Western Cape Government

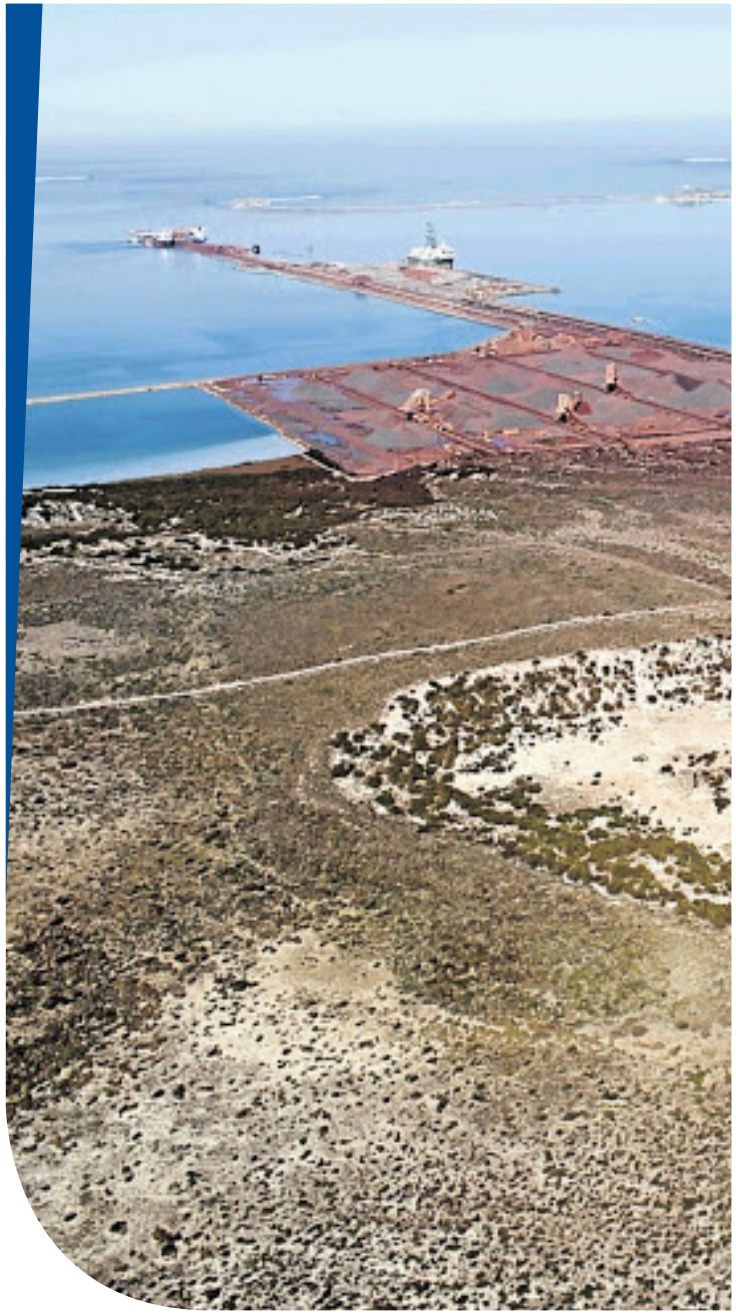
BETTER TOGETHER.

Greater Saldanha Regional Spatial Implementation Framework

Energy and Electricity Grid Corridors

Final Report

December 2017



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Acronyms and Abbreviations

CCGT	Combined Cycle Gas Turbine
CoCT	City of Cape Town
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DEA	National Department of Environmental Affairs
DEA&DP	Western Cape Government: Department of Environmental Affairs & Development Planning
Dx	Distribution
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
ESI	Electricity Supply Industry
GSRSIF	Greater Saldanha Regional Spatial Implementation Framework
GSR	Greater Saldanha Region
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resources Plan
kV	Kilovolt
LNG	Liquefied Natural Gas
MVA	Megavolt Amp
MW	Megawatt
NDP	National Development Plan: Vision 2030
NEMA	National Environmental Management Act, Act 107 of 1998, as amended
NPGPN	National Phased Gas Pipeline Network
NPS	Nuclear Power Station
OCGT	Open Cycle Gas Turbine
PICC	Presidential Infrastructure Coordinating Commission
R&D	Research and Development
RE	Renewable Energy
SBM	Saldanha Bay Municipality
SBNSP	Saldanha Bay Network Strengthening Project
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SFF	Strategic Fuel Fund
SIP	Strategic Integrated Project
TDP	Transmission Development Plan (Eskom)
Tx	Transmission
WC	Western Cape
WCG	Western Cape Government
WCIF	Western Cape Infrastructure Framework
WCIP	West Coast Industrial Plan

1. Introduction

1.1. Background

In March 2014, the Western Cape Minister of Local Government, Environmental Affairs and Development Planning approved the Western Cape Provincial Spatial Development Framework (PSDF).

In adopting a strategic view of the Provincial space economy, the PSDF identified three functional regions where significant development trends and/or development potentials were seen to exist. One of these identified functional regions is the emerging Greater Saldanha Regional Industrial Complex, with the Saldanha Bay/Vredenburg growth centre at its heart.

This Greater Saldanha Region (GSR) is noted as experiencing a wide range of developmental and environmental initiatives driven by an array of role-players. These initiatives, furthermore, are likely to be progressively realised in implementation programmes over an extended period of time.

It is against this background that the Western Cape Government: Department of Environmental Affairs & Development Planning (WCG: DEADP), in partnership with the municipalities in the West Coast district, agreed to collaborate in preparing a Regional Spatial Implementation Framework (RSIF) for the broadly defined Greater Saldanha Region, with a specific focus on the Saldanha Bay/ Vredenburg development centre, and the adjoining towns of the bordering municipalities of Swartland and Bergrivier.

1.2. Project Terms of Reference

The Greater Saldanha RSIF (GSRSIF) was originally directed to address the following priorities for the Greater Saldanha Region:

- Improving regional competiveness;
- Skills Development (education) linked to Job Creation (assimilating young people out of schools);
- Integrated Social Strategy: Co-ordination and building of social capital in all stakeholders through an appropriate structure (per municipality) supported by a Social Contract; and
- Infrastructure: Integrated Planning and Budgeting.

In addressing all the above, the project Terms of Reference specified that the GSRSIF should contain the following elements:

1. A vision for the integrated development of the functional region.
2. An assessment of the existing levels of development in the functional region.
3. An assessment of the challenges of provincial land use planning in relation to other provincial functional areas listed in Schedules 4 and 5 of the Constitution;
4. An assessment of Provincial priorities, objectives and strategies, dealing in particular with:
   - Compliance with land use planning principles as set out in LUPA;
   - Biodiversity, ecology, tourism, heritage and agricultural resources, socio-economic development, efficient use of resources and government infrastructure; and
   - Adaptation to climate change, mitigation of the impact of climate change, renewable energy production and energy conservation.
5. A review and update of the Greater Saldanha Area Environmental Management Framework that includes a Strategic Environmental Management Plan.
6. Proposals to unlock opportunities in the functional region's space-economy,
7. including the identification of a list of catalytic governmental regional infrastructure projects
8. by determining bulk infrastructure requirements for water, solid waste, energy, and transport over the next 15 years; taking into account existing Infrastructure Growth Plans (IGP) and the Industrial Project Inventory conducted by the DEDAT; also including three-year action plans to align and inform the MTEF.
9. An accessibility analysis for social infrastructure (i.e. education, health, libraries and sport facilities) for the West Coast District.
10. Proposals on the rationalisation and clustering of social services and facilities in order for government to deliver these services in an integrated and financial sustainable manner.
11. A determination of the viability of different public transport options, as well an investigation on the shift from road to rail for freight.
12. Proposals on settlement level strategies that align housing with transport, land-use, economic and large-scale infrastructure decisions within a long-term vision of a more integrated region.
13. Categories of land development that will require approval under section 53(1) of LUPA.
14. A description of the process followed in the drafting of the Regional Spatial Implementation Framework.

1.3. Outputs of the GSRSIF

Following an initial phase of work that addressed the Status Quo and SWOT elements of the overall project, the full range of outputs required of the GSRSIF was reassessed and a variation order was approved by the Provincial Tender Bid Adjudication Committee, in February 2017.

Accordingly, in order to achieve the desired GSRSIF project outcomes, the Professional Team is to deliver a number of outputs within an overall 21-month programme, as follows:

- Inception Report (month 1)
- Status Quo Assessment Report (months 2 – 6)
- SWOT Analysis (months 6 – 12)
- Thematic Component Studies (months 2 – 17)
  - Review and Update of draft Greater Saldanha Environmental Management Framework
  - West Coast District Social Facilities Study
  - Economic Development Enabling Infrastructure Assessment
  - Information Communications Technology (ICT) Thematic Study
  - Energy Grid/Corridors Framework
  - Regional Transport and Freight Assessment
- Summary Report and Implementation Framework (months 17 – 21)

The revised scheme of work and outputs to be completed for the GSRSIF is illustrated below in Diagram 1.

1.4. This Report

The West Coast Industrial Plan (WCIP) completed in March 2016 and supplementary work carried out in terms of the report on Economic Development Enabling Infrastructure in March 2017, highlighted the extent to which the timely and adequate supply of electricity in the GSR (and, most especially, in the Saldanha-Vredenburg development centre) is a prerequisite to enable the successful take-off of envisaged larger scale industrial development there, over time.

In addition, debates relating to the role that the Saldanha-Vredenburg area may play in the generation of electricity into the Provincial Energy Grid have also been raised in the context of the use of Liquefied Natural Gas (LNG) as a transition fuel to be used in balancing and/or baseload electricity generation as part of the longer term move away from the country's historic reliance on coal, a carbon-rich fossil fuel acknowledged to be environmentally detrimental. This idea was set out initially in the White Paper on the Energy Policy of South Africa (Department of Minerals and Energy, 1998), and further endorsed in the National Development Plan (NDP, 2011) and the Western Cape Infrastructure Framework (WCIF, 2013).

Within the broader context of implementing the use of LNG as part of the Natural Gas feedstock, the Port of Saldanha Bay was seen as one of three potential ports for the landing of imported LNG. While subsequent studies reportedly carried out by the Department of Energy have suggested that the ports of Richards Bay and Coega are better suited in the short-term for the importation of LNG[1], the apparent strength of the business case relating to the importation and use of LNG to generate both baseload electricity in the Western Cape as well as serve as a source of energy for prospective industrial developments in the Saldanha-Vredenburg area is such that the role of the Port of Saldanha in the short-medium term remains an attractive proposition for some role-players[2].

In the light of debates such as these, which touch on the potential development trajectory of the GSR, this report seeks to achieve the following:

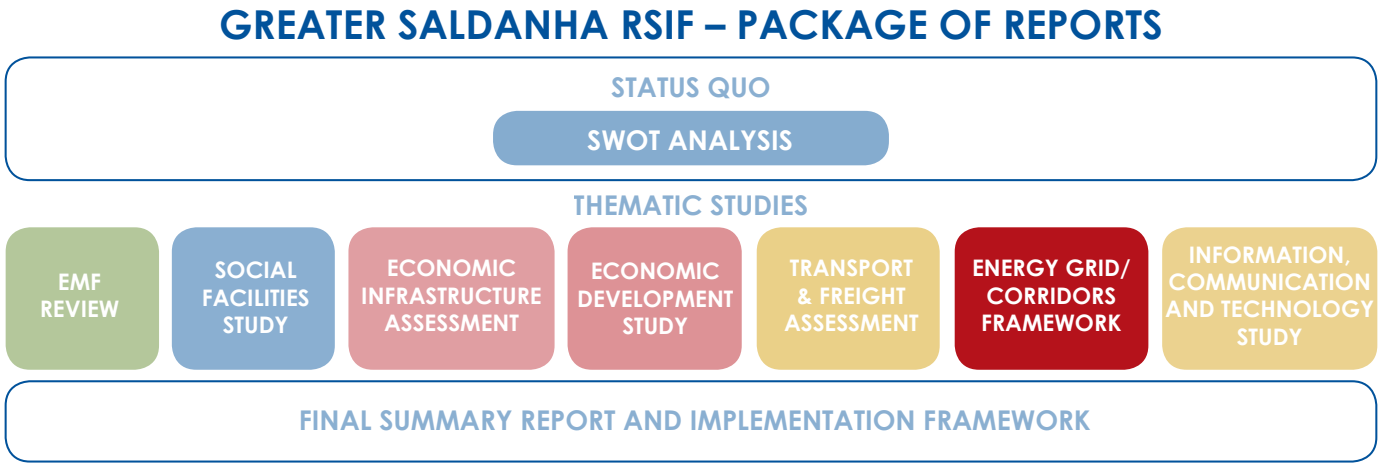

Diagram 1. GSRSIF Package of Reports

1 https://gaslng.ipp-gas.co.za; accessed 19 September 2017
2 Interview with Mr H. Jonker, WCG: Department of Economic Development & Tourism, 19 July 2017

1. To review briefly the legal and regulatory context for electricity generation, transmission and distribution together with some of the debates relating to the mix of energy sources that will fuel electricity generation in the GSR in the foreseeable future.
2. The report also seeks to understand, where possible, the configuration of current and future planned energy corridors (gas pipeline as well as electricity transmission and distribution powerline route alignments) and major electricity transmission and distribution facilities (substations) in order to consider the spatial implications of these.
3. Finally, the report identifies possible ways and means for the use of spatial planning tools and instruments to ease the path of regulatory approvals that are required when new infrastructure and energy corridors are planned and implemented.

