stakeholder main group	Stakeholder name / Agency	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Project Executing Entity (PEE)	National Cleaner Production Centre of South Africa (NCPC-SA)	NCPC-SA is an experienced actor particularly in the field of energy efficiency, renewable energy, electric vehicle infrastructure and technology gap assessments, and already serves as executing entity of the GEIPP. NCPC-SA has engaged with UNIDO before and has experience with the GEF.	NCPC-SA will serve as execution entity of the project, forming the project management unit jointly with dtic. It will furthermore be part of the project steering committee. Component 1-4.
Beneficiaries / Local private sectors	Municipalities of pilot industrial parks, including: 1. Cape Town Municipality 2. Nelson Mandela Bay Metropolitan Municipality 3. Buffalo City Metropolitan Municipality 4. Tshwane Metropolitan Municipality 5. Maluti-a-Phofung Local Municipality 6. eThekwini Metropolitan Municipality	Municipalities are key stakeholders for various aspects of planning and implementation of industrial parks	Municipalities will actively participate in the execution, especially in project capacity building and awareness raising, demonstration projects, and planning and regulatory aspects. They will be included as members of technical working groups and contribute to Components 1 to 3.

Stakeholder main group	Stakeholder name / Agency	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
	Park management and selected tenant companies of the selected pilot industrial parks: 1. Atlantis SEZ 2. Coega Special Economic Zone 3. East London Industrial Development Zone (ELIDZ) 4. Ekundustria 5. Phuthaditjahaba Industrial Park 6. Umbogintwini	Park managers and tenant companies possess knowledge on opportunities and challenges of fostering sustainable energy solutions for industrial parks	Park managers and selected tenant companies will actively participate in the project execution, especially in project capacity building and awareness raising, demonstration projects, and standards and data management. They will be included as members of technical working groups and contribute to Components 1 to 3.
Financial Sector	Development Finance Institutions (DFIs)	DFIs understand the opportunities and challenges of de-risking infrastructure and development project activities. Potential partners comprise the Development Bank of Southern Africa (DBSA), the Industrial Development Corporation (IDC), the International Finance Corporation (IFC), Private Financing Advisory Network (PFAN), Kreditanstalt f?r Wiederaufbau (KFW), AFD?s Sustainable Use of Natural Resources and Energy Finance (SUNREF)	DFIs will support the project in finance the pilot demonstrations and in setting up the financial investment environment (see Component 3), e.g., as members of financial working groups. They will contribute to Components 2 and 3.
	Commercial banks	Commercial banks are the experts in financing the operation of their clients, including from the industry sector.	Commercial banks can be supportive in setting up the financial investment environment with their practical experience for financing industrial and manufacturing activities and contribute mainly to Component 3.

Stakeholder main group	Stakeholder name / Agency	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Provincial Governments	Provincial Governments / entities	Provincial Governments are relevant for various aspects of planning and implementation of industrial parks	Provincial Governments will be consulted during project preparation and execution. They will be included as members of technical working groups and support Component 1 to 3.
	South African Local Government Association (SALGA)	SALGA is active as local government association, hosting an urban energy support network[1] which is a forum on energy and environment (co-hosted by Sustainable Energy Africa & South African City Network). SALGA is reporting to the Department COGTA.	SALGA will facilitate access to municipalities and IP / SEZ managements and support the information dissemination through their network. Component 1 to 3.
	South African Cities Network (SACN)	SACN facilitates knowledge and information exchange, experiences and best practices on urban development and city management amongst members. Secretariat to oversee governance, administration, and programme functions. SACN is reporting to the Department COGTA.	SACN will be consulted for the coordination between municipalities and IP / SEZ managements and will be engaged to support the information dissemination through their network. Component 1 to 3.
Implementing Partners / Local Academia and Research institutions	Sector experts	Sector efforts possess in-depth sector knowledge from research and capacity development in industrial processes. Sector experts include for instance GreenCape, TIPS, CSIR, SANEDI, SAREBI, UNEP District Energy Initiative, etc	Under the project sector experts can consult the project with sector expertise, e.g. as members of technical working groups for Component 1 to 3.
	Development Cooperation	Development partner institutions conduct numerous activities that target greening the South African economy and industry. Institutions comprise for instance GIZ or SECO, among others.	Development partner organizations will help to coordinate with and access information from related activities, in order to provide technical know-how and best practice experience, e.g., as members of technical working groups. Component 1 to 3.

[1] https://www.cityenergy.org.za

Please provide the Stakeholder Engagement Plan or equivalent assessment.

Please find attached the Stakeholder Engagement Plan

The Stakeholder Engagement Plan (SEP) is designed to ensure effective engagement of all relevant stakeholders throughout the project lifecycle in South Africa. This plan builds upon the interviews and workshops conducted during project preparation. The project will aim at maintaining fluid and two-way dialogue with the relevant national government institutions and agencies, the private sector, and civil society for national activities, as well as with local and international NGOs, the international community, and other stakeholders.

In addition, provide a summary on how stakeholders will be consulted in project execution, the means and timing of engagement, how information will be disseminated, and an explanation of any resource requirements throughout the project/program cycle to ensure proper and meaningful stakeholder engagement

The project team conducted inception workshop, validation workshop and several bi-lateral meetings with national stakeholders including, dtic, line ministries, NCPC-SA, CSIR, SALGA as well as target Industrial Parks managements. Please find attached the Stakeholder Engagement Plan for further details.

Select what role civil society will play in the project:

Consulted only; Yes

Member of Advisory Body; Contractor;

Co-financier;

Member of project steering committee or equivalent decision-making body;

Executor or co-executor;

Other (Please explain)

3. Gender Equality and Women's Empowerment

Provide the gender analysis or equivalent socio-economic assesment.

Please find attached the "Gender Analysis and Action Plan" for detailed description of project?s interventions related to gender equality and women empowerment.

The project considers gender dimensions in all of its activities to enhance the gender mainstreaming, inclusiveness and sustainability of the project intervention. Accordingly, the project logical framework incorporated, wherever possible, the gender dimensions with specific indicators and target in line with UNIDO and GEF Gender Policies and Strategies.

UNIDO recognizes that gender mainstreaming is a key strategy for achieving gender equality and the empowerment of women (GEEW) which are crucial for achieving a significant positive impact on sustained economic growth and inclusive industrial development, which are key drivers of poverty alleviation and social progress. The project aims to demonstrate good practices in mainstreaming gender aspects through its activities, wherever possible, and avoid negative impacts on people, due to their gender. Consequently, gender dimensions will be considered throughout the whole project cycle. Guiding principle of the project will be to ensure that both women and men are provided equal opportunities to lead, participate in and benefit from the project. Therefore, the outcomes, outputs and activities will be designed to meet the different needs and priorities of women and men.

Women and girls face many challenges that hinder them to equally lead, contribute to and benefit from the energy transition. These include limited access to finance, lack of secure land title and time poverty, caused by unbalanced distribution of care work. For instance, globally, women only receive about 2% of venture capital?in the sustainable energy sector, this is even lower. Social and legal restrictions often limit their rights to own land, borrow money and make their own economic decisions. Barriers such as a lack of access to credit and training, a lack of digital literacy, as well as pervasive cultural and gender norms prevent women from entering and sustaining studies in STEM fields, thus limiting the possibilities for women to develop and use energy-based technologies. The gender disparity is replicated in terms of **access to trainings and skills** development, contributing to a correspondingly low percentage of women employed as professionals who then face a lack of support and enabling environment for advancing in these sectors.

Gender perspectives are often overlooked in the energy sector in general, and in energy policies in particular. Women?s different and specific needs, experiences and knowledge are not yet well-represented in energy planning and policymaking?leading to energy policies that exacerbate existing inequalities. Underlying all key policy actions is a need for the generation, collection, and use of gender statistics, including gender-disaggregated quantitative and qualitative data, that reflect all aspects of energy production, consumption and development impacts.

There is a growing recognition of the role of women within the energy workforce ? from representation in leadership and boards, to technical training and mentoring (IRENA 2019). There is strong evidence linking gender-diverse boardrooms with better company performance and the promotion of innovation and development. Women- led businesses have been found to be more efficient and achieve higher growth in profits. In light of this, the dialogue on gender and energy is shifting from women being identified as part of vulnerable groups to acknowledging the power they hold as key agents of change: as consumers, producers, distributors, and decision makers across the energy value chain (ESMAP, Global Alliance).

Nevertheless, research demonstrates that, to date, the gender gap in the energy sector remains as wide as ever. While the participation of women can vary significantly by energy subsector, it remains well below the economy-wide proportion of 48 percent globally, with 22%in oil and gas and 32% in renewables (IEA, 2020). The gap is even more pronounces at boardroom levels, where women usually make up for less than 20%. Moreover, it was found that, on average, electricity and gas companies show a gender pay gap of 15.2%, meaning that women make an average 84.8 pence for every pound earned by their male counterparts.[1]

Post-apartheid, the South African government has made significant shifts through social policy to abolish discriminatory practices in women ownership of businesses and participation in the labour force. Even though women represent over half of the population the likelihood of black women owning businesses is slim. In general, black women are employed within sectors classified as ?care work? for example domestic work, public service professions and retail.

The dtic programmes that aim at redistributing economic power by the inclusion of black-owned small businesses into supply chains of established companies are not always successful in consistently focusing on women inclusion. Moreover, the industrial policy does not cater for strategies within sectors or industries where women can dominate. Through the Industrial Development Corporation (IDC), the dtic provides initiatives that target women-owned businesses with small funding allocations. However, for women-owned businesses access to finance is an ongoing restraint. [2]

The low-carbon economy provides many opportunities to reduce gender inequalities and increase women?s economic participation. Promoting women participation early in the project development phase is therefore essential. Ensuring capacity building and skills transfer is important for women?s inclusion in technical and management roles. Providing opportunities for new businesses and economic activities will create a platform for increased participation of women.

In practical terms, the project will address, among others, following actions:

1) During the inception phase of the project, the gender analysis and action plan will be updated and validated at the inception meeting. The Action Plan will inform the project annual work plan to promote women's engagement in the project execution and be adhered throughout the project execution and considered for regular monitoring of the progress.