This work is intended to feed into further Provincial and Municipal planning processes as an informant towards contributing to the establishment of ongoing iterative processes for engagement (institutional arrangements) around the planning and implementation of electricity infrastructure and related spatial allocations for energy corridors and installations.

1.5. Report Structure

This report is structured as follows: -

Section 2 deals in brief with the following contextual aspects: -

- The Statutory and Regulatory context of the electricity and gas components of the energy sector;
- The Status Quo of the current Bulk Electricity Infrastructure in the GSR.

Section 3 deals with the following: -

- The Policy context and related Strategic programmes of government as these relate to the energy sector in the GSR;
- Sketching out in brief three Energy Scenarios, and examining the potential spatial implications of these in the GSR; and
- Identifying the current forward planning related to the Electricity Transmission and Distribution Networks in the GSR as well as the Phased Gas Pipeline Network Initiative, and highlighting the potential spatial implications of this.

Section 4 addresses: -

- A broad discussion on potential spatial planning tools and instruments that may be used in reflecting known aspects of forward planning related to the Energy Network in a way that might ease the path of regulatory approvals for future implementation of infrastructure; and
- A consideration of possible institutional arrangements that may assist in ensuring closer collaboration between all critical role-players in the fields of energy grid network planning, spatial planning, environmental management and land development management at the levels of national government, State-Owned Enterprises (SOEs), provincial government and local government.
- Highlighting the key conclusions drawn from the previous sections of the report and setting out any relevant recommendations.

2. Context

In 2012, the Cabinet adopted the National Development Plan (NDP), which remains, formally, the Plan that guides the key programmes and strategic objectives of Government in South Africa.

At an overarching policy level, the NDP makes a number of statements on South Africa's energy future; notably envisaging that, by 2030, the country would have an adequate supply of electricity and liquid fuels to meet its needs. Amongst its key proposals in this regard are: -

- The country must move to less carbon-intensive electricity production through procuring at least 20,000MW of renewable energy (thus reducing carbon emissions from the electricity industry from 0.9 kg/kilowatt-hour to 0.6 kg/ kilowatt-hour), increased hydro-imports from the region and increased demand-side measures, including solar water heating
- The country must seek to incorporate a greater share of gas in the energy mix, both through importing liquefied natural gas and, if reserves prove commercial, using shale gas. Moreover, in this regard, the country must seek to develop infrastructure for the import of liquefied natural gas, mainly for power production, over the short to medium term.

The above may be seen as providing a broad "Energy Agenda" for the Electricity Supply Industry (ESI) within which the government has moved to develop its policies and programmes, accordingly.

2.1. Energy Generation and Electricity: A Broad Legal and Regulatory Context

The electricity, piped-gas and petroleum pipeline industries are regulated by the National Energy Regulator of South Africa (NERSA), established in terms of the National Energy Regulation Act (Act 40 of 2004). NERSA's mandate is to regulate these industries in terms of the provisions of the following legislation:

- The Electricity Regulation Act (Act 4 of 2006)
- The Gas Act (Act 48 of 2001) and
- The Petroleum Pipelines Act (Act 60 of 2003)

In addition, the National Energy Act (Act 34 of 2008) is intended to "ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy".

The above suite of legislation makes provision for the country's energy needs and electricity supply to be determined and guided through the formulation of:

Policy Framework: Integrated Energy Plan – in terms of National Energy Act (34 of 2008)

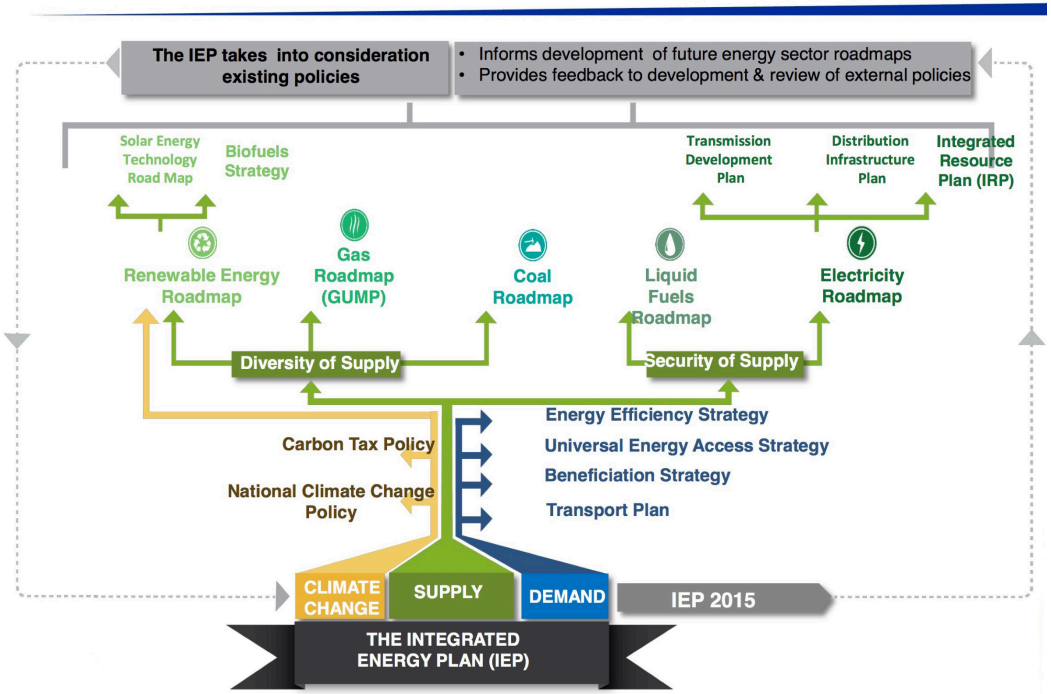

Figure 1. Overall relationship of the IEP and other Plans in Energy Planning

4. An Integrated Energy Plan (IEP – in terms of the National Energy Act) that is intended to be the overall energy plan for the country, dealing with the sectors of liquid fuels (petrol, diesel, paraffin), gas and electricity. Currently, a Draft IEP (released in November 2016) is under review following a public commentary period; and
5. An Integrated Resources Plan (IRP) that deals in greater detail with the generation and supply of electricity. The IRP is seen as a sub-set of the IEP and IRP 2010-2030 was approved in March 2011 as "a living plan", to be periodically updated. At end-2016, the IRP was issued in a draft revised form, informed by a Base Case Scenario, that is also subject to comment and review, as at the time of writing.

In general, it is understood that the position of the Department of Energy as per the draft IEP (2016) is that, in order to meet South Africa's energy needs whilst reducing carbon emissions over time, in line with the country's obligations as a signatory to the Paris Accord (2015), emphasis is to be placed on broadening electricity supply technologies to include LNG and LNG imports, nuclear, biomass and renewable energy resources (wind, solar and hydro).

Nevertheless, these planning processes have been (and remain) highly contested and the draft IEP and IRP 2010-2030 are not seen, at the time of writing, as providing definitive and clear-cut pathways toward a sustainable mix of energy sources and a sustainable ESI.

For example, in its formal comments on the draft updated IRP (2016), the Council for Scientific and Industrial Research (CSIR) submitted a modelled Least Cost scenario for electricity provision up to 2050 that, it argued, demonstrated that "it is least cost for any new investment in the power sector to be solar PV, wind or flexible power. Solar PV, wind and flexible power generators (e.g. gas, CSP, hydro, biogas) are the cheapest new-build mix". The CSIR comment noted further that the "Least Cost scenario run is the mix that is the cheapest, emits less CO2, consumes less water and creates more jobs in the electricity sector than both Draft IRP 2016 Base Case and Carbon Budget scenarios."[3]

Despite such authoritative inputs, the Department of Energy remains apparently committed to implementing a nuclear power station build programme as contemplated in the IRP (2016), which proposes a need for new nuclear generation to be brought into the energy mix at around 2037. Equally, however, several stakeholder groupings remain resolute in calling into question the rationality and bona fides of this strategy, in the light of inputs such as those from the CSIR[4].

This makes any forward planning within the context of the GSR more challenging as it results in questions which remain unanswered in relation to aspects such as energy generation configuration and fuel sources (nuclear vs LNG vs renewables etc.).

2.1.1. The Electricity Supply Industry in Outline

When the Electricity Regulation Act was promulgated in 2006, South Africa's ESI was dominated by Eskom, incorporated as a public company (State Owned Enterprise with the Government as the sole shareholder) since 1 July 2002. As the successor to the state power utility known as the Electricity Supply Commission (Escom), which was created in March 1923, Eskom was a vertically integrated monopoly responsible for almost all the generation, transmission and bulk distribution of electricity in the country.

In line with the prescripts of the 1998 White Paper on the Energy Policy of South Africa, various policy enactments were undertaken in the early 2000s to try to advance a more competitive ESI. In this regard, the Electricity Regulation Act thus made provision for so-called Independent Power Producers (IPPs) to undertake electricity generation.

However, the prospect of competition and the potential unbundling of Eskom proved socio-politically controversial and, whilst Eskom was split into three divisions covering the operations of Generation, Transmission and Distribution, it remains responsible for some 95% of electricity generation[5] and still owns all the major electricity grid infrastructure (EGI).

Following the initial investigations related to the potential unbundling of Eskom in the early 2000s, a Cabinet decision led to a Ministerial Determination in September 2007, in terms of Section 34 of the Electricity Regulation Act, to adopt a so-called Single Buyer Model for the ESI[6].

This market model effectively creates a system where, in line with the legislative framework and Ministerial Determinations made (as guided by the IRP) the national Department of Energy acts to procure specified amounts of electricity generated by NERSA-approved IPPs (generating electricity from various sources, including renewable sources).

Eskom, as the single owner/operator of the transmission and bulk distribution networks in the country, is solely authorised to purchase the generated electricity (at the rate-cost as per the outcomes of the DoE procurement process) and introduce this into its grid network in a manner that secures the integrity and stability of the national power supply to meet the demand across all regions of the country.

Currently, Eskom reports the following programmes fall under the ambit of its Single Buyer Office[7]:

1. **Renewable Energy Independent Power Producer (REIPP) programme:** which requires up to 3725 MW of renewable energy capacity as specified in the IRP 2010.
2. **Medium Term Power Purchase Programme:** which covers power purchase agreements for approximately 400 MW of co-generation and generation capacity, approved and concluded.
3. **Department of Energy Open Cycle Gas Turbine (OCGT) programme:** which calls for 1020 MW generation capacity
4. **Municipality generation and short-term contracts for security of supply.**
5. **Small Renewable IPP programme:** The DoE has initiated the small renewable IPP (SRIPP) programme by releasing a request for information (RFI) in order to test the market appetite for small projects and assess the readiness of (onshore wind, solar PV, biomass, biogas, or landfill gas) projects within the 1 to 5 MW capacity band.

3 Formal comments on the Integrated Resource Plan (IRP) Update Assumptions, Base Case and Observations 2016, CSIR, April 2017
4 see, for example, https://www.outa.co.za/nuclear-campaign - accessed 19 September 2017

5 http://www.gov.za/about-sa/energy - accessed 19 September 2017
6 Tuson, P. and Power, P: Willing-seller/willing-buyer in a single buyer model, 2008 (http://www.ee.co.za/wp-content/uploads/legacy/TranT_Willing.pdf - accessed 19 September 2017)

7 http://www.eskom.co.za/Whatweredoing/Pages/GuideIPP.aspx - accessed 19 September 2017

6. **Regional Import IPP programmes:** Currently Eskom is supporting Government led initiatives in regions without providing financial commitment. Future IRPs will have to provide specific direction on which programmes to pursue.

Again, as with the situation related to the overall balance of decisions regarding the optimum mix of energy sources in the country going forward, the status of Eskom's willingness and/or financial ability to continue as a purchaser of electricity from IPPs beyond already contracted-in Power Purchase Agreements (PPAs) is somewhat uncertain, at the time of writing[8]. This also, once more, introduces an element of uncertainty into the overall system architecture and operational design.

Of note with regard to the above is that, from the perspective of local-, regional- and provincial-scale planning and development initiatives, the current configuration of the ESI effectively prohibits (public or private) institutions at those spheres to make electricity supply arrangements (other than individual instances of licensed generation for own use) that might be more flexible, responsive to need and demand, and, importantly, more cost efficient and environmentally sustainable.

That is likely to be seen as a hindrance to the ability of such institutions to act in support of legitimate, strategic development and/or business objectives that may be in their own or in the general public's best interest. In this regard, the current situation may be open to challenge on Constitutional grounds, as has recently been contended in a High Court application brought in July 2017 by the CoCT against the Minister of Energy[9].

2.1.2. The Oil and Gas Sector in Outline

In line with the adopted NDP, government moved to launch a so-called "fast results programme" entitled Operation Phakisa in July 2014.

8 https://www.businesslive.co.za/bd/companies/energy/2017-09-01-eskom-gets-deadline-to-sign-deals-with-ipps--but-gets-reprieve-on-price/ - accessed 19 September 2017

9 On this, see, for example, http://blog.caf.co.za/?p=477, C&A Friedlander Attorneys, 1 August 2017 (accessed on 19 September 2017)

Amongst a number of sectoral initiatives pursued in terms of Operation Phakisa, one was the so-called "Offshore Oil and Gas Lab". Recognizing that

South Africa's oil and gas sector is in a relatively early stage of development, the Lab sought to investigate the sector's potential to create large value for the country in the long term.

In this regard, the CSIR notes that South Africa has "potential resources of approximately 9 billion barrels oil and 11 billion barrels oil equivalent of gas. In order to realise the potential of the gas reserves in the country and to contribute to the transition to a low carbon economy, the Operation Phakisa Offshore Oil and Gas Lab… set a target of achieving 30 exploration wells in the next 10 years. In addition, the need to accelerate the planning for gas to power as part of the Government's Integrated Resource Plan (IRP) and for State Owned Entities to pre-plan for the logical development of gas transmission servitudes within South Africa was recognized"[10].

Within the national-scale of activities in this regard, the West Coast of South Africa is seen to hold some prospects of resources of economic significance (e.g. the Ibhubesi and Kudu Gas fields in the Orange Basin), as illustrated below:

10 https://gasnetwork.csir.co.za/ - (accessed on 19 September 2017)

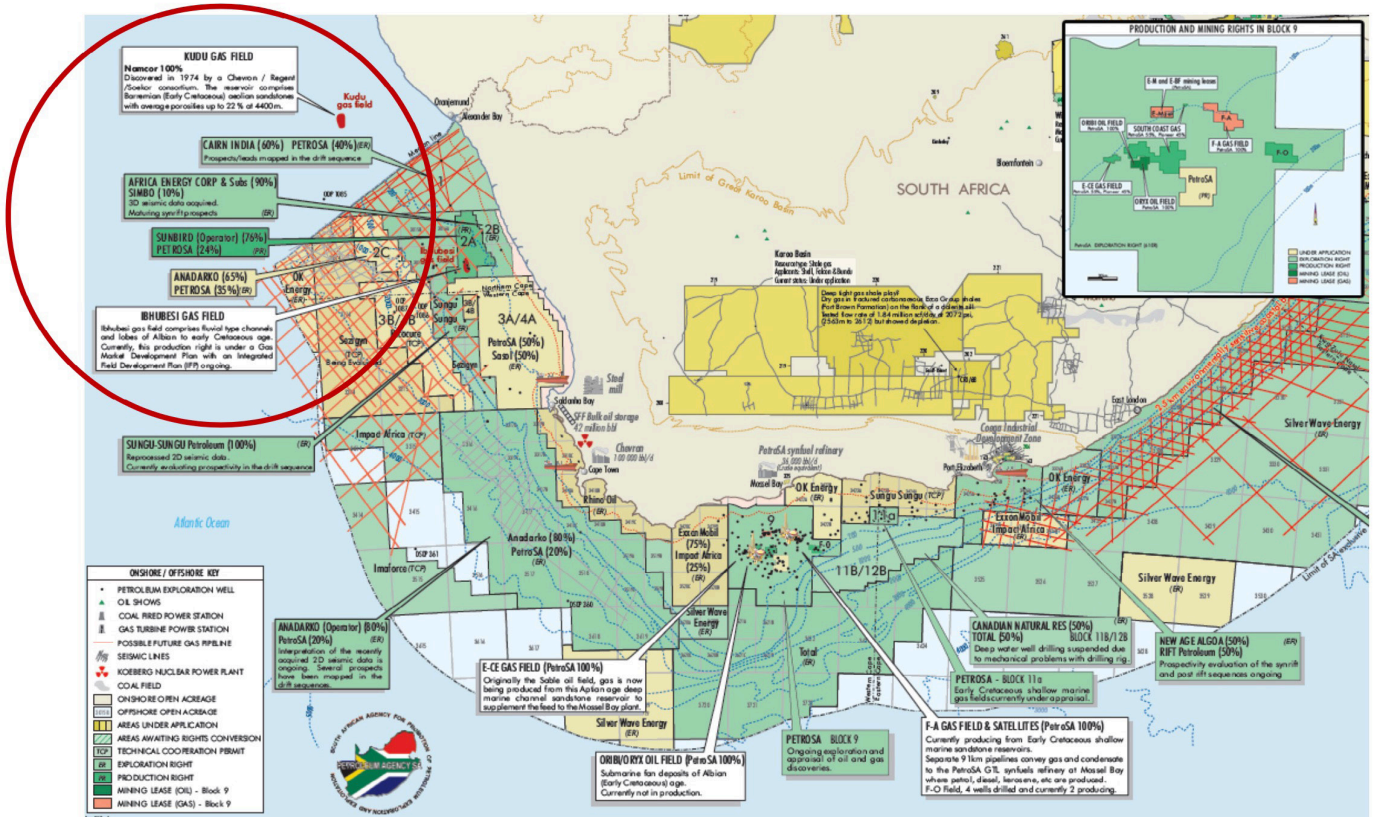

Figure 2. Overview of Prospective Onshore and Offshore Oil and Gas Resources

The Operation Phakisa Oil and Gas Lab identified 11 initiatives needed to press forward with developing the oil and gas sector in South Africa. Amongst these key initiatives is included the development of a National Phased Gas Pipeline Network (NPGPN).

As part of this report, the spatial implications of the NPGPN as it pertains to the GSR will be further discussed in Section 3.

2.2. Status Quo of the Electricity Network in GSR[11]

This section provides an overview of the inputs drawn from the West Coast Industrial Plan (WCIP, March 2016) and a follow-up report entitled Assessment of Regional Economic Infrastructure in the Saldanha Bay, Bergrivier and Swartland Local Municipal Areas (March 2017).

2.2.1. Current Electricity Grid Infrastructure (EGI)

Eskom's Western Cape transmission network stretches over a distance of about 550 km from Gamma substation (near Victoria West) to Philippi substation (near Cape Town). Koeberg Power Station is the only baseload power station situated locally. There are also four peaking plants in the Western Cape, consisting of pumped-storage and gas turbine generation, which help to meet the demand in the region.

At the Provincial-scale, the Western Cape has a peak daily demand of around 4 000 MW, of which around 1 800 MW can be generated at Koeberg. In total, in order to meet daily demand as well as meet its electricity export commitments to Namibia, Eskom imports around 2 000 MW into the Western Cape daily, from its generation pool in the Highveld via Eskom's Cape Corridor. In this regard, the first 765 kV line connecting the Kappa substation to Sterrekus substation was completed in late 2016, increasing the Cape Corridor's power transfer capability by approximately 1 500 MW[12].

The West Coast region's bulk supply of electricity is provided by Eskom, while the municipalities provide reticulation and distribution within most their respective urban centres.

Based on Eskom's 2011 West Coast Master Planning investigation, the regional electrical network is ageing, and in need of a number of strengthening, upgrading and rehabilitation projects.

The main transmission substations (MTS) in the area are situated at Muldersvlei to the south-east, and the Aurora MTS between Saldanha and Hopefield. Upgrades to the Muldersvlei MTS were completed in 2015.

Currently, the Saldanha Bay area is fed from the 400MVA Aurora substation via a 132-kV line to the Blouwater substation. This substation is already constrained on transmission capacity and will require an upgrade to be able to distribute electricity (either from Eskom or from local IPP power generators in the area).

The towns of Vredenburg, Saldanha, St Helena Bay and Velddrif are supplied through 66kV networks while Langebaan, Jacobsbaai and Paternoster are supplied through 11 kV networks. There is currently 66MVA available capacity at the substation in Blouwater which has been allocated to the proposed rare earth mineral beneficiation project.

Figure 3. Close-up of Western Cape provincial transmission network (Source: extract from Figure 6.29 of Eskom's 2016-2025 TDP)

11 Much of this section is based on the report entitled Assessment of Regional Economic Infrastructure in the Saldanha Bay, Bergrivier and Swartland Local Municipal Areas, prepared by PDG (March 2017) as an input into the GSRSIF process.

12 http://www.engineeringnews.co.za/article/eskom-commissions-765-kv-transmission-line-in-western-cape-2016-12-01/rep_id:4136

Figure 4. Eskom's West Coast South distribution system

Figure 5. Zones served by individual substations

2.2.2. Future Development Demand and Capacity Impact Projections in GSR

The West Coast Industrial Plan (WCIP, March 2016) and a follow-up report entitled Assessment of Regional Economic Infrastructure in the Saldanha Bay, Bergrivier and Swartland Local Municipal Areas (March 2017) attempted to project demand in the major infrastructure services networks, based on identified projects that were assessed as likely to be implemented in the short to medium term.

This work highlighted that identified industrial and mining activities proposed in Saldanha result in a substantially higher demand for electricity, relative to Bergrivier and Swartland. These outcomes are detailed as follows:

- It is estimated that the Saldanha projects will result in an additional 140 MVA load demand on the distribution network.
- The Swartland projects are estimated to increase the load demand by an additional 25 MVA and Bergrivier by 9 MVA.
- In Swartland the majority of the increased demand is driven by the projects located in Malmesbury, while Bergrivier is approximately equally distributed between Piketberg and Velddrif.

From the perspective of assessing the impact of the anticipated future projects on the current electricity network capacity in the GSR study area, the following was noted:

- Three of the substation service areas in the study area were projected by Eskom to have reached load capacity by 2017 namely, Velddrif, Darling and Ongegund.
- Piketberg and Malmesbury substations are projected to have adequate capacity available to accommodate the developments through at least one substation.
- It is estimated that the Blouwater substation will be inadequate to accommodate the Saldanha developments within the available capacity.
- However, the more recently installed Aurora substation serving a regional service area is projected to have over 450 MVA capacity available for future development and, as such, is projected to have more than adequate capacity to accommodate the regional load demands driven by the projects located in its extended service area.