2) Efforts will be made to promote participation of women and men in capacity building and awareness raising activities, at community, managerial and technical levels, as participants and trainers. Given that some of the trainings to be provided by this project will be of a technical nature, if necessary, the project will also provide bridging training courses so that women who may not have a technical background will have an intermediary training.

3) Gender-sensitive recruitment will be practiced at all levels where possible, especially in selection of project staff. Gender responsive TORs will be used to mainstream gender in the activities and tasks of consultants and experts. In cases where the project does not have direct influence, gender sensitive recruitment will be encouraged. In cases where the project is not expected to affect women and men differently, gender-sensitive recruitment will still be encouraged to ensure diversity in team

composition. Furthermore, whenever possible existing staff will be trained, and their awareness raised regarding gender issues.

4) All decision-making processes will consider gender dimensions. At project management level, Project Steering Committee meetings will invite observers to ensure that gender dimensions are represented, while also the gender balanced composition in project committee will be emphasized. For this purpose, women?s groups and associations, gender experts and /or other stakeholder concerned with gender and energy will be consulted.

5) When data-collection or assessments are conducted, gender dimensions will be considered. This can include sex-disaggregated data collection, performing gender analysis, etc.

6) All training materials and knowledge management activities will be gender mainstreamed. This includes integration of gender dimensions into publications, for instance presenting sex-disaggregated data, gender-energy nexus theory, gender sensitive language in publications, photos showing both women and men, and avoid presenting stereotypes, as well as assuring that women, men and the youth have access to and benefit from the knowledge created.

The planned project outcomes will be enhanced by considering gender equality and women?s empowerment by adopting a gender lens at high-level decision-making bodies and forums, and within planning and developments relating to sustainable energy systems for industrial parks. A component-by-component short description is provided:

Component 1: Fostering the coordination towards sustainable energy transformation of IPs / SEZs by creating a conducive enabling environment under consideration of social equity. Meetings and and capacity building activities under this component have women participation targets. The training activities under this component have women participation targets and women's training needs are taken into account following consultations with local women?s organizations.

Component 2: Demonstration of low-carbon and sustainable energy solutions through EIP pilots. The focus of this component is to successfully demonstrate the feasibility and attractiveness of low-carbon energy options for industrial parks. The project consultations will include local community and/or women civil society groups during the design / feasibility study of the pilot projects to not only integrate the needs of women into project design but also provide equal opportunities for women and men to lead, benefit from and participate in the demonstration-scale pilot project.

Component 3: De-risking scheme for upscaling and replication of sustainable energy solutions in IPs/SEZs. This component serves to identify opportunities for de-risking investments in low-emission IP/SEZ activities and develop concepts for an investment friendly strategic framework. Meetings and consultations will have women participation targets.

Component 4: Monitoring & Evaluation. This component will focus on the effective monitoring and evaluation of the project during implementation and after completion and will include gender-sensitive targets and indicators.

[1] See https://www.environment.gov.za/sites/default/files/reports/greeneconomy_policyreview.pdf.

[2] https://www.engerati.com/energy-retail/fixing-the-gender-pay-gap-in-the-energy-industry/

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment?

Yes
Closing gender gaps in access to and control over natural resources;

Improving women's participation and decision making Yes

Generating socio-economic benefits or services or women Yes

Does the project?s results framework or logical framework include gender-sensitive indicators?

Yes
4. Private sector engagement

Elaborate on the private sector's engagement in the project, if any.

The private sector will be engaged in the project through the following stakeholders:

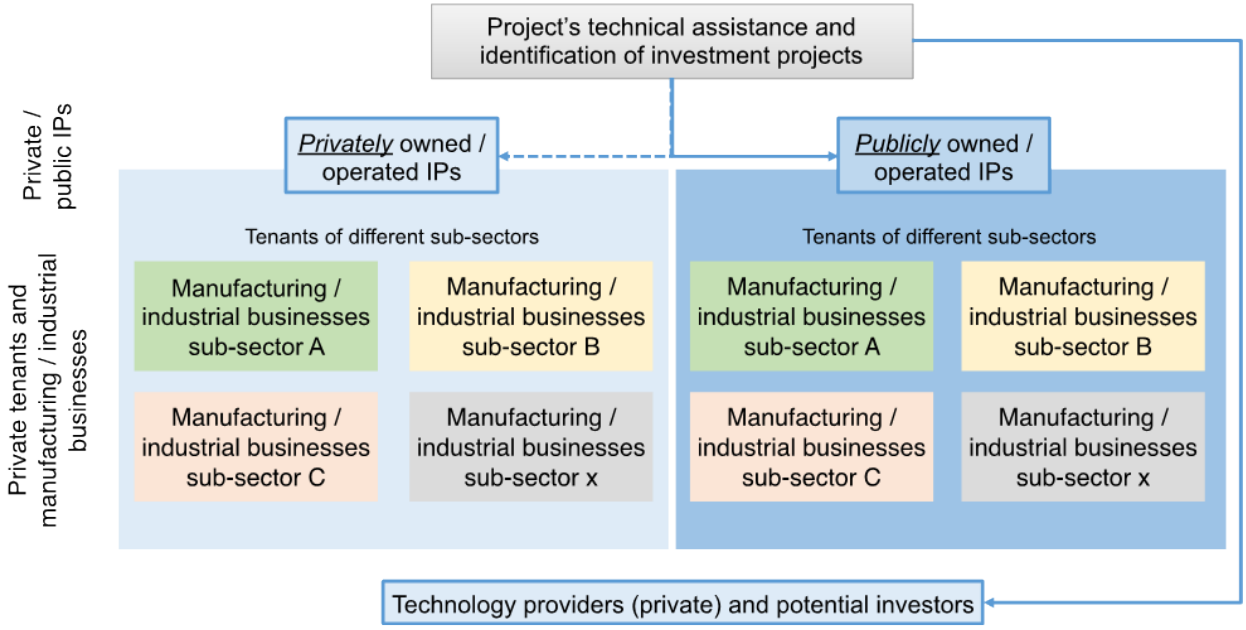
1) The **National Cleaner Production Centre South Africa (NCPC-SA)**: The NCPC-SA is the articulating arm of the Department of Trade, Industry and Competition, which is responsible for implementing government programmes on energy efficiency, water and resource management in the industry and manufacturing sector. The NCPC is not a private sector institution, but it helps to mobilize the private sector. It is a foundation whose mission is to promote, strengthen and consolidate the efficient use of energy in the industry sectors, contributing to the competitive and sustainable development of the country. It promotes the reduction of energy consumption, incl. the engagement of the private sector at industrial park and tenant (industrial company) level.

2) **Private IPs and private sector establishments operating at IPs:** Most IPs in South Africa are privately owned and operated. Hence, private IP managements are part of the main target group of the project for adopting and implementing sustainable energy practice at their parks. In addition, most manufacturing establishments and companies located within both governmental and privately run IPs are private companies as tenants. These companies are main beneficiaries and key target group of the project. In general, the project will deal with IP management and individual tenant companies of different industrial sub-sectors operating

in publicly owned / operated IPs (main target group) and potentially in privately owned / operated IPs (see Figure 28).

3) **Technology providers and potential investors** like private ESCOs, IPPs or utilities will be encouraged to actively provide their services to IPs / SEZs and manufacturing companies. In the municipalities and IPs / SEZs receiving support under Component 2 of the project, a multi-stakeholder coordination group will be established. This will be helpful and beneficial to bring all local stakeholders around the table, potentially including local private energy service provides and community representatives. In addition, the financial sector and commercial banks as experts in financing the operation of their clients, including from the industry sector, will be mobilised to finance investment project identified under the project.

Figure 28: Private sector engagement and involvement



5. Risks to Achieving Project Objectives

Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation.(table format acceptable):

5.1 Project risk table

Table 9: Project risks

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
General: National government engagement and project governance					
National Government ministries remove their support for the project or are not involved, including due to political or social change	Political and institutional risk	High	Low	The Project will be executed by the Department of Trade, Industry and Competition (the dtic). UNIDO has received the letter of endorsement from Ministry of Environment for the project activities. Further Ministries will be involved as implementing partners closely in the project to ensure their participation. The Ministries are part of the current National Steering Committee. This risk also entails lack of support and engagement from the relevant ministries and institutions.	UNIDO Throughout the project.
Co-finance partners remove support for the project	Political and organizational	Medium	Low	Multiple contacts and extensive discussions have been held with the cofinancing partners. During implementation, regular contact with cofinancing partners will be important to ensure cofinancing. Contact with other private and public institutions interested in the project will also help mitigate the risk of current co-finance partners decline or leave the project.	UNIDO the dtic Throughout the project.

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Local municipalities and IPs / SEZs remove support for the project (e.g., by change of government or changing priorities)	Political	High	Medium	A removal of support from one or more municipalities will require to identify additional municipalities in order to meet the deliverables of Component 2. Therefore, the project will be in dialog with a number of cities interested in support on sustainable energy solution for local IPs / SEZs in their cities, in order generate a pipeline of other cities that can be selected.	NCPC-SA UNIDO the dtic Throughout the project.
Component 1: Fostering the coordination towards sustainable energy transformation of IPs / SEZs by creating a conducive enabling environment under consideration of social equity					
Lack of interest from local authorities to support and coordinate the projects	Political	High	Low	The project will be in constant exchange with local municipalities and governmental operated IP / SEZ to ensure awareness and demonstrate benefits.	NCPC-SA UNIDO the dtic Municipalities Throughout the project.
Accessibility of reliable energy data for energy database, e.g. due to confidentiality and competitiveness	Technical	Medium	Low	The project will engage third party auditors for gathering data and setting up the database. Information will be treated confidential. The database could follow the example of the GNR (?Getting the Numbers Right?) Database of the Global Cement and Concreate Association.[1]	NCPC-SA UNIDO Throughout the project.
Component 2: Demonstration of low-carbon and sustainable energy through pilots					

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Investors are not interested in pilot activities	Financial	High	Low	Support feasibility studies and invite international peers for exchange experiences. Increase transparency on permitting process and planned national government support (e.g., in coordination etc.). Increase awareness raising to private sector.	NCPC-SA UNIDO the dtic Municipalities Throughout the project.
The pilot projects cannot be implemented and commissioned as planned in accordance with the expected performance.	Technical	High	Low	Install a strong project management to allow tendering and commissioning of projects in time. Conduct pre-feasibility studies and assessment according to international best practice. Ensure in the tender process international and national best available technologies are used for the projects.	NCPC-SA UNIDO the dtic Municipalities Throughout the project.
Component 3: De-risking scheme for upscaling and replication of sustainable energy solutions in IPs / SEZs					

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Inadequate support/will from local authorities and other stakeholders to commit to strategies, policies and regulations	Political	High	Low	The project will establish a multi-stakeholder marketplace to bring together authorities, private sectors and financial institutions to demonstrate interest in the development of sustainable energy projects. Municipalities of pipeline project will provide an official letter confirming the engagement in the activities, confirming co-finance and commitments to implement a policy, programme, or action related.	NCPC-SA UNIDO the dtic Municipalities Throughout the project.
Other cities are not attracted by the outreach activities	Technical	Medium	High	The project will establish a multi-stakeholder marketplace to bring together authorities, private sectors and financial institutions to demonstrate benefits and best practice as well as to raise awareness and interest in the development of sustainable energy projects. Focus will be put on cost-benefit analysis and the sustainable impact of the interventions, incl. co-benefits on local environmental, social and economic aspects.	NCPC-SA UNIDO the dtic Throughout the project.
Environmental and Social Risks (see ESMP for details)					

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Social and Gender Risk Inequitable access of women to project benefits Resistance against or lack of interest in the project activities from stakeholders, especially regarding to the active promotion of gender equality. .	Political and organizational	Low	Medium	A full gender analysis and action plan was carried out and its recommendations were incorporated into the project design. Social safeguarding to ensure gender is mainstreamed throughout the project design. To ensure gender inclusiveness of all project activities, UNIDO methodology for gender assessment and gender responsive communication showing the benefits of gender equality for both women and men will be applied. To mainstream gender dimensions and empower women, adequate and gender responsive communication strategy will be implemented, and sensitization workshops will be organized. Gender mainstreaming will include thorough and gender responsive communication and ensure stakeholder involvement at all levels, with special regard to involving women and men, as well as civil society and non-governmental organizations promoting gender equality. This shall mitigate social and gender related risks, promote gender equality, and maximize the potential contribution of the project to improving gender equality.	NCPC-SA UNIDO the dtic Throughout the project.

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Potential pollution resulting from the disposal of the technologies to be installed in the project, including batteries from photovoltaic panels.	E&S	Medium	Low	The pilot projects and the disposal plan of the technologies will be screened based on the E&S criteria. If negative impacts assessed to be more than the positive impacts, the technology will not be supported by the project. The project team will comply with national law and regulations related to environmental protection. This requirement will be included in the subcontracts of the installation/construction companies. The project will identify the appropriate recycling procedures to be applied at the end of the lifetime of the technologies and integrate these practices into target IP waste management plans. These recycling guidelines will be linked with the national initiatives (e.g., Gauteng e-Waste Management System and initiatives of e-waste Association of South Africa, EWASA). Recycling or second-life use of batteries will be included in the contractual agreements relevant to technology supply and commissioning.	NCPC-SA UNIDO the dtic Throughout the project.

Risk description	Main category	Impact severity	Likelihood	Risk Mitigation Strategy and Safeguards	By Whom / When?
Potential labor allegations from either the selected industrial zones or from the supply chains of the clean technologies to be installed, i.e. solar photovoltaic panels	E&S	Medium	Low	The pilot projects will be screened based on the E&S criteria. If negative impacts assessed to be more than the positive impacts, the technology will not be supported by the project. The project team will comply with national law and regulations related to labor. This requirement will be included in the subcontracts of the installation/construction companies.	NCPC-SA UNIDO the dtic Throughout the project.

5.2 COVID risks

COVID-19 risk analysis[2]

The project will fully consider the negative implications of COVID-19 and identify the most appropriate ways to conduct implementation by using safety measures and preventive precautionary procedures. Such as organizing virtual meetings and trainings where face-to-face meetings bear health risks. The project team will be in continuous consultations with the governmental project stakeholders on how COVID-19 could impact the implementation of project activities and additional challenges that may subsequently arise due to the national pandemic restrictions. That would be pinned in the project schedule to accommodate to the prolongation of activities implementation and mobilization challenges during the pandemic period.

Table 10: COVID-19 risk analysis

Risk	Risk level	Risk mitigation measure

Project implementation as per expected timelines might be hindered due to the pandemic, leading to delays	Low/ Medium	Some delays in communications with counterparts and stakeholders and implementation are expected, in case lockdown regulations and directions in South Africa continue to be enforced throughout the year 2022. The project document was developed in consideration of such risk factors, and initial communications with the stakeholders will provide extra emphasis on the timelines so that the counterparts and stakeholders are fully aware of the timelines for implementation. Also, opportunities in post-recovery measure of COVID-19 will be communicated to increase level of confidence of stakeholders in how the project can support South Africa in addressing not only its climate challenges, but also in supporting economic growth. In the case that delays are still foreseen, UNIDO will immediately inform the GEF Operational Focal Point in South Africa and the GEF Secretariat to seek support and guidance.
Availability of Technical Expertise and Capacity and Changes in Timelines	Low	The project will carefully anticipate and monitor any possible implications of COVID-19 for a project start in 2022. This includes inter alia continued lockdown regulations and their respective implications on planning and working conditions in IPs / SEZs (including for park managers and the labour force of tenant companies), as well as capacity changes with the executing entity and other project partners. Regarding capacity changes at core partners, this alternative stakeholders were identified; the foreseen diversity of partners will allow to decrease the risk, and communication within the technical working groups and other for a such as roundtables allows to retain a constant open dialogue with the urban-industry-energy nexus ?community? in this respect.
Stakeholder Engagement Process	Low	Hybrid stakeholder engagement processes consisting of both virtual and face-2-face meetings are foreseen throughout the project. In light of experiences made with the pandemic in 2020-2022, the project will ensure that all exchanges foreseen as physical meetings (such as Communities of Practice, conferences, workshops) will be planned with a virtual alternative scenario. The foreseen helpdesk and matchmaking platform, as well as the increased experience with using virtual conferencing solutions help to decrease this risk.
Enabling Environment	Low	Fostering sustainable energy in the urban-industrial context is in line with the focus of the Economic Reconstruction and Recovery Plan of the South African Government, which includes priority interventions inter alia in energy security, reindustrialization, and green economy. The project will thus seek to harness opportunities with respective COVID-19 measures.
Financing (National debt crisis, availability of co-financing, price increases in procurement)	Low	As per the foreseen budgeting approach, GEF funding and a diversity in co-financing allows the project to develop a certain resilience against financing risks. A close monitoring of financing risks and an open dialogue with co-financiers will be done by the project executing entity.

COVID-19 opportunity analysis

For the project, opportunities in the context of measures taken in response to the COVID-19 pandemic exist regarding innovation in climate change mitigation and engaging with the private sector, also in line with the ?South African Economic Reconstruction and Recovery Plan? in October 2020[3].

Table 11: COVID-19 opportunity analysis

Opportunity	**Opportunity level**	**Opportunity optimization measure**
Promote energy efficiency improvements and low and zero-carbon technologies such as renewable energy, while not increasing the use of harmful chemicals and ensuring the ability to recapture and recycle materials at the end of life;	High	By its design the project foresees fostering of sustainable energy activities and as such can harness opportunities with recovery measures in the country.
Promote local business development projects which improve resilience to climate change;	High	Fostering sustainable energy activities in IPs / SEZs allows parks to become more resilient to the adverse impacts of climate change, e.g. concerning the reliability of energy supply.
Promote sustainable business practices that are bio-based, energy efficient and chemicals free (as far as possible).	High	Energy efficiency measures are part of the scope of measures for IPs / SEZs to improve their practices

5.3 Climate risk assessment

South Africa?s sensitivity to climate change, and its impacts

Like many other developing countries, South Africa is especially vulnerable to the impacts of climate change. Water is the primary medium through which the impacts of climate change are being felt in South Africa. Increases in climate variability and climatic extremes are impacting both water quality and availability through changes in rainfall patterns, with more-intense storms, floods and droughts; changes in soil moisture and runoff; and the effects of increasing evaporation and changing temperatures on aquatic systems. South Africa has been experiencing a serious drought since 2015, with associated crop losses, water restrictions, and impacts on food and water security.[4]

Observational records show that temperatures in the region have been increasing over the last century and that the rate of warming has been increasing ? most notably in the last two decades. For the period 1961 to 2014, temperatures over the region have increased at a rate of 0.4 ?C per decade (Figure 1). Temperature trends across seasons show a slightly larger warming in summer (December-January-February) and autumn (March-April-May) compared with the other seasons. These observed increases in land surface temperatures have occurred simultaneously with increases in evapotranspiration across the region.[5]

According to Davis-Reddy and Vincent (2017), trends in sea surface temperatures (SST) demonstrate warming at all latitudes along the entire southern African coastline. Changes in SST have important implications for the upwelling strength in the Benguela Current system as well as the Agulhas Current, both of which are important drivers of regional climate. Rainfall over southern Africa is characterised by strong inter-annual and inter-decadal variability. These alternating patterns of above-normal/below- normal rainfall periods clearly illustrate the rainfall cycles prevalent in southern Africa where extreme wet and dry years have resulted in floods and droughts. Against this variability there is little evidence of a substantial change in mean annual rainfall (wetting or drying) over the period 1961 to 2014. Changes in many extreme weather events have been observed since 1950. Some changes are evident with clear long-term trends (e.g., more frequent hot days), whilst others are more difficult to detect (e.g. tropical cyclones and thunderstorms).

Projected climate futures

According to recent results of Global Climate Models (GCMs)[6], temperatures in South Africa are projected to continue to increase during the 21st century, with the rate of increase reflecting the concentrations of GHG in the atmosphere. Average annual temperatures are likely to increase by 1-3 ?C by 2050, with higher increases expected during summer months. Warming is likely to be greatest towards the interior of the region, and lower in coastal areas.