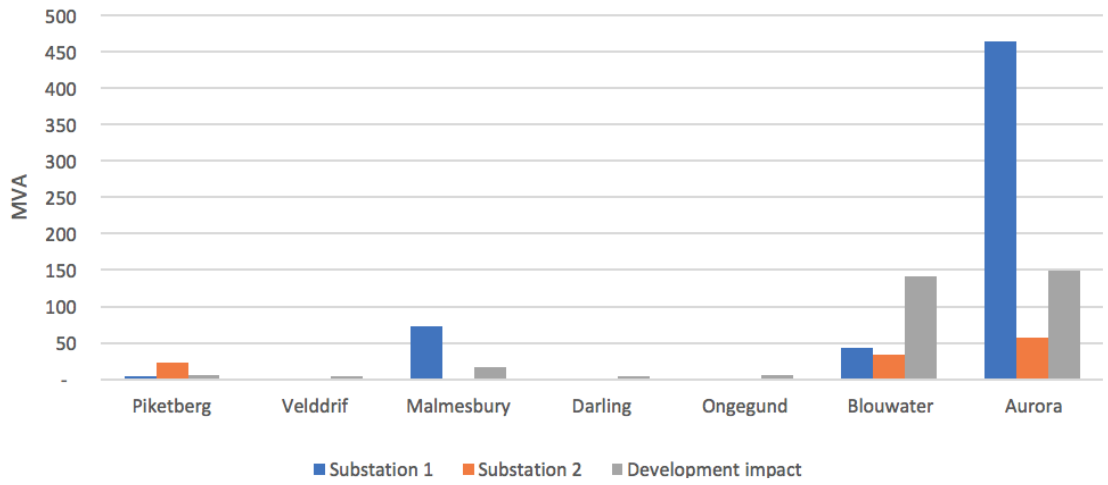

Figure 6. Substation load capacity and estimated additional demand (Data source: Eskom Western Cape West Coast Master Plan: load forecasting, 2011)

Table 1. Projects of Relevance in the GSR (Eskom TDP 2016-2025))

SCHEME NAME	PROJECT NAME	EXPECTED YEAR
Cape Corridor Phase 2: Gamma-Kappa-Sterrekus 765 kV Line	• Kappa-Sterrekus 1st 765 kV line • Loop-in-and-out Koeberg-Muldersvlei 400 kV line into Sterrekus • Sterrekus substation 1st 765/400 kV 2 000 MVA transformer	**Completed**
Muldersvlei Ext. 3rd 500 MVA 400/132 kV Transformer and 132 kV Series Reactors	• Replace the 2 x 240 MVA units with a 3rd 500 MVA 400/132 kV transformer and 132 kV series reactors	2018
Saldanha Bay Network Strengthening (Phase 1)	• At Aurora substation, replace two of the four existing 400/132 kV 250 MVA units with 2 x 500 MVA units as part of refurbishment • Strategically acquire a substation site in the Saldanha Bay area • Construct 2 x 400 kV lines (operated at 132 kV) from Aurora substation to the new distribution Blouwater substation	2022
Saldanha Bay Network Strengthening (Phase 2)	• Blouwater Transmission substation (1st and 2nd 400/132 kV 500 MVA transformers) • Loop-in Ankerlig-Aurora 1 400 kV line	**Deferred**
Cape Corridor Phase 5: 3rd 765 kV Line	• 3rd 765 kV line (West Coast alignment)	Strategic

2.2.3. Upgrade Proposals for the West Coast EGI

Eskom's 2011 load forecasting exercise took numerous development proposals into account in the West Coast region, many of which are included in the project list of the WCIP.

Based on these load forecasts, overload was predicted at the Aurora, Hopefield and Yzerfontein sub-stations without system improvement.

Further capacity constraints were identified at Blouwater, Darling, Langebaan, Velddrif, De Hoek and Mooreesburg substations, and upgrades were planned accordingly.

In this regard, the most significant intervention on the part of Eskom in planning for future electricity demands in the GSR is the Saldanha Bay Network Strengthening Project (SBNSP)

However, of potential concern at present is that, despite the projections that the upgrade of the Aurora substation and its linkages to the Blouwater substation (Phase 1 of the SBNSP) is seen to be of greatest importance in ensuring supply capacity to support projected growth in the GSR, Eskom's latest available Transmission Development Plan (TDP, 2016-2025), indicates that the Aurora substation upgrades have been delayed until 2022 (but are still noted as a priority in the region). Furthermore, Phase 2, which is the upgrade of the Blouwater substation is noted as being "deferred".

Table 1 highlights the current time estimations given by Eskom in the Transmission Development Plan (2016-2025) for projects that are of direct relevance to the GSR in terms of impact and/or spatial requirements.

With regard to the above issues on timing of network upgrades, it is understood that Eskom carries out consistent monitoring of demand as well as project uptake in its planning areas and, given the current levels of demand in the network and prevailing uncertainty in the rate of development of projects in the Saldanha Bay area – taken with a fiscally constrained investment environment for Eskom – the challenge of ensuring timely investment in the SBNSP becomes one that may require facilitation and/or intervention at strategic levels. At present, however, the assessment by Eskom appears to be that the level of demand does not warrant a revision of their TDP timetable[13].

2.2.3.1 Saldanha Bay Network Strengthening Project

As noted above, Eskom's Transmission Development Plan (2016 – 2025) indicates that the main project to augment transmission capacity in the GSR will be the Saldanha Bay Network Strengthening Project. This project is currently at EIA stage, with a Record of Decision under appeal, as at the time of writing (September/October 2017).

According to the EIA[14], the scope of the Saldanha Bay Network Strengthening Project includes the following elements:

- Construction of a new 400/132kV Transmission Substation in the Saldanha Bay area with a planned capacity of 3 x 500 MVA transformers. The transmission substation footprint will be 600m x 600m
- Construction of a new 132/66kV Distribution Substation near the current Blouwater Substation in the Saldanha Bay area. The distribution substation footprint will be 120m x 120m.
- The construction of two 400kV power lines (approximately 35 - 40 km) from the Aurora Substation to the new proposed distribution and transmission substations. A servitude of 55m is required for each power line
- Construction of 3 x double circuit 132kV power lines to connect the new distribution substation to the new transmission substation.
- Replacing two of the four existing 250 MVA 400/132kV transformers with 2 x 500 MVA transformers at Aurora Substation.
- Establishing 2 x 132 kV feeder bays around Aurora Substation."

While Phase 1 of the Saldanha Bay Network Strengthening Project is planned for 2022 as per the Transmission Development Plan, Phase 2 which involves the actual upgrading of the Blouwater substation in Saldanha has been deferred to a later date (no year given)[15].

2.2.4. GSR Electricity Implications

An initial analysis of the proposed industrial developments investigated under the WCIP process suggests that the upgrade of the Blouwater substation and the installation of a single 400kV transmission line should be sufficient to satisfy the projected demand to the Saldanha Bay area.

Given the assumption that Blouwater substation is nearing capacity, any increase in demand (irrespective of if the proposed industrial developments proceed) would require the immediate upgrading of Blouwater substation and the transmission line. However, Eskom's Ten-Year Plan indicates that this upgrade is only planned for 2022 or later.

The largest bulk regional infrastructural component relating to the capacity of the region, the Aurora substation, is estimated to have surplus capacity to accommodate the load demands of the identified projects. However, at the local scale, according to the Eskom West Coast Masterplan projections, the projects located in three of the towns could not be accommodated in the immediate term. Furthermore, the projected Blouwater substation capacity deficit could impede a number of projects in Saldanha Bay and therefore negatively impact on economic development in the region.

This, therefore, raises an important issue related to the timing of network upgrades and also further highlights the need for a forum or vehicle of some sort that would facilitate engagement on this issue between Eskom and Provincial and Local Government stakeholders.

13 Refer to Minutes of the GSRSIF Energy Focus Group held in Vredenburg on 30 August 2017
14 Savannah Environmental Pty (Ltd), January 2017. Revised EIA Report, Saldanha Bay Network Strengthening Project
15 Eskom, October 2015. Transmission Development Plan 2016-2025

3. Future Electricity Generation Scenarios and Associated Corridors for Electricity Grid Infrastructure and Gas Pipelines

3.1. Summary of Policy Framework

Within the complex array of South Africa's legal and policy frameworks, the implementation of activities related to the development of a multifaceted, sustainable energy sector are directed in terms of a number of key programmes, which take their lead from the National Development Plan, 2012. The principal programmes of relevance are noted as follows: -

- The Energy Strategic Integrated Projects (SIPs 8, 9 and 10), which are being implemented in terms of the SA National Infrastructure Plan, 2012, and are overseen by the Presidential Infrastructure Coordinating Commission (PICC)
- The Oil and Gas Lab undertaken in terms of Operation Phakisa

In addition, at the Provincial level, the Western Cape Infrastructure Framework (2013) identified energy transition strategies, which included:

1. Introduce infrastructure so that natural gas can be used as a transition fuel.
2. Align energy generation infrastructure with a point of gas import (e.g. Saldanha Bay).
3. Develop the renewable energy sector.
4. Shift transport patterns to reduce reliance on liquid fuel[16].

The above elements of an overarching Policy Framework may be taken to drive sectoral activities in relation to developing the energy sector, with particularly relevant application in the GSR as regards:

SIP 8: Green Energy in support of the South African economy

Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IPR2010 and to support biofuel production facilities.

SIP 9: Electricity Generation to support socio-economic development

Accelerate the construction of new electricity generation capacity in accordance with the IRP2010 to meet the needs of the economy and address historical imbalances.

SIP 10: Electricity Transmission and Distribution for all

Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development.

Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity.

Figure 7. Energy SIPs (Source: PICC, 2012. Presentation: Summary of the National Infrastructure Plan)

- **SIP 8: Green Energy in Support of the South Africa Economy** may be seen to underpin the sequential Bid Windows of the Renewable Energy Independent Power Producers Programme (REIPPP) that have occurred to date and which have led to a number of RE projects being located in the GSR, including
  - Aurora Solar PV Project
  - Swartland Solar PV Project
  - West Coast 1 Wind Farm
  - Hopefield Wind Farm
  - Darling Wind Farm
- **SIP 9: Electricity Generation to Support Socio-Economic Development** may be seen to be underpinning the state's IEP and IRP processes as well as Eskom's power station build programmes, including the conversion of the Ankerlig Peaking Power Station from diesel-fired OCGT technology to LNG-fired CCGT technology, and Nuclear 1; and
- **SIP 10: Electricity Transmission and Distribution for All** may be seen to underpin Eskom's sequential annual Transmission Development Plans that seek to respond to electricity demand by programming as best possible a logical approach to rolling out the national Electricity Grid Infrastructure (EGI) and associated spatial corridors.

16 This report is not focused on liquid fuel issues though, from a spatial perspective, it is noted that a 108 km-long Pipeline owned by Chevron transports crude oil between the Strategic Fuel Fund Storage Tank Farm at Saldanha to the Chevron Refinery located to the south in Milnerton. This is noted as forming part of the energy grid corridors in the GSR and Greater Cape Metro region.

In order to assess the potential spatial impact of the existing and potential future Electricity Grid Infrastructure (EGI) and Gas Pipeline Infrastructure, this section sketches three potential Electricity Generation Scenarios, as informed by inputs received at meetings with officials working on the Provincial Energy Game Changer and GreenCape in July 2017. Thereafter, data obtained that reflect the spatial corridors associated with existing and potential future EGI and Gas Pipelines are illustrated.

3.2. Future Electricity Generation Scenarios of Relevance to GSR

In the course of interacting with stakeholders, a number of discussions were had related to the apparent uncertainty about the future configuration of energy sources in the GSR, the Western Cape and, in fact, the country as a whole.

In order to deal with this uncertainty for the purposes of this report, advice received from officials working on the Energy Game Changer in the Province[17] was that three broad scenarios might best be contemplated. These scenarios were put forward as follows: -

- Scenario 1: Nuclear at Duynefontein – around 1 GW generation
- Scenario 2: Gas-to-Power – around 1 GW generation
- Scenario 3: Gas-to-Power – around 300 MW generation localised at Saldanha

With regard to the above scenarios, the following is noted:

- Whilst the Western Cape, through the Koeberg Nuclear Power Station (NPS), is responsible for some 1,800 MW of daily baseload generation on the national grid, the provincial grid remains a net importer of some 2,200 MW of electricity per day to meet provincial needs and electricity export commitments to Namibia. The augmentation needed means that electricity is transmitted to the Western Cape over considerable distances from the coal-fed power stations located in Limpopo and Mpumalanga provinces. Accordingly, Eskom's Tx network is designed to deliver electricity within its service regions both from within and from outside the province
- However, long-distance transmission of electricity is inefficient, with losses of energy of up to 20% over the distances concerned and baseload generating capacity that meets demand locally may be assumed to be seen to be preferred from an efficiency perspective over the longer term;
- In addition, with the success to date of the Renewable Energy IPP Programme and the trend of declining costs in that sector – taken with the modelling done by the CSIR as part of its submission in response to the draft IRP(2016) that indicated that electricity generation through renewable energy was a Least Cost-Highest Return option – it is accepted that additional investment would be supported for continuing the rollout of renewable energy installations that would be integrated into the Electricity Grid network in the province (as well as nationally). This would be in line with the February 2016 Cabinet approval of Renewable Energy Development Zones (REDZ) and in accordance with SIP 8: Green Energy[18];

3.2.1. Scenario 1: 1 GW-Plus Nuclear Baseload Generation

In line with the proposed intention to develop a number of Nuclear Power Stations (NPS) to generate 9,600 MW of baseload electricity generation by 2030 in terms of the still-current IRP, 2010, the Department of Energy and the Department of Environmental Affairs have been pursuing an Environmental Impact Assessment (EIA) process to identify a preferred site for the so-called Nuclear 1 development.