Projected changes in rainfall vary more, due to differences in the ability of climate models to replicate observed rainfall patterns and simulate rainfall- producing processes. However, there is agreement between

models that central southern Africa (incl. the southwestern Cape of South Africa) is likely to be drier. Climate change is projected to alter the frequency and intensity of some extreme events in the future. Projections based on dynamical downscaling suggest that the annual frequency of very hot days (number of days when the maximum temperature exceeds 35 ?C) will increase and that the frequency of extreme rainfall events (20 mm or more of rain falling within 24 hours) will increase over the eastern parts of southern Africa.

Based on information from the IPCC Special Report in Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) and IPCC Fifth Assessment Report (AR5), projected increases in extreme temperatures combined with dry spells may increase the risk of wildfires. Coastal storm surges are expected to increase as a result of sea level rise. Higher sea levels will mean that smaller storms are likely to have an increased impact on the coastline.

Climate risks and mitigation measures by output

Changes in climate will progressively impact infrastructure and the vulnerability of the energy sector will depend on the changing demand for power, the capacity of existing energy services and the ability to invest in low-carbon technologies. In addition, a rapidly growing urban population, coupled with the expected increases in climate hazards and inadequate infrastructure, will make cities (more) vulnerable to climate change. Both aspects, will be addressed by the project.

Table 12: Climate risks and mitigation measures by output

Project Objective and Output	**Climate risks over the period 2020 to 2050**	**Resilience practices and mitigation measures**
Outputs under Component 1	Not expected	N/A

Project Objective and Output	Climate risks over the period 2020 to 2050	Resilience practices and mitigation measures
Outputs under Component 2 and 3	Climate risks and hazards could affect project?s objectives or outputs over the period 2020 to 2050. Impact from climate change may occur projects and infrastructure at the IPs / SEZs leading to physical, project and institutional impacts. This could include: Changing climate hazard / pattern, such as increasing average temperature, change in average seasonal precipitation (drought, floods); increasing storm surge height etc. Physical impact, incl. changing availability of raw material and natural resources; changing assets and site conditions; impact on operational performance. Project and institutional impact, incl. technical (lowered energy output) and financial performance (increasing CAPEX and OPEX)	The risks are expected to be moderate and manageable. Financial, environmental and social underperformance or failure of the project and the pilot activities is unlikely. The project pre-feasibility studies (as part of Component 2) will consider potential changing conditions in its sensitivity analyses and design the plants accordingly. Resilience towards climate change impact is one of the added benefits of decentralized energy systems at IP / SEZ level, as a combination of available renewable energy sources will provide more flexibility to the local energy system to adapt to potential impacts of climate change. Since not all locations of the pilot IPs / SEZs and local energy systems are known yet the project will undertake a climate risk screening for each project (as part Component 2). This will include a climate vulnerability assessment and plan actions as part of the feasibility studies to increase the resilience of the project's outputs and outcomes.

Technical and institutional capacity and information needed to address climate risks and resilience enhancement measures

Potential responses to the climate risks in the focus sectors, i.e., energy, industry and urban settlement, of the project in South Africa include[7]:

1) Ensuring affordability of renewable energy (e.g., market creation, incentives for innovation)
2) Policy environment to regulate energy production, transmission and consumption
3) Air quality monitoring
4) Policy and legislative guidelines for air quality management

5) Planning infrastructure should take into account mitigation and adaptation to climate risks. Buildings can be designed using features that promote adaptation, for example to enable circulation of air for cooling, and with shaded windows in the direction of the sun ? whilst also being constructed with energy-efficient materials.

6) Urban management (e.g., natural ventilation for cooling, safeguard critical infrastructure; create rainwater storage and flood retention areas)

7) Land-use planning (e.g., protect high-yield agricultural land, environmentally sensitive areas and natural landscapes from urban sprawl; plan greater inter-connectivity between different land uses and transport; intensify land uses where appropriate; revise flood lines)

8) Soft adaptation options, e.g., livelihood protection, social safety nets

Awareness-raising and education, communication of climate information and early warning systems are important adaptations across all sectors. These require institutional cooperation and coordination across sectors, particularly in planning and development practices that reduce vulnerability to climate hazards. Key element is the strengthening of institutional capacities at local, national and regional levels for integrated resource and energy management.

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[1] https://gccassociation.org/sustainability-innovation/gnr-gcca-in-numbers/

[2] Refer to http://www.thegef.org/sites/default/files/documents/GEF_COVID_Project_Design_Review_Considerations_20200925.pdf

[3] https://www.gov.za/sites/default/files/gcis_document/202010/south-african-economic-reconstruction-and-recovery-plan.pdf

[4] Department of Environmental Affairs, 2017. South Africa?s 2nd Annual Climate Change Report. Pretoria: Department of Environmental Affairs

[5] Davis-Reddy, C.L. and Vincent, K. 2017: Climate Risk and Vulnerability: A Handbook for Southern Africa (2nd Edition), Council for Scientific and Industrial Research, Pretoria, South Africa.

[6] See Davis-Reddy, C.L. and Vincent, K. 2017

[7] See Davis-Reddy, C.L. and Vincent, K. 2017

6. Institutional Arrangement and Coordination

Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.

UNIDO as the GEF Agency will be responsible for the implementation of the project, which entails oversight of project execution to ensure that the project is being carried out in accordance with agreed standards and requirements. The project will be executed by a national Project Executing Entity (PEE), the National Cleaner Production Centre South Africa (NCPC-SA). The proposed institutional structure for the GEF funded project comprises a number of bodies. In general, the project will be managed by a Project Manager at the Project Executing Entity that works in close cooperation with dtic. The main project bodies are the following:

The **Implementing Agency (IA)** for the project will be United Nations Industrial Development Organization (UNIDO), i.e., UNIDO?s Department of Energy in Vienna supported by the UNIDO Regional Office in South Africa; UNIDO supports the project implementation and serving as counterpart towards GEF.

The **Project Executing Entity (PEE)** for the project is responsible for the management and administration of the project as well as managing the delivery of project outputs. The PEE for the project is the NCPC-SA, which has been executing related projects on behalf of CSIR/dtic. The envisaged PEE was nominated by the Government.

The **Project Steering Committee (PSC)** is a high-level cross-sectorial committee comprising of lead policy makers and heads of departments. It consists of representatives from the following institutions and is chaired by the dtic:

1) Department of Trade, Industry and Competition of South Africa (dtic)

2) The Project Executing Entity (PEE): National Cleaner Production Centre South Africa (NCPC-SA)

3) UNIDO

4) Representatives from the Technical and Financial Working Groups

The project steering committee will be created to supervise and provide guidance to the project execution. The function of the PSC is to focus mainly on procurement, institutional arrangements, and financial management of the project. It will meet at least twice a year or more frequently, if required. The selection of consultancies and companies is the responsibility of the PSC. The PSC will consult and coordinate the project with relevant line ministries and national authorities, i.e., Department of Environment, Forestry and Fisheries of South Africa (DEFF), Department of Mineral Resources and Energy (DMRE) and National Treasury.

The **Project Management Unit (PMU)** will be formed by and hosted in NCPC-SA facility. The team will consist of a full-time National Project Coordinator (NPC), project assistant, short-term and long-term technical experts when required and component coordinators with specialized expertise hired by NCPC-SA to work on specific components. The PMU is designed to achieve efficiency, effectiveness and coordination in the management of funding from a variety of donors, the government, and non-governmental organizations (NGOs). The PMU also ensures effective coordination and efficiency when there are project activities that are similar and inter-dependent on each other for execution. The PMU will be responsible for executing project activities day-to-day and monitoring the project's work plan and achievement of the deliverables as well as promoting the project.

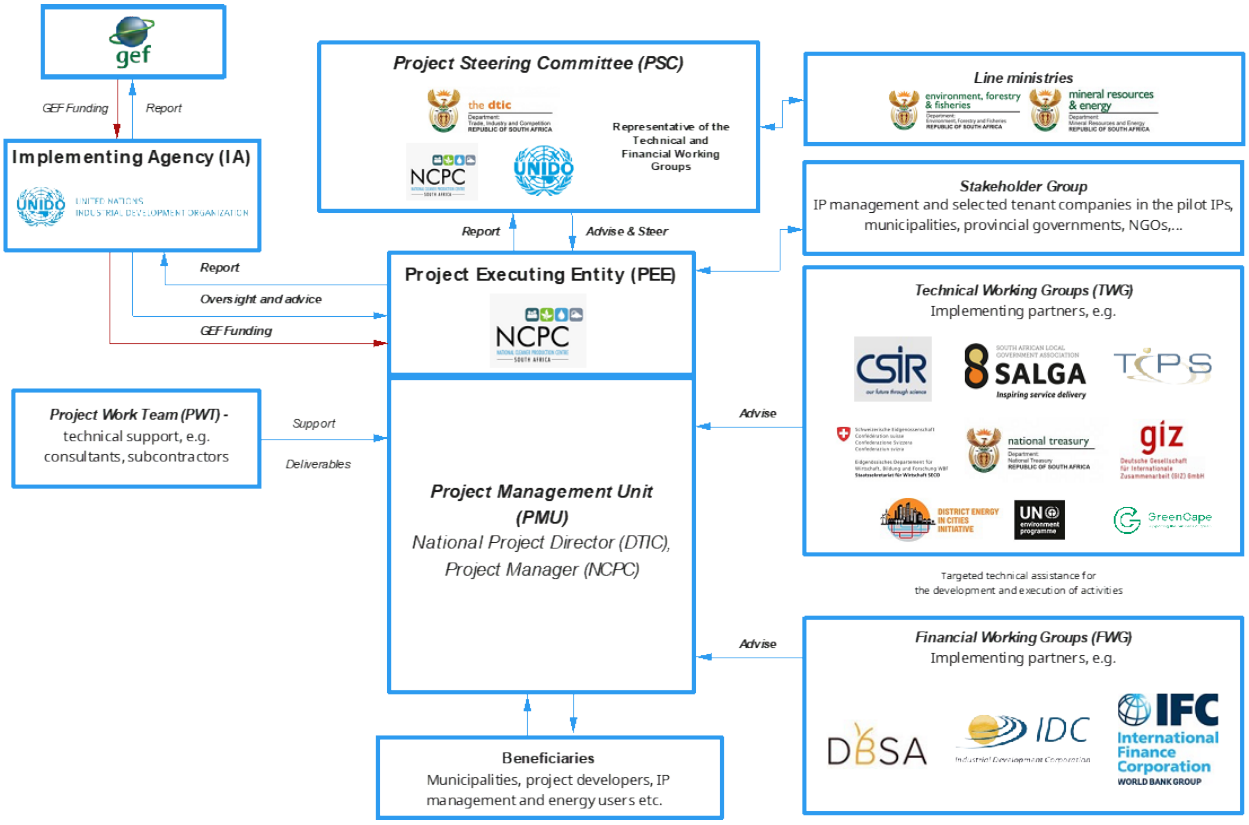
Technical working groups (TWG) will be formed to facilitate the involvement of interested partners in the implementation of the project components. Participation will be opened to any interested stakeholder upon request addressed to the PSC. The TWGs are expected to provide technical advice as well as to facilitate networking at the national and international level. The TWGs will meet quarterly during project implementation, under the leadership of one governmental department and with secretarial support from the PMU.

Financial working groups (FWG) will be formed to facilitate the involvement of interested partners in the financing of the project components. Participation will be opened to any interested stakeholder upon request addressed to the PSC. The FWGs are expected to provide technical advice as well as to facilitate networking at the national and international level. The TWGs will meet quarterly during project implementation, under the leadership of one governmental department and with secretarial support from the PMU.

The project will also seek to engage further with the forthcoming UNIDO Global Industry Programme, which is under development by UNIDO? Energy Systems and Infrastructure Division (ESI) under the Department of Energy. The ESI Division focuses on promoting sustainable energy solutions and infrastructure for industrial development. The promotion of industrial de-carbonization through crosscutting solutions, such as energy management systems and standards, energy systems optimization, and deployment of renewable energy technologies is one of the core functions of the Division. With support of the Vienna Energy Forum virtual series in 2020 and 2021[1], the ESI Division intends to develop two global programmes aiming at accelerating the energy transition for powering industrial development and food system transformation. The Global Programme for industrial development will aim for supporting the decarbonisation of the industrial energy system by developing low-carbon infrastructures in developing and emerging economies.

The anticipated institutional setting is illustrated below:

Figure 29: Institutional Arrangement



Coordination:

The project will collaborate with ongoing national (e.g., IPRP), and other international projects (e.g., Global Eco Industrial Park Programme (GEIPP)) in South Africa focusing IPs but also renewable energy, energy efficiency and climate change through knowledge sharing of qualitative and quantitative data on energy, investment, expert pools, lessons-learned, GHG emission reduction calculations, fuel savings etc. In addition to GEIPP, the project team will coordinate with and build on the UNIDO projects in the country in particular:

- Accelerating cleantech innovation and entrepreneurship in SMEs to support transition towards a circular economy and create green jobs in South Africa funded by GEF

- Pipeline development to deploy clean energy technology solutions in municipal wastewater treatment works of South Africa funded by GCF

- Strengthened adaptation capacity for a green and resilient economy in South Africa funded by the government of Flanders

On local level, the project will give special focus on coordinating the prioritization of investment pipeline with the IP and SEZ managements and relevant national authorities (e.g., provincial development agencies).

The coordination among different stakeholders will be facilitated by NCPC-SA and where relevant by the dtic.

GEIPP's interventions focus on resource efficiency solutions (materials, water, waste exchange) to support IPs to increase production efficiency and minimize their environmental impact. The project's interventions will complement GEIPPP through integrating a new set of solutions on renewable energy technologies (supply), energy efficiency (demand) and energy data collection & analysis mechanism that will be an incremental contribution to the programme.

Technology transfer: Full or partial ownership of equipment/assets purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the government counterpart in consultation with the UNIDO Project Manager.

Legal context: The Government of the Republic of South Africa agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed on 3 October 1994.

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[1] https://www.viennaenergyforum.org/vef-virtual-series

7. Consistency with National Priorities

Describe the consistency of the project with national strategies and plans or reports and assesments under relevant conventions from below:

NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc.

The project has been designed to complement, without duplicating, other on-going and planned projects and programmes. On the national level it is aligned with for instance the National Climate Change Response Policy of 2011 (NCCRP), the Integrated Resource Plan (IRP) and South African Renewable Energy Master Plan (SAREM), as well as the National Strategy for Sustainable Development and Action Plan, the Industrial Policy Action Plan or the Green Transport Strategy 2018-2050. The project also aligns with the initiatives outlined below.

SAREM is one of 14 industry specific masterplans being developed under the Department of Trade, Industry and Competition (DTIC?s) national masterplan process, which was launched in July 2019. The masterplan development approach is a collaboration between industry, labour and government to develop an industrial plan for the sector. This includes setting out a vision for an industry in South Africa, identifying blockages and constraints, and proposing a set of key actions that need to be taken forward over the short and medium term. The masterplans essentially facilitate a process whereby industry commits to a certain amount of investment and creating a certain number of jobs against an industry masterplan. Government, for its part, undertakes to understand and remove impediments to these plans.[1]

The **Integrated Resource Plan (IRP)** has been published in 2018. The IRP outlines the expected energy capacity needed in South Africa. SAREM represents an opportunity to identify jobs and investment in the renewable energy sector linked to the IRP, as well as to articulate how job creation and investment might be optimised and maximised if various impediments were removed, or new supportive policy was designed. [2]

To address the significant contribution of transport to national GHG emissions, the government through the Department of Transport has developed a **Green Transport Strategy (GTS)**, which aims to minimise the adverse impact of transport on the environment, while addressing current and future transport demands. This is underpinned by sustainable development principles. The strategy will promote green mobility to ensure that the transport sector supports the achievement of green economic growth targets and the protection of the environment.[3]

On the international level, the project seeks to support South Africa as a signatory to the UNFCCC and the Paris Agreement in achieving its Nationally Determined Contributions. The project targets to support South Africa in overcoming capacity and technology needs as identified in South Africa?s National Communications and the Third Biennial Update Report, which include sustainable energy as a priority topic. The project also links to other international reporting frameworks and policy documents targeted at enhancing transformational shifts towards a low-emission and resilient development path, including the Agenda 2030 with its SDGs.

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[1] Green Cape, 2020, Background to the South African Renewable Energy Masterplan (SAREM): https://www.green-cape.co.za/assets/SAREM_Background-Information_20200820.pdf

[2] ibid.

[3] Department of Transport, 2018, Green Transport Strategy for South Africa: (2018-2050): https://www.transport.gov.za/documents/11623/89294/Green_Transport_Strategy_2018_2050_onlineversion.pdf/71e19f1d-259e-4c55-9b27-30db418f105a

8. Knowledge Management

Elaborate the "Knowledge Management Approach" for the project, including a budget, key deliverables and a timeline, and explain how it will contribute to the project's overall impact.

Overall KM strategy: The project will apply for its knowledge management several knowledge management (KM) tools, which are partially integrated in the activities and deliverables of the project components. The KM tools and products are based on experiences and best-practices approaches of UNIDO, incl. its international Global Industry Programme, and NCPC-SA. Internal knowledge management will be undertaken through monthly coordination calls or meetings between the NCPC-SA and the technical assistance group, annual meetings of the Steering Committee, regular coordination calls between the NCPC-SA and the sponsors of the pilot projects etc. The NCPC-SA will develop a methodological approach to track activities, knowledge developed, and the impacts of its work.

As described under Component 1, a national energy database for typical energy profiles will be created. The database will help to monitor, benchmark and map energy project in IPs / SEZs. For the operation of the database an internal procedure guidebook will be developed within NCPC-SA that will allow for ensuring necessary process are defined and followed also in future, e.g., by potential future staff. The results from the pilot projects will inform fact sheets and the lesson learned material.

The following KM results indicators will be applied (see description below):

Table 13: Knowledge management result indicators

KM objective	KM Indicators	Baseline	Targets	Means of Verification

Results documentation and assessment	**Indicator KM1:** Number of energy demand and consumption profiles of IPs / SEZs and representative tenants **Indicator KM2:** Number of benchmark database of typical energy intensities of relevant industrial **Indicator KM3:** Number of fact sheets	**Baseline KM1:** 0 **Baseline KM2:** 0 **Baseline KM3:** 0	**End of project target KM1:** for up to 10 **End of project target KM2:** 1 **End of project target KM3:** 3	M&E reporting and results
Dissemination and sharing with stakeholders	**Indicator KM4:** Number of guides and guiding documents **Indicator KM5:** Number of training sessions and workshops **Indicator KM6:** Number of marketplaces, CoP (alternatively webinars)	**Baseline KM4:** 0 **Baseline KM5:** 0 **Baseline KM6:** 0	**End of project target KM4:** 3 **End of project target KM5:** 3 **End of project target KM5:** 6	M&E reporting and results Publication on webpage

Learning from experiences: As a platform for knowledge transfer, the NCPC-SA will establish a help desk enabling the transfer of national and international best practices from partners and existing projects supported by UNIDO to the local stakeholders in South Africa. UNIDO and partners will support through the participation on awareness raising activities, training sessions, the CoP and the marketplace approach, and will provide guidance on the development of the database and knowledge products.

Results assessment and documentation: The results of the pilot activities will be captured in knowledge product, e.g., fact sheets (see Deliverables for Output 2.3). The fact sheets will present the lessons learnt and main technical, environmental and economic characteristics. The sheets will be informed by project documentation (e.g., feasibility studies) and the first performance reports summarizing the results in terms of energy performance, GHG mitigation and sustainable development impact, if available in the initial phase already. In addition, sanitized information of the energy profiles at IPs / SEZs will be published at the NCPC-SA webpage.