Candidate sites in this regard were:

1. A site located at Duynefontein, adjacent to the existing Koeberg Nuclear Power facility, which is some 35 km north of central Cape Town;
2. A site located at Thyspunt in the Eastern Cape, which is situated between the coastal settlements of Oyster Bay and St Francis Bay; and
3. A site located at Bantamsklip, situated in the Western Cape along the southern coast midway between Danger Point and Quoin Point.

After due process over a number of years, the national Department of Environmental Affairs issued an EIA Authorisation in respect of the Duynefontein site, as envisaged in the setup for Scenario 1[19].

As noted above, in its original conception, Scenario 1 envisaged the development of a Nuclear Power Station (NPS) at Duynefontein, which would generate a daily baseload output of around 1 GW. With the recent issuance of the EIA Authorisation, it is possible to describe the intended facility as follows:

- **Generation Capacity:** it is proposed that future Duynefontein Nuclear Power Station would make use of Pressurised Water Reactor (PWR) technology and would be designed and operated to generate up to 4,000 MW (4 GW) of electricity per day using two to three reactor units
- **Grid Integration:** the electricity generated at the Duynefontein NPS is likely to be integrated into the grid via the Omega/Sterrekus and Stikland substations.

The following is noted in the above regard: -

17 Personal communication: Dr H. Fast, 6 July 2017

18 https://www.environment.gov.za/mediarelease/cabinet_gazetting_redz: issued 24 February 2016 – accessed on 30 October 2017

19 Department of Environmental Affairs: Environmental Authorisation for Proposed Construction of a Nuclear Power Station and Associated Infrastructure at Duynefontein, Western Cape, 11 October 2017

- Development of the Duynefontein NPS to its full capacity would meet the current daily electricity demand in the Western Cape (4,000 MW)
- At the time of its being commissioned, the NPS would likely utilise the same EGI corridors as the Koeberg NPS and integrate with the existing Tx network.

3.2.2. Scenario 2: 1 GW Gas-to-Power Generation

Any discussion of gas-to-power needs to acknowledge that LNG has, historically, been associated with firing so-called Peaking Power Stations, which have been largely designed to operate at peak demand times and not to be run constantly, as baseload power stations do. Accordingly, LNG-fired power stations have not been widely used for baseload generation, which has more commonly been the remit of coal- and nuclear-fired power stations.

However, internationally, with the increasing reliance on Renewable Energy, LNG-fired power stations have been found to be good "partners" for Wind and Solar-based energy and the technology and operations and maintenance regimes have progressed such that they are now classed as being suited to baseload generation as well[20].

Within the ambit of Scenario 2, then, which envisages large-scale gas-to-power generation within the Province of around 1 GW a day or more, there are a number of initiatives that are of potential relevance. The two that appear of greatest relevance to the GSR are noted as follows:

1. The conversion of the Ankerlig Peaking Power Station, located near Atlantis in the City of Cape Town, from diesel-fuel powered Open Cycle Gas Turbines (OCGT) to LNG-fired Combined Cycle Gas Turbines (CCGT); and
2. The proposed development of a LNG-fired power plant located on the eastern side of the ArcelorMittal Saldanha Steel manufacturing site in the Saldanha Bay municipal area by the International Power Consortium South Africa (Pty) Ltd.

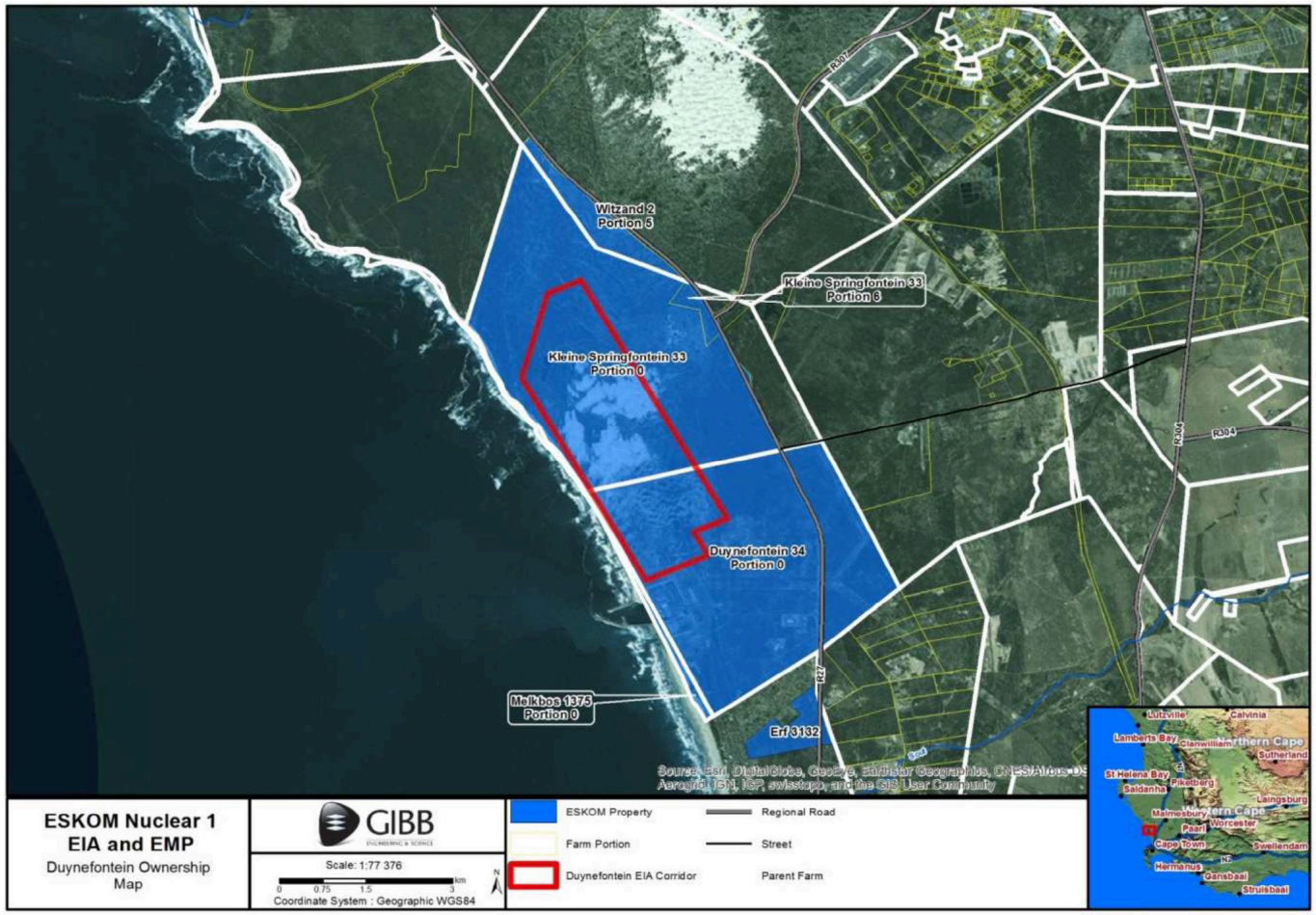

Figure 8. Duynefontein NPS Site (Source: GIBB Nuclear-1 EIA, Revised Draft Version 2, August 2015)

3.2.2.1 *Ankerlig Power Station Conversion to CCGT*

In 2008, Eskom appointed Messrs Savannah Environmental (Pty) Ltd to undertake an EIA process related to the conversion of the Ankerlig Power Station from nine diesel-fired Open Cycle Gas Turbine units to LNG-fired Combined Cycle Gas Turbine units and the associated development of a 400 kV Tx line to link the power station to the Omega/Sterrekus substation, located some 13 km south-east of the Atlantis industrial area.

- Generation Capacity: The conversion of the Ankerlig Peaking Power Station's nine diesel-fuel powered Open Cycle Gas Turbines (OCGT) to LNG-fired Combined Cycle Gas Turbines (CCGT) is anticipated to result in an increase in the generating capacity of the power station from about 1,350 MW to approximately 2,070 MW and result in a more cost-efficient and flexible facility for future deployment in the Western Cape grid network;

20 GreenCape: Utility Scale Renewable Energy. Market Intelligence Report, 2017

- Grid Integration: the electricity generated at the Ankerlig CCGT Power Station is intended to be integrated into the grid via the Omega/ Sterrekus substation.
- LNG Feedstock: The 2008 EIA report appears not to have dealt with the issue of where the LNG to be used in the operation of the Ankerlig CCGT facility would be sourced from in detail. However, a subsequent EIA process that relates to the exploitation of the Ibhubesi Gas Field (refer 2.1.2 above) indicates that, should that source be utilised, it would be the intention to supply LNG to the Ankerlig Power Station via a network of offshore production and terrestrial transmission pipelines.

In the shorter term, however, it is likely that LNG may be imported into South Africa (possibly through the Port of Saldanha Bay or, as is intended in terms of a current Ministerial Determination, through the ports of Richards Bay and Coega).

Should it prove possible to develop a LNG Import Facility at the Port of Saldanha Bay, it would likely be the intention then to supply the LNG feedstock to Ankerlig via Phase 1a of the envisaged National Phased Gas Pipeline Network.

In the case of importation of LNG taking place at either of the officially endorsed ports, it is likely that the means of transport of LNG would, in the interim, be via road and/or rail, although the feasibility of this arrangement in terms of cost and logistics is not known at this stage.

A final point to be noted in this regard is that the current Ministerial Determination to focus on developing LNG import facilities at Richards bay and Coega does not tie up with the phasing of the National Phased Gas Pipeline Network, which appears to be based on the assumption that Saldanha Bay Port is the most likely initial site of LNG importation. Work, however, is proceeding on a SEA for the National Phased Gas Pipeline Network, which appears still to be premised on Phase 1a of

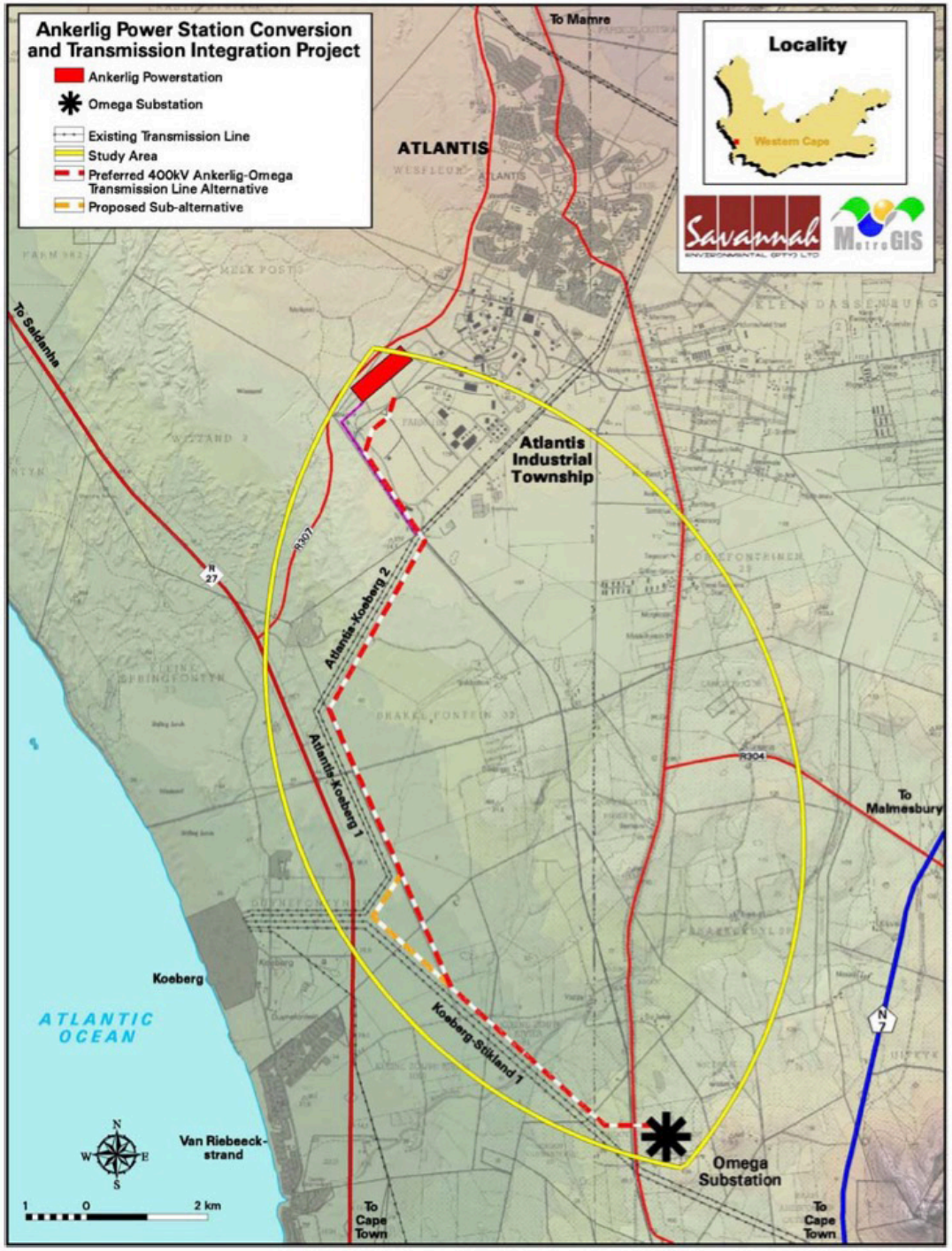

Figure 9. Locality of the Proposed Ankerlig CCGT Power Station and associated 400 kV Tx lines (alternative alignments) to Omega/Sterrekus Substation

Phasing

- Phase 1a: Saldanha to Ankerlig
- Phase 1b: Saldanha to Mossel Bay
- Phase 2: Mossel Bay to Coega
- Phase 3: Richards Bay to Secunda
- Phase 4: Mozambique Southern Border to Richards Bay
- Phase 5: Abrahamvilliersbaai to Ankerlig Take-off
- Phase 6: Phase 1 to Oranjemund (Namibia)
- Phase 7: Coega to Richards Bay

- Rompco: Komatiepoort to Secunda
- Shalegas: Beaufort West to Phase 2

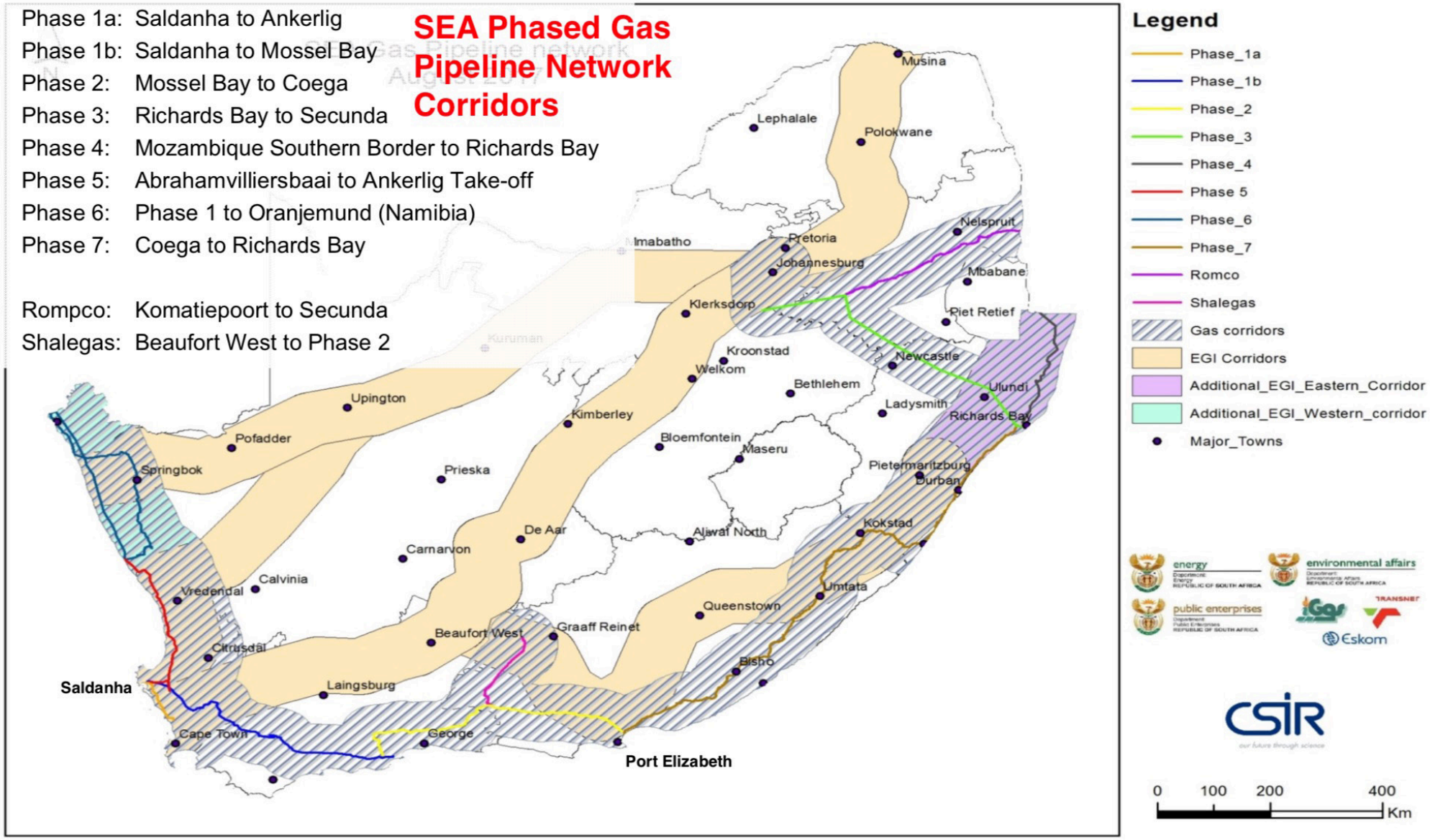

Figure 10. Latest National Phased Gas Pipeline Network Phasing (including National EGI Corridors) (Source: Taken from presentation made at the Operation Phakisa Offshore Oil and Gas Exploration A1 Workstream, Expert Reference Group Meeting 1, 13 September 2017)

the network being the said Saldanha to Ankerlig link (refer to 3.3.2).

3.2.2.2 Saldanha Steel IPP Gas-to-Power Initiative

In response to the rate and scale of electricity tariff increases over time in South Africa, ArcelorMittal has determined that, in order for their Saldanha Steel plant to remain viable under extremely difficult trading conditions, it is vital that the company sources a cheaper supply of electricity.

In line with this, the company entered into an agreement with an IPP, the International Power Consortium South Africa (Pty) Ltd (IPCSA) for the proposed development of a 1,400 MW LNG-fired power plant located on the eastern side of the Saldanha Steel site, as illustrated in Figure 11.

However, the licensing issues related to an IPP on-selling surplus electricity to other commercial customers currently appear to be complex and these would have to be resolved.

- **Generation Capacity:** it is proposed that the Saldanha Steel Gas-to-Power Plant would ultimately be configured as a LNG-fired CCGT power plant that would have a net capacity of 1,507 MW. It will consist of eight air cooled gas turbines[21].
- **Grid Integration:** the electricity generated at the Saldanha Steel Gas-to-Power Plan is intended in the first instance for the use of Saldanha Steel, which will be the anchor off-taker of electricity generated up to its daily need of around 160 MW of baseload with a peaking power requirement of around 250 MW. As such, a 132 kV line is to be built to supply the manufacturing facility, as is indicated on Figure 12. The project is also conceived to potentially form part of the Department of Energy's Gas-to-Power programme or, as an alternative, to on-sell surplus electricity generated (potentially up to 1,150 MW) to local users in the Saldanha Bay local area[22]. In this regard, it is reported that a number of West Coast-based companies as well as the CoCT had already signed off-take agreements as at February 2016[23]. The latter instance would require the appropriate regulatory approval on the part of NERSA and is also likely to require grid integration with the Eskom Tx and Dx EGI. This is most likely to be feasible via the Blouwater substation, which is located adjacent to the proposed CCGT plant site. In this case, it is understood it would be necessary for the Saldanha Bay Network Strengthening Project to have been implemented (see Section 3.3.1.1)
- **Natural Gas Feedstock:** The ERM EIA report of 2016 indicates that it is intended to import the LNG feedstock via the Port of Saldanha Bay as follows[24]:

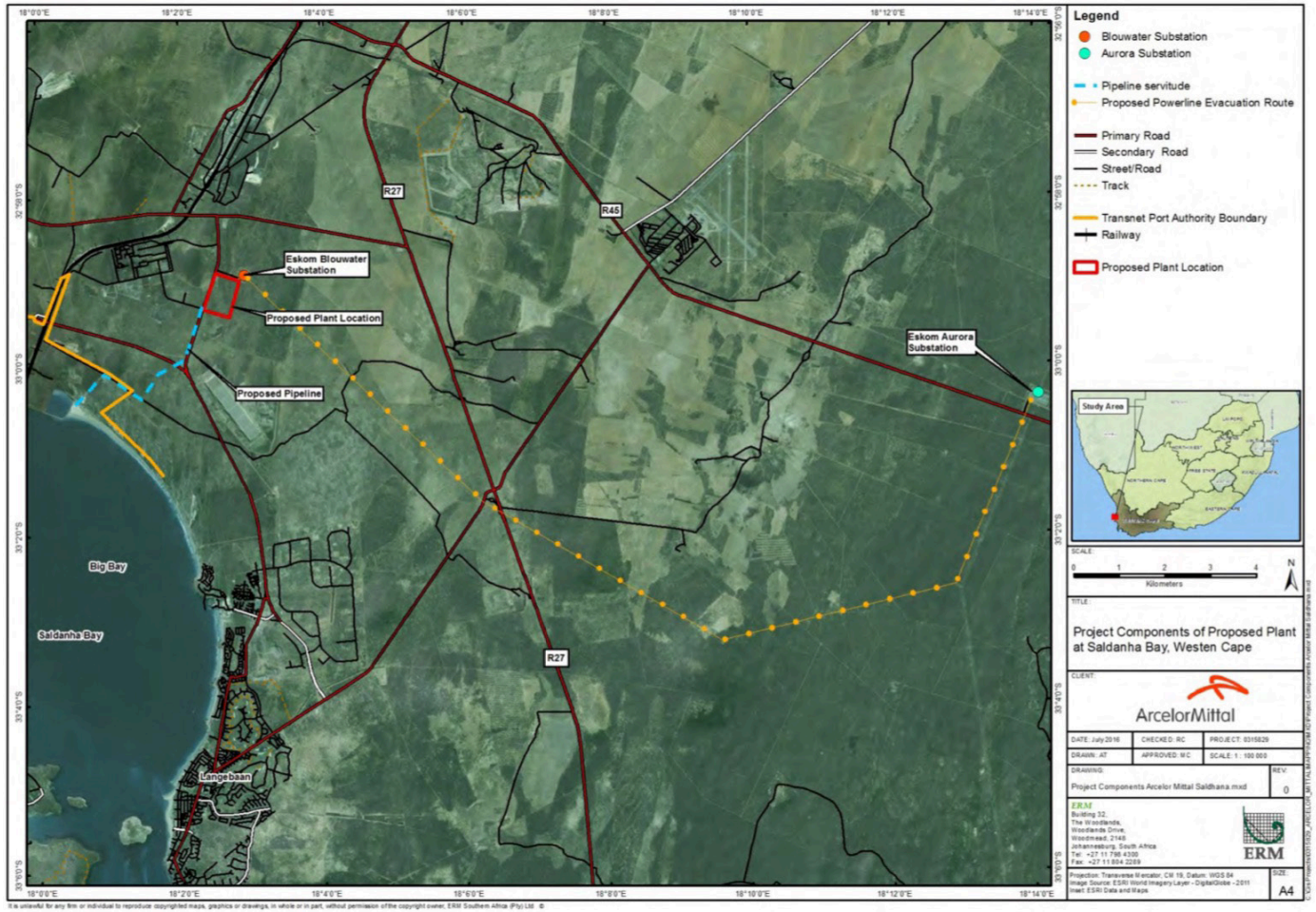

Figure 11. Locality of the Proposed Saldanha Steel Gas-to-Power Plant (Downloaded from https://gasnetwork.csir.co.za/workshops-and-presentations/ accessed on 21 October 2017)

21 ERM, October 2016. Environmental Impact Assessment for a Gas-fired Independent Power Plant to Support Saldanha Steel and Other Industries in Saldanha Bay, Western Cape: Final Report V1

22 Ibid

23 https://www.netwerk24.com/ZA/Weslander/Nuus/massive-gas-fired-power-plant-for-saldanha-20160203-2 - accessed 19 October 2017

24 Op. Cit.

- "LNG will be supplied by ship to the Port of Saldanha, where it will be regasified and then offloaded via a submersible pipeline either from a mooring area located off shore or a berthing location in the Port of Saldanha Bay".
- The report also notes that initial discussions have been held with the Transnet National Ports Authority (TNPA) in Saldanha in this regard but also refers to the fact that an assumption has been made that the import facility would be as per the DoE's planned import terminal at the Port. However, if this should not materialize in the timeframe needed to supply the Saldanha Steel CCGT plant, the EIA report notes further that "a separate EIA will be undertaken to permit the marine component of the import of LNG".
- This suggests that, notwithstanding the fact that the current Ministerial Determination appears to exclude the Port of Saldanha Bay from the DoE's LNG plans, there is a locally-based conviction that a commercial case exists to pursue the envisaged development of a LNG import terminal and associated facilities to, at least, provide feedstock for the Saldanha Steel CCGT plant.
- Should Phase 1a of the National Phased Gas Pipeline Network be developed over time, this business case would surely be strengthened.