Outreach and dissemination to stakeholders: The knowledge products, CoP and the marketplace focus on sharing information and results of the project and on sustainable energy solutions to relevant stakeholders and the public. This will be done as described through training sessions, workshops and multi-stakeholder meetings tailored to the needs of each stakeholder (local governments, IPs / SEZs, project developers, investors and operators). Additionally, a website on district energy will be developed. On the NCPC-SA website following elements could be published subject to the final design and content available and required:

Demonstration projects fact sheets including a summary of the technical, environmental and economic characteristics of all the demonstration projects developed.

1) ***International case studies and best practices*** including international case studies and best practices.

2) ***Resources*** including reports, summaries, recordings and live streams from workshops and webinars, and infographics available for download.

3) ***Information on the Project Marketplace*** providing the matchmaking space between IPs / SEZs, tenants, developers, investors, ESCOs and public entities to attract investment and encourage project development.

4) News/Media and Event Calendar including news, updates on events as well as media tool kits with tailored communication.

All training materials and knowledge management activities will be gender mainstreamed. This includes integration of gender dimensions into publications, for instance presenting gender-disaggregated data, gender-energy nexus theory, gender sensitive language in publications, photos showing both women and men, and avoid presenting stereotypes, as well as assuring that women, men and the youth have access to and benefit from the knowledge created.

9. Monitoring and Evaluation

Describe the budgeted M and E plan

The project results, corresponding indicators and mid-term and end-of-project targets in the project results framework will be monitored annually and evaluated periodically during project implementation. If baseline data for some of the results indicators is not yet available, it will be collected during the first year of project implementation. The Monitoring Plan included in the Monitoring and Evaluation table below including the roles, responsibilities, and frequency of monitoring project results.

Project-level monitoring and evaluation will be undertaken in compliance with UNIDO requirements. The UNIDO South Africa Country Office will support ensuring full compliance with UNIDO requirements on project monitoring, quality assurance, risk management, and evaluation. Additional mandatory GEF-specific M&E requirements will be undertaken in accordance with the GEF Monitoring Policy and the GEF Evaluation Policy and other relevant GEF policies. The Monitoring plan, will guide the GEF-specific M&E activities to be undertaken by this project. In addition to these mandatory UNIDO and GEF M&E requirements, other M&E activities deemed necessary to support project-level adaptive management will be agreed during the Project Inception Workshop and will be detailed in the Inception Report. Additional GEF monitoring and reporting requirements:

Inception Workshop and Report: A project inception workshop will be held within 60 days of project CEO endorsement, with the aim to:

1. Familiarize key stakeholders with the detailed project strategy and discuss any changes that may have taken place in the overall context since the project idea was initially conceptualized that may influence its strategy and implementation.

2. Discuss the roles and responsibilities of the project team, including reporting lines, stakeholder engagement strategies and conflict resolution mechanisms.

3. Review the results framework and monitoring plan.

4. Discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E budget; identify national/regional institutes to be involved in project-level M&E; discuss the role of the GEF OFP and other stakeholders in project-level M&E.

5. Update and review responsibilities for monitoring project strategies, including the risk log; SESP report, Social and Environmental Management Framework and other safeguard requirements; project grievance mechanisms; gender strategy; knowledge management strategy, and other relevant management strategies.

6. Review financial reporting procedures and budget monitoring and other mandatory requirements and agree on the arrangements for the annual audit.

7. Plan and schedule Project Board meetings and finalize the first-year annual work plan.

8. Formally launch the Project.

GEF Project Implementation Report (PIR): The annual GEF PIR covering the reporting period July (previous year) to June (current year) will be completed for each year of project implementation. The PMU will collect the necessary data and complete PIR. The PIR will be reviewed and submitted to the GEF by UNIDO. Any environmental and social risks and related management plans will be monitored regularly, and progress will be reported in the PIR. The PIR submitted to the GEF will be shared with the Project Board. The quality rating of the previous year?s PIR will be used to inform the preparation of the subsequent PIR.

GEF Core Indicators: The Core indicators included as Annex F will be used to monitor global environmental benefits and will be updated for reporting to the GEF prior to MTR and TE. Note that the project team is responsible for updating the indicator status. The updated monitoring data should be shared with MTR/TE consultants prior to required evaluation missions, so these can be used for subsequent ground truthing. The methodologies to be used in data collection have been defined by the GEF and are available on the GEF website.

In addition to the core indicators, the PEE is responsible to track materialized co-financing, as both should be reported upon at MTR and TE stage.

Mid-term Review (MTR): The MTR will be conducted in the second year of the project implementation. The evaluation will be independent, impartial and rigorous. The evaluators that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing, or advising on the project to be evaluated. Equally, the evaluators should not be in a position where there may be the possibility of future contracts regarding the project under review.

The GEF Operational Focal Point and other stakeholders will be actively involved and consulted during the evaluation process.
The final MTR report and MTR TOR will be publicly available in English and will be publicly posted. A management response to MTR recommendations will be posted publicly within six weeks of the MTR report?s completion.

Terminal Evaluation (TE): An independent terminal evaluation (TE) will take place upon completion of all major project outputs and activities. The terms of reference, the evaluation process and the final TE report will follow the standard templates and guidance for GEF-financed projects. The evaluation will be independent, impartial and rigorous. The evaluators that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing or advising on the project to be evaluated. Equally, the evaluators should not be in a position where there may be the possibility of future contracts regarding the project being evaluated. The GEF Operational Focal Point and other stakeholders will be actively involved and consulted during the terminal evaluation process. The final TE report and TE TOR will be publicly available in English. A management response to the TE recommendations will be posted to publicly within six weeks of the TE report?s completion. Final Report: The project?s terminal GEF PIR along with the terminal evaluation (TE) report and corresponding management response will

serve as the final project report package. The final project report package shall be discussed with the Project Board during and end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Financial Audits: NCPC-SA will undergo financial audits as part of annual CSIR/NCPC-SA audit according to their internal rules and regulations. The cost of the audits is considered to be in-kind contribution of NCPC-SA. The financial audit report will be submitted to UNIDO annually.

M&E Action Plan

M&E Activity	**Description**	**Responsible Parties**	**Timeframe**	**Indicative budget (USD)**
Inception Workshop (IW)	Report prepared following the IW; which includes: - A detailed workplan and budget for the first year of project implementation, - An overview of the workplan for subsequent years, divided per component, output and activities. - A detailed description of the roles and responsibilities of all project partners - A detailed description of the PMU and PSC, including an organization chart - Updated Procurement Plan and a M&E Plan, Gender Action Plan - Minutes of the Inception Workshop	PMU (project executing entity)	1 report to be prepared following the IW, to be shared with participants 4 weeks after the IW (latest)	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity.

Steering Committee Meeting	Prepare minutes for every Steering Committee Meeting.	PMU (project executing entity)	At least 1 per year Minutes to be submitted 1 week following each PSC meeting	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Half-yearly progress report	Part of UNIDO requirements for project monitoring. - Narrative of the activities undertaken during the considered semester - Analyzes project implementation progress over the reporting period; - Describes constraints experienced in the progress towards results and the reasons. - Considers progress on gender action plan	PMU (project executing entity)	Two (2) half-yearly progress reports for any given year, submitted by July 31 and January 31 (latest)	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Quarterly expenditure reports	Detailed expenditure reports (in excel) broken down per project component and budget line, with explanations and justification of any change	PMU (project executing entity)	Four (4) quarterly expenditure reports for any given year, submitted by January 31, April 30, July 31 and October 31 (latest)	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity

Project Implementation Review (PIR)	Analyses project performance over the reporting period. Describes constraints experienced in the progress towards results and the reasons. Draws lessons and makes clear recommendations for future orientation in addressing the key problems in the lack of progress. Considers progress on gender action plan and stakeholder engagement. The PIRs shall be documented with the evidence of the achievement of end-of-project targets (as appendices).	PMU (project executing entity) for collecting the required data, prepare a draft and submit it to UNIDO. UNIDO will review PIR and submit it to the GEF.	1 report to be prepared on an annual basis, to be submitted by 15 July latest	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Tracking of progress towards project framework indicators	Periodic tracking of progress towards achieving the project framework indicators as per annex A	PMU (project executing entity)	At least every six months, as inputs into the half-yearly report and PIR	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Monitoring of the implementation of Gender Action Plan and Environmental and Social Management Plan	The PMU will monitor and update where relevant Gender Action Plan and ESMP to ensure the women empowerment, environmental sustainability and inclusiveness are ensured.	PMU (project executing entity)	Continuous	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity

Annual Financial Audit Annual Inventory of Non-expendable equipment	Annual financial audits as part of the CSIR/NCPC-SA procedures Report with the complete and accurate records of non-expendable equipment purchased with GEF project funds	NCPC-SA PMU (project executing entity)	Annually 1 report per year as at 31 December, to be submitted by 31 January latest	In-kind co-financing Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Co-financing Report	Report on co-financing (cash and/or in-kind) fulfilled contributions from all project partners that provided co-finance letters.	PMU (project executing entity)	1 annual report from each co-finance partner, and 1 consolidated report, to be submitted by 31 July latest	Part of the PMU budget under the contractual agreement that will be signed between UNIDO and the project executing entity
Medium-Term Evaluation (MTE) / Medium-Term Review (MTR)	The purpose of the MTE or MTR is to provide an independent assessment of project performance at mid-term, to analyse whether the project is on track, what problems and challenges the project is encountering, and which corrective actions are required so that the project can achieve its intended outcomes by project completion in the most efficient and sustainable way. It will verify information gathered through the GEF tracking tools. MTR will evaluate the progress on the gender action plan.	UNIDO Execution through Independent Evaluation Expert (national) Support: Project Manager, PMU	At mid-point of project implementation (year 2)	US$ 20,000

Terminal Evaluation (TE)	Further review the topics covered in the mid-term evaluation. Looks at the impacts and sustainability of the results, including the contribution to capacity development and the achievement of global environmental goals. It will also consider achievement on the gender action plan and ESMP.	UNIDO Execution through Independent Evaluation Expert (international) Support: Project Manager, PMU	Approximately six (6) months prior to the project?s technical completion date	US$ 30,000
TOTAL M&E COST				**US$ 50.000**

10. Benefits

Describe the socioeconomic benefits to be delivered by the project at the national and local levels, as appropriate. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?