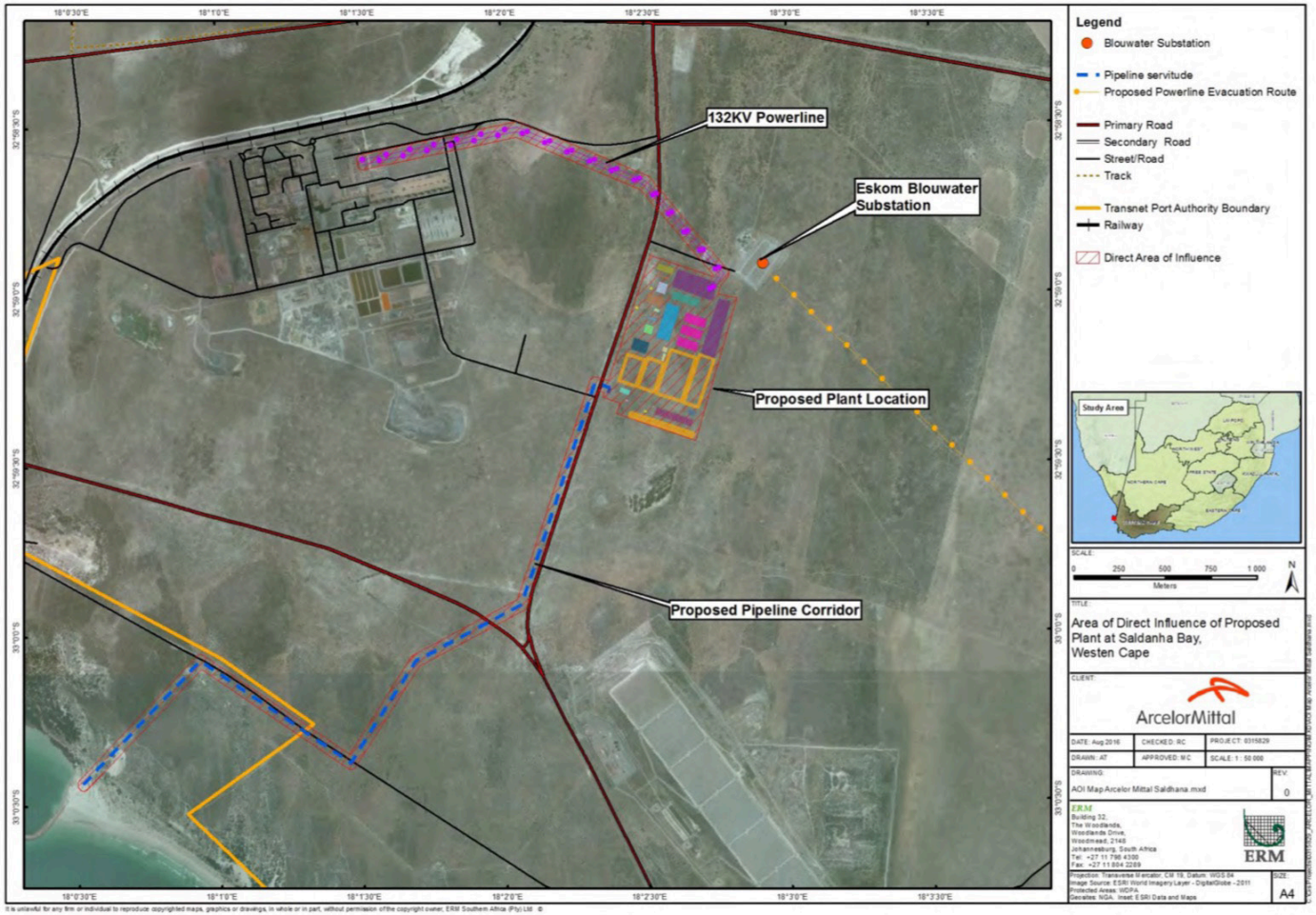

Figure 12. Layout and Linkages between Saldanha Steel Gas-to-Power Plant and Manufacturing Facility

3.2.3. Scenario 3: Smaller-Scale IPP Gas-to-Power Generation

This scenario is seen to have more localised relevance to Saldanha Bay Municipality insofar as it envisages a smaller scale take-up of LNG-fired gas-to-power of around 300 MW a day. This is of the order of magnitude that would enable ArcelorMittal to meet its daily energy demands at its Saldanha Steel plant (of around 160 MW with a peaking demand of 250 MW).

In this scenario, the complex licensing issues related to an IPP on-selling surplus electricity to other commercial customers is avoided.

However, it is doubtful whether the smaller scale of LNG take-up in this scenario would be commercially viable as the volume of LNG needed would still have to be imported and either landed at the Port of Saldanha Bay, as in the previous scenario, or brought in by road or rail freight.

This Scenario also would appear not to require grid integration with the Eskom EGI and hence the implementation of the Saldanha Network Strengthening Project may not be essential.

3.3. Spatial Corridors Associated with EGI and Potential Gas Pipeline Infrastructure in the GSR

With the above scenarios as background, this section of the report focuses on mapping out the following:

1. The key Spatial Corridors associated with the development of the Electricity Grid Infrastructure (EGI) necessary to supply electricity within the GSR; and
2. Prospective corridors associated with the development of a Gas Pipeline Network to operationalise the envisaged development of Natural Gas-fired power plants at Ankerlig and Saldanha Bay.

At the outset, it should be noted that two key Strategic Environmental Assessment (SEA)processes are currently (October 2017) underway to determine the following:

1. Phase 2 of a process to identify further Renewable Energy Development Zones (REDZ) and, associated with this, the identification of EGI Corridors at a national scale; and
2. Gas Pipeline Corridors at the national scale.

These large-scale (100 km-wide) corridors illustrate areas within which the main alignments for EGI and Gas Pipeline infrastructure would occur, which would "knit together" key elements of the national energy grid network such as:

- The geographic areas where baseload generation predominantly occurs (presently in the north of the country) with areas to which transmission of electricity is required.
- Areas where Gas is likely to be landed (e.g. at Saldanha Bay, Richards Bay and Coega) or sourced from (e.g. Mozambique) and areas of demand/usage to which it will be transmitted.

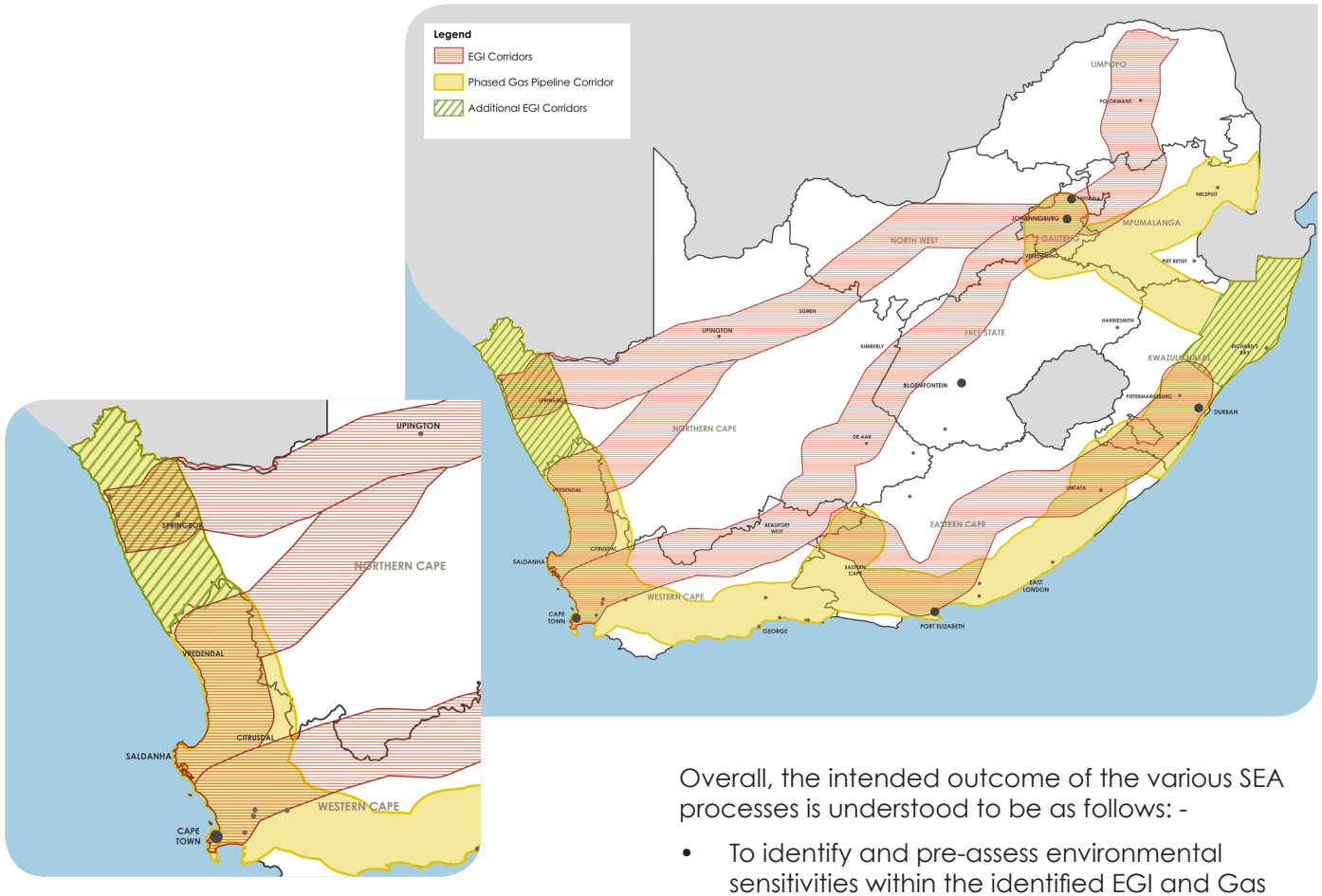

Figure 13. National EGI and Gas Pipeline Spatial Corridors

- The broadly defined EGI Corridors also seek to cover areas associated with Renewable Energy Development Zones (REDZ) in order to integrate into the EGI prospective Renewable Energy projects and potential gas-to-power projects, including potential IPP gas-to-power projects.

Whilst the Gas Pipeline SEA processes are ongoing, the above EGI Corridors were placed in the Government Gazette on 17 April 2017, for comment. No comment was forthcoming that related specifically to the EGIs.

Overall, the intended outcome of the various SEA processes is understood to be as follows: -

- To identify and pre-assess environmental sensitivities within the identified EGI and Gas Pipeline Corridors (as well as the REDZ);
- In so doing, to facilitate streamlined environmental authorisation processes for the development of the energy infrastructure related to gas and/or electricity.

In this regard, the CSIR notes that "upon gazetting of the energy corridors, it is envisaged that the environmental authorisation process for gas pipeline and [electricity] transmission infrastructure will be streamlined in specific areas identified through the SEA process as being less sensitive to the negative impacts associated with the development of this infrastructure. This should incentivise potential developers to plan and develop in the least

sensitive areas. The SEA process also provides a platform for coordination between the various authorities responsible for issuing authorisations, permits or consents and thereby will further contribute to a more streamlined environmental authorisation process" .

3.3.1. Current and Potential EGI Corridors in GSR

Within the context of the above national-scale EGI Corridors, data have been sourced from Eskom to illustrate the spatial impact of its current and proposed future grid network in the GSR and immediate surrounds.

Figure 14 illustrates the following elements of the main Eskom Tx grid network in the study area: -

- Tx Substations and Dx Subtstations
- Tx Network including, where data is applicable, Commissioned Lines, Surveyed Lines and Designed Lines, with capacities ranging from:
  - 765 kV line
  - 400 kV lines
  - 275 kV lines
  - 132 kV lines
  - 66 kV lines
- In addition, the map illustrates current approved and/or operational RE plants, including the following:
  - Aurora Solar PV Project
  - Swartland Solar PV Project
  - West Coast 1 Wind Farm
  - Hopefield Wind Farm
  - Darling Wind Farm

The following points are noted:

- Based on available data, there are currently no significant EGI Corridors at the regional scale that are not already commissioned and/or designed and subject to EIA processes;
- However, based on information contained in the latest available Transmission Development Plan (Eskom, 2015), there is the prospect of a new 765 kV line (with its associated 80m-wide servitude) being developed to loop through the West Coast District area and descend southward towards Cape Town. It should be noted, though, that this is recorded as having a "strategic" timeline (refer to Section 2.2.3 above) and hence no potential alignment is available in the public domain as yet.

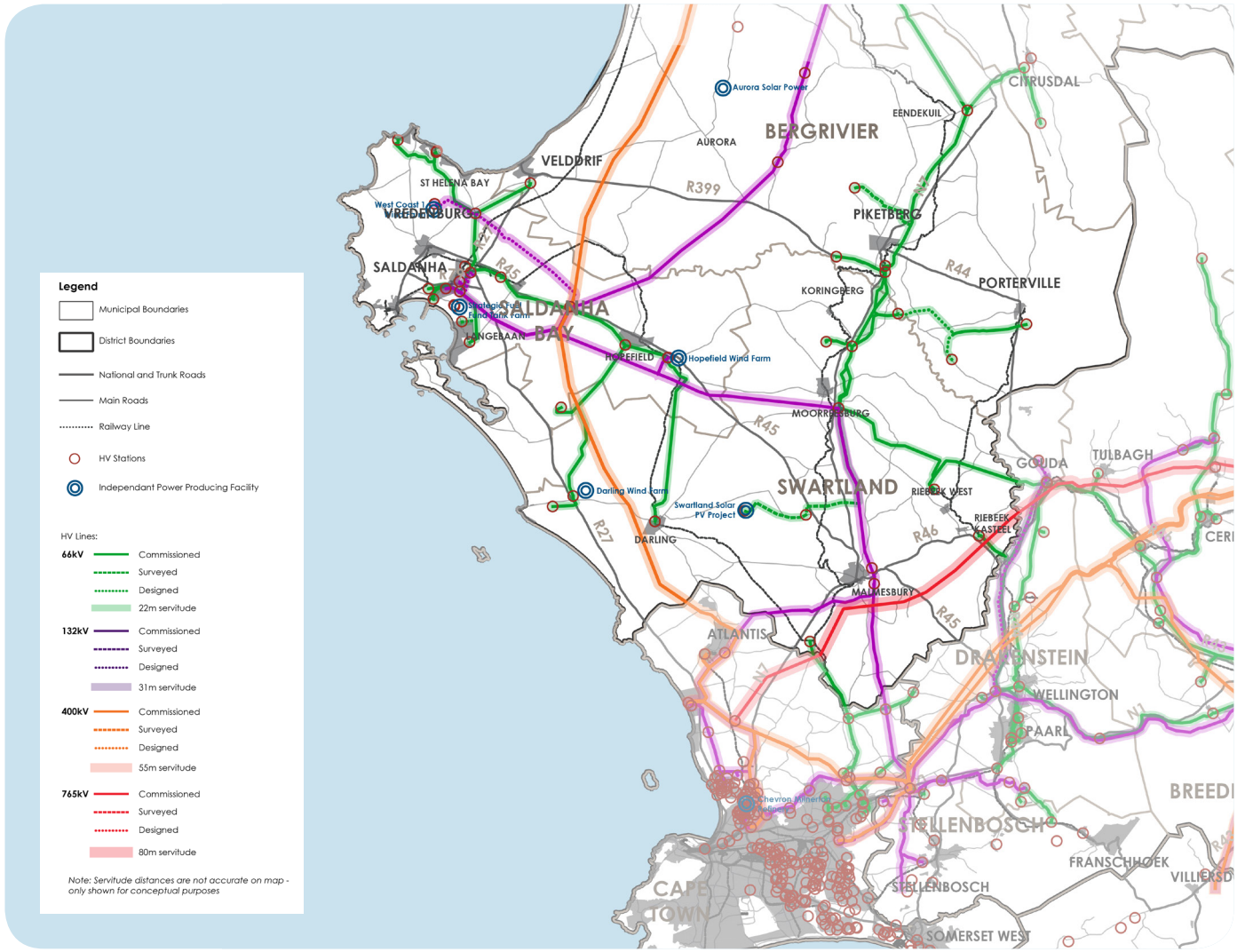

Figure 14. EGI Corridors in the GSR (Commissioned, Surveyed and/or Designed Powerlines) Data Source: Eskom

- The most significant new build development that impacts on the GSR is associated with the Saldanha Bay Network Strengthening Project (see Figure 15).

3.3.1.1 Saldanha Bay Network Strengthening Project

As described in Section 2.2.3.1 above, Figure 15 illustrates the spatial impact of the Saldanha Bay Network Strengthening Project:

The following points are noted: -

- The above map illustrates the preferred spatial arrangements for the following elements of the project: -
  - The preferred site (Site F) for the proposed new 400/132kV Transmission Substation in the Saldanha Bay area with a planned capacity of 3 x 500 MVA transformers. The transmission substation footprint will be 600m x 600m
  - The preferred site (Site A) for the proposed new 132/66kV Distribution Substation near the current Blouwater Substation in the Saldanha Bay area. The distribution substation footprint will be 120m x 120m.
  - The preferred route alignment (within a 1 km-wide corridor) for the construction of two 400kV power lines (approximately 35 - 40 km) from the Aurora Substation to the new proposed distribution and transmission substations. A servitude of 55m is required for each power line
  - The preferred route alignment (within a 1 km-wide corridor) for the construction of 3 x double circuit 132kV power lines to connect the new distribution substation to the new transmission substation.
- The EIA Authorisation is currently under appeal and the above spatial proposals are thus subject to final ratification and/or amendment.

As indicated in Section 2.2.3 above, the earliest estimated date of implementation of this project is

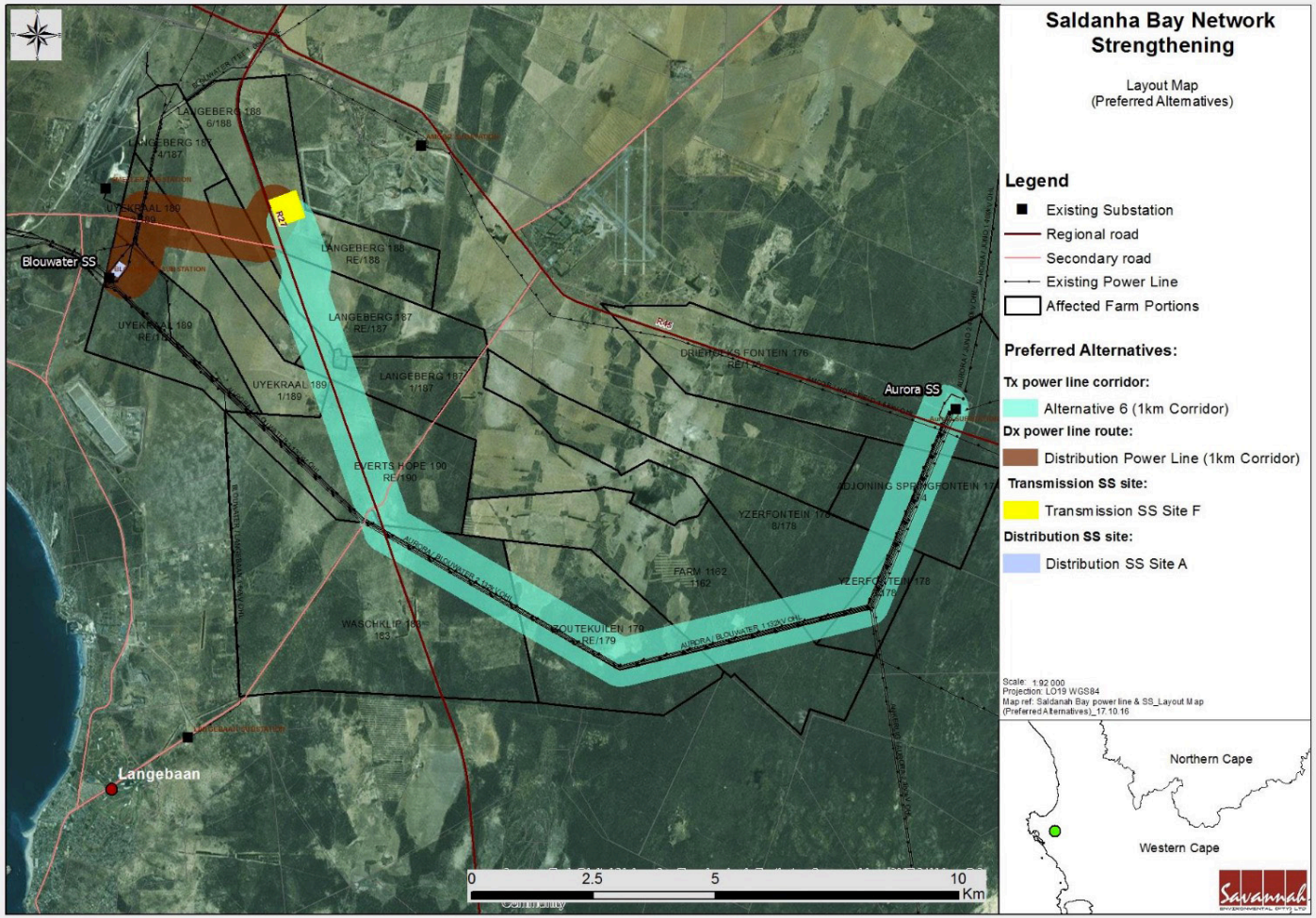

Figure 15. Saldanha Bay Network Strengthening Project: Preferred Spatial Layout

2022. It should be noted, however, that the project is split into two phases:

- Phase 1, scheduled for implementation in 2022, is comprised of the following elements:
  - Work at Aurora substation to replace two of the four existing 400/132 kV 250 MVA units with 2 x 500 MVA units as part of refurbishment
  - The acquisition of a substation site in the Saldanha Bay area
  - The construction of 2 x 400 kV lines (operated at 132 kV) from Aurora substation to a new Distribution substation at the existing Blouwater site
- Phase 2, which is noted as being deferred and subject to further assessment relating to market demand, comprises of:
  - The development of the Blouwater Transmission substation (1st and 2nd 400/132 kV 500 MVA transformers); and
  - The Loop-in of the Ankerlig-Aurora 1 400 kV line

3.3.2. Gas Pipeline Networks

Accepting that there remains some uncertainty as to the future configuration of the gas energy sector in South Africa, particularly as regards (a) the sourcing of natural gas (whether this would be from exploiting offshore resources located off the western and southern coasts of South Africa; or relying on imports from neighbouring countries such as Mozambique or from further afield via Port entries; or whether it would be possible to include into the mix of sources offtake from the shale gas resources notionally located in the Karoo Basin), and (b) in the case of the GSR and GCM areas specifically, whether or not the Port of Saldanha Bay would be sanctioned as a port of entry for the landing of LNG imports, this section seeks to illustrate the spatial dimensions of work currently underway to plan for elements of a future National Phased Gas Pipeline Network that relate to the study area.

3.3.2.1 Phase 1a Corridor: Saldanha to Ankerlig

As noted previously, work is underway to develop a SEA that identifies preferred corridor alignments for an envisaged National Phased Gas Pipeline Network. Phase 1a of the envisaged NPGPN is the route linking Saldanha Bay to Ankerlig power station (refer to Figure 13).

Available information suggests that the precise routing of this pipeline is not yet clearly established. However, a previous Environmental Screening Study undertaken by the CSIR for a proposed LNG Terminal at Saldanha