Social benefits

In terms of social benefits, through the introduction and expansion of sustainable energy sources, the project will contribute to South Africa`s transition to a low-carbon environment, reducing air pollution and CO2 emissions and thus improving air quality for the citizens of the country. This has the co-benefit of improving citizen?s health and lowering associated health care costs and potential death rates. In South Africa, up to 44 million people are exposed to air pollution from coal power plants.[1] The extraction, storage, transportation, and utilization of coal produces fugitive dust, which has been linked to pulmonary diseases. Health costs related to coal emissions will peak in 2022, at up to R45 billion in that year alone. As many as 2080 premature deaths annually were predicted due to air pollution from power plants in South Africa. Health costs can be reduced significantly by increasing the share of renewable energy utilization.

From the point of view of gender mainstreaming benefits, the project will provide social benefits to the women in industrial parks in terms of new job, investment (e.g., gender lens investment principles under output 3.1.) and skill development opportunities. In addition, the project will enhance workplace conditions such as access to safer and cleaner indoor air due to integration of renewable energy.

Environmental benefits

In terms of environmental benefits, use of fossil fuel-based energy generation is reduced and shifts to sustainable energy solutions, including renewable energies, which decreases the demand for fossil fuels. Eventually, this leads to a reduced environmental footprint of the industry sector, which is expressed in mitigated GHG emissions (tCO2e/a) and renewable energy capacity installed (MW). In the case of water, the continuous release of various chemicals from coal mines has drastically affected water quality. This has further resulted in acidification and degradation of the water, affecting the aquatic bodies and human health[2].

At the same time a shift to sustainable energy solutions furthers resource efficiency and circular economy practices. This may also include reduced levels of pollution due to more efficient use of resources, which can have co-benefits for preservation and protection of local biodiversity.

Economic benefits

South Africa has an abundance of renewable energy resources. Investing into renewable energy sources opens new opportunities for current coal sector employees and other job seekers. South Africa can significantly boost employment by increasing the share of renewables. Indirect benefits also include employment creation through skills upgrading and training, technology transfer, improved reputation and increased incidence of the ?demonstration effect? arising from the application of best practice for sustainable energy sources in IPs / SEZs, leading to wider uptake of more efficient practices

[1] ASS/UfU/IET/CSIR. 2020. Making the Paris Agreement a success for the planet and the people of South Africa. Unlocking the co-benefits of decarbonising South Africa?s power sector. COBENEFITS Policy Report. Potsdam/Pretoria. www.cobenefits.info

[2] See https://www.accord.org.za/ajcr-issues/conflict-implications-of-coal-mining-and-environmental-pollution-in-south-africa/

11. Environmental and Social Safeguard (ESS) Risks

Provide information on the identified environmental and social risks and potential impacts associated with the project/program based on your organization's ESS systems and procedures

Overall Project/Program Risk Classification*

PIF	CEO Endorsement/Approval	MTR	TE
Medium/Moderate	Medium/Moderate		

Measures to address identified risks and impacts

Elaborate on the types and risk classifications/ratings of any identified environmental and social risks and impacts (considering the GEF ESS Minimum Standards) and any measures undertaken as well as planned management measures to address these risks during implementation.

Please find attached ESMP.

The project has been categorized as Category B as per the UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP) and based on an analysis of the environmental and social risks of the project which means that there are few likely adverse impacts, which will be site-specific, and few if any will be irreversible. In most cases, impacts can be readily avoided or mitigated with appropriate mitigation measures or incorporating internationally recognized design criteria and standards. During the PPG phase, an Environmental and Social Management Plan (ESMP) has been developed and is included herewith as an attachment.

Supporting Documents

Upload available ESS supporting documents.

Title	Module	Submitted
10817-Annex_GEF-7-SA_ESMP_updated-FINAL	**CEO Endorsement ESS**	
10817-Annex_GEF-7-SA_ESMP_updated-final	**CEO Endorsement ESS**	
UNIDO_ESS_SA_GEF7_200206_signed	**Project PIF ESS**	

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Project Strategy	Indicator	Baseline	Target/deliverables	Sources of verification
PROJECT OBJECTIVE Reduce GHG emissions and accelerate the decarbonization of industrial parks through providing support to IP/SEZ managements, tenants, municipalities, and other core stakeholders	A: Metric tonnes of greenhouse gas emissions avoided during the project (GEF Core Indicators #6)	0	Direct: 1,291,449 tCO2eq Indirect: 5,100,000 tCO2eq	Monitoring energy consumption and supply at pilot IP / SEZ in demonstration projects. Workshop reports, capacity-building reports, community engagement reports, pilot reports, and surveys of pilot IPs / SEZs
	B. Number of direct beneficiaries disaggregated by gender (GEF Core Indicators #11)	0	Approx. 15,000 working in manufacturing / service jobs in IPs / SEZs as well as trainees ca. 30% female and 70% male	Workshop reports, capacity-building reports, community engagement reports, pilot reports, and surveys of pilot IPs / SEZs
OUTCOME 1 Government and local authorities ensure a conducive IP-associated policy and regulatory environment, especially with regard to energy generation and consumption formulated in a sustainable and inclusive manner.	1. Number of IPs / SEZs with improved management practice (UNIDO IRPF Indicator[1] -BUS.1: Number of firms with improved management practices)	Insufficient energy management practices and lack of coordination plans	6 IPs / SEZs with improved energy management and coordination practice	Policy, regulatory, coordination and energy analysis reports

Output 1.1: The coordinative capacities for sustainable energy solutions are strengthened at 6 IP / SEZ municipality management levels through coordination plans	TCO.3: Number of toolkits and guidelines produced	No coordination plan has been developed yet	Six (6) Coordination plans developed Minimum four (4) annual extended-stakeholder meetings at each selected industrial zone Quarterly roundtables conducted throughout the project	Coordination plans Meeting reports
Output 1.2: Analysis of typical energy profiles based on the introduced energy database conducted and disseminated with IPs, industrial establishments, the government, and municipalities	PAO.2 Number of analytical and statistical publications produced	No analysis of energy profiles has been conducted yet at selected IPs / SEZs	5 Energy analyses conducted at selected IPs / SEZs Data collection mechanism (1) designed and operational place Protocols report for post-project management of the system and data collection and analysis (1) submitted to the dtic for adoption Annual online reports on data aggregated and processed by the system shared with dtic (minimum 2 reports) Two (2) training sessions for data suppliers and users of the system, including two (2) training reports (target participants of 40, %40 women)	Energy analysis reports Meeting minutes

Output 1.3 IP / SEZ management and tenant companies are provided with guidance on establishing IP / SEZ energy strategies at local sites that are sustainable and foster social inclusion	PAO.1: Number of industrial strategies and industrial policy documents drafted / prepared	0 Technical Roadmap 0 Policy Roadmap	Recommendations for best practices on how to approach energy analysis and strategies at the IP / SEZ levels provided through guidelines report (1) 3 Technical Roadmap: on integrated energy planning strategies for 3 selected municipalities, IPs / SEZs and neighboring communities 1 Policy Roadmap: The policy roadmap and/or relevant regulation including proposals for regulatory and financial aspects related to energy demand and supply, e.g., IPP licensing, feed-in regulation and potential regulations for public-private-partnerships (PPP) is developed and submitted to the Government for adoption.	Roadmaps documentation

Output 1.4 The capacities of key stakeholders on sustainable energy aspects (incl. gender dimensions) at IPs / SEZ are enhanced through workshops and awareness raising	TCO.1 Number of capacity building activities provided	0 Capacity Building events 0 Knowledge products 0 Community of Practice (CoP) meetings 0 Helpdesk operationalized	Five (6) capacity development trainings on energy efficiency and renewable energy solutions are provided for employees and managers of IPs / SEZs and tenant companies as well as municipalities officials (target participants 300, 40% women) Three (3) knowledge products and information on sustainable energy solution aspects (technical, business models and operations, financing) addressed to IPs /SEZ, industrial establishment and municipalities and other stakeholders. Community of Practice (CoP) for relevant stakeholders such as IP / SEZ managers, industrial establishments (tenants) and municipalities through 8 meetings Help desk (1) to support clarifying incoming requests from IPs / SEZs and to facilitate for requested trainings is formed up and operationalized	List of participants (gender disaggregated data) Minutes of Meeting Event Reports Knowledge products

OUTCOME 2 IP / SEZ managements and manufacturing businesses gain confidence and sufficient evidence of the technical, economic, social and environmental viability and benefits of sustainable energy solutions for industrial production in the urban-industrial-energy nexus	INV.2: Number of projects or business financed TEC.3: Number of new technologies adopted	Insufficient evidence-based data on sustainable energy solutions in IPs and SEZs	3 demonstration projects are implemented to create evidence base data on the technical, economic, social and environmental viability and benefits of sustainable energy solutions for industrial production in the urban-industrial-energy nexus	Technology delivery reports 3 case studies of the demonstration projects

Output 2.1 Sustainable energy technology at 3 IP / SEZ pilot projects are implemented to demonstrate low-carbon energy solutions at industrial zone level	INV.2: Number of projects or business financed TEC.3: Number of new technologies adopted	0 Feasibility studies 0 Implementation of sustainable energy solutions	Energy audits and rapid assessment for up to 3 IPs / SEZs to identify potential fields of enhancements Feasibility studies for each demonstration project, including technical and financial assessment, as well as socio-economics impacts Three (3) state of the art energy solutions implemented at selected pilot IPs / SEZs for demonstrating the technical and economic feasibility Monthly and annual operation reports on demonstration, including pilot performance and net environmental, social and economic benefits compared to baseline, uploaded to the data system Conduct before and after energy user questionnaires with six (6) users based on the monitoring methodology Three (3) case studies incl. lessons learned, social and equity impacts, contributing to an increased understanding of financial viability and (required) de-risking instruments for the application of sustainable energy solutions in IPs / SEZs	Energy audits and rapid assessments Feasibility Studies Technology delivery reports

Outcome 3 The Government and the financial sector enhance the financial and investment environment to de-risk investments in sustainable energy infrastructure in IPs / SEZs	POL.3: Number of guidelines adopted by relevant actors INV.1: Number of investment-ready proposals elaborated TCO.1 Number of capacity building activities provided	0	Upscaling strategy (1) and a pipeline of investments (10) de-risks the similar investments in IPs/SEZs	1 upscaling strategy Pipeline of investments Workshop reports
Output 3.1 Strategy for upscaling of IP / SEZ sustainable energy pilot programme is put in place considering gender lens investment principles	POL.3: Number of guidelines adopted by relevant actors	0 upscaling strategies of IP / SEZ sustainable energy pilot programme	Upscaling strategy (1) of IP / SEZ sustainable energy pilot programme, including a technology roadmap and a policy roadmap as key element of the strategy for implementation until 2030 Guidelines report (1) to the government regarding requisite training and support to SMEs and ESCOs to contribute to scaling up and servicing additional value chains and contributing to localization efforts. Recommendation report (1) on introduction procedures for regular and mandatory energy audits at IP / SEZs	Upscaling Strategy document Guidelines report (1) Recommendation report (1)

Output 3.2 A project pipeline of sustainable energy technology investments in IPs / SEZs identified	INV.1: Number of investment-ready proposals elaborated	No support to IPs / SEZs for preparation of bankable projects has been given yet.	Continuous dialogue is structured (4 workshops) between relevant stakeholders and financial sector institutions and stakeholders for identifying financing opportunities 10 IPs / SEZs pipeline projects developed through technical assistance on suitable financial support scheme(s) at the park level to support the uptake of respective measures in additional IPs / SEZs (public and private) across the country	10 project briefs Documentation of meetings Proposal drafts
Output 3.3 The capacity of key stakeholders on financing options for sustainable energy investments in IPs / SEZs are strengthen through establishing a marketplace	TCO.1 Number of capacity building activities provided	No matchmaking platform established yet No annual coordination workshops or conferences	A matchmaking platform (1) (marketplace) for bringing together key stakeholders Three (3) annual dedicated conferences for bringing together all the relevant stakeholders	Conference reports List of participants (gender disaggregated data) Meeting minutes
Outcome 4 The project?s achievements and impact effectively monitored and evaluated	4. Project Results-based Framework set up and implemented	1	1	Project document and progress reports

Output 4.1 Mid-term review	4.1 One independent mid-term review conducted	0	independent mid-term review conducted	MTE report
Output 4.2 Terminal evaluation	4.2 One independent Terminal evaluation conducted	0	Independent Terminal evaluation conducted	TE report

[1] UNIDO Integrated Results and Performance Framework indicators

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

ANNEX C: Status of Utilization of Project Preparation Grant (PPG). (Provide detailed funding amount of the PPG activities financing status in the table below:

The following activities are completed during the PPG phase:

? Stakeholder engagement activities during PPG (consultations, workshops, steering committee)

? Disclosure of relevant studies and information to stakeholders

? Analysis of baseline and ongoing/planned initiatives

? Collection of baseline data on relevant sectors/technologies

? Preparation of relevant technical feasibility studies

? Preparation of environmental and social management plan (ESMP) (for Category B projects)

? Gender Analysis and Action Plan

? Description of the project implementation/execution modalities and agencies (incl. draft TOR for contractual arrangements, assessments of proposed executing agency capacity)

? Obtaining of co-financing letters from donors, NGOs, Agencies and government

? Finalization of project documents

The remaining PPG funds will be spent within the first year of implementation and in accordance with the guidance on eligible expenditure as per the GEF Guidelines on the Project and Program Cycle Policy (2020 update)

Activities	Verification at CEO endorsement submission	Budgeted Amount	Amount Spent to Date	Amount Committed
Stakeholder engagement activities during PPG (stakeholders consultations, inception workshop, validation workshop)	Done. Consultation with all the relevant stakeholders conducted. Inception workshop and validation workshop organized and the outcomes are integrated into project design.	2,000	2,000	0
Validating the collection baseline data on relevant sectors/technologies and ongoing/planned initiatives, policies	Completed and integrated into project document	2,000	2,000	0
HACT based capacity assessment of proposed executing agency	Done. Internal Self HACT assessment is conducted. The capacity of the project executing entity has been found adequate based on the previous collaboration with ENCPC-SA.	13,500	13,500	0
Development of the Environmental and Social Management Plan (ESMP) outlining the relevant risks as well as the mitigation measures for the project	Completed. ESMP is developed and shared along with the submission package.	3,000	3,000	0
Development of Gender Analysis Action Plan	Completed. Gender Analysis Action Plan is developed and shared along with the submission package.	5,000	3,000	2,000
Description of the project implementation/execution modalities and agencies (including drafting ToRs for contractual arrangements on the role of executing agency).	Done. ToRs for national execution is developed and the internal comments are integrated.	2,000	1,000	1,000
Development of detailed ToRs for national execution between ENCPC-SA and UNIDO	Done. The ToR is developed	1,500	500	1,000

Initial pre-feasibility study to compare location, optimization and appropriate business models for the development of sustainable Industrial Parks.	Done in close consultations with relevant stakeholders such as the dtic, ENCPC-SA, CSIR, DBSA etc.	5,000	0	0
Consolidation of all inputs into the CEO Approval Document as per GEF template	Done.	2,000	1,000	1,000
Obtaining co-financing letters from donors, NGOs, agencies and government through consultations	Almost completed. Two letters pending.	2,000	0	2000
Integrate pending comments from PIF stage	Done. Government feedback is integrated into project design.	2,000	1,000	1,000
Stakeholder consultations to verify the CEO approval document and finalization of project document and its annexes.	Done. The project team conducted inception and validation workshops along with bilateral meetings with national stakeholders (e.g., dtic, industrial parks managements, ENCPC-SA, Department of Mineral Resources and Energy (DMRE), CSIR, DBSA etc.	5,000	3,000	2,000
Formal validation of the CEO approval document, UNIDO internal review and submission to GEF Sec; preparation for project start.	Completed	5,000	1,000	4,000
	Total	**50,000**	**36,000**	**14,000**

Remaining funds will be utilized for eligible expenditure items as per GEF Guidelines during project inception, within one year of CEO Approval of the project.

ANNEX D: Project Map(s) and Coordinates

Please attach the geographical location of the project area, if possible.

Name of Pre-selected IP / SEZ	Coordinates
Atlantis Special Economic Zone	-33.59432, 18.47250
Coega Special Economic Zone	-33.79603, 25.6679
East London Industrial Development Zone (ELIDZ)	-33.04845, 27.85346
Ekandustria	-25.69627, 28.7023
Phuthaditjhaba Industrial Park	-28.52763, 28.8965
Umbogintwini Industrial Complex	-30.01657, 30.90392

ANNEX E: Project Budget Table

Please attach a project budget table.

Sum of Budget (USD)	Component 1	Component 2	Component 3	M&E	PMC	Grand Total
Selected PEE	315,322	549,750	194,250		110,400	1,169,722
Contractual Services – Company	62,000	90,500				152,500
Data collection, analysis and management expert team	62,000					62,000
Consultant company to provide TA to IPs		90,500				90,500
International consultants	84,000					84,000
International policy experts	84,000					84,000
Local consultants	24,500		45,000			69,500
National Expert to develop and manage coordination plan	24,500					24,500
National Policy Expert			24,000			24,000
National partnership expert			21,000			21,000
Office supplies					3,400	3,400
Laptops, IT equipment					3,400	3,400
Training/workshop/meeting	40,500		9,750		3,000	53,250
Kick-off workshop					1,500	1,500
Final workshop					1,500	1,500
Trainings and workshops	40,500		9,750			50,250
Travel	25,822	2,000	7,250		8,000	43,072
Travel	25,822	2,000	7,250		8,000	43,072
Salary and benefits / Staff costs	30,000	7,250	13,750			51,000
NPC or a national expert	10,000					10,000
National Project Coordinator (NPC)	20,000	7,250	13,750			41,000
Contractual Services – Individual	48,500		118,500		96,000	263,000
Capacity building expert	48,500					48,500
National Policy Expert			14,000			14,000
Expertise to develop upscaling strategy			42,000			42,000
National Technical Energy Expert (s) to develop pipeline projects			62,500			62,500
PMC - National Project Coordinator (NPC)					56,000	56,000
PMC - National Project Assistant					40,000	40,000
Equipment		450,000				450,000
Grant support for prioritized technology demonstration projects		450,000				450,000
UNIDO				50,000		50,000
Contractual Services – Individual				50,000		50,000
National Independent Evaluation Expert				20,000		20,000
International Independent Evaluation Expert				30,000		30,000
Grand Total	**315,322**	**549,750**	**194,250**	**50,000**	**110,400**	**1,219,722**

ANNEX F: (For NGI only) Termsheet

Instructions. Please submit an finalized termsheet in this section. The NGI Program Call for Proposals provided a template in Annex A of the Call for Proposals that can be used by the Agency. Agencies can use their own termsheets but must add sections on Currency Risk, Co-financing Ratio and Financial Additionality as defined in the template provided in Annex A of the Call for proposals. Termsheets submitted at CEO endorsement stage should include final terms and conditions of the financing.

n/a

ANNEX G: (For NGI only) Reflows

Instructions. Please submit a reflows table as provided in Annex B of the NGI Program Call for Proposals and the Trustee excel sheet for reflows (as provided by the Secretariat or the Trustee) in the Document Section of the CEO endorsement. The Agencys is required to quantify any expected financial return/gains/interests earned on non-grant instruments that will be transferred to the GEF Trust Fund as noted in the Guidelines on the Project and Program Cycle Policy. Partner Agencies will be required to comply with the reflows procedures established in their respective Financial Procedures Agreement with the GEF Trustee. Agencies are welcomed to provide assumptions that explain expected financial reflow schedules.

n/a

ANNEX H: (For NGI only) Agency Capacity to generate reflows

Instructions. The GEF Agency submitting the CEO endorsement request is required to respond to any questions raised as part of the PIF review process that required clarifications on the Agency Capacity to manage reflows. This Annex seeks to demonstrate Agencies? capacity and eligibility to administer NGI resources as established in the Guidelines on the Project and Program Cycle Policy, GEF/C.52/Inf.06/Rev.01, June 9, 2017 (Annex 5).

n/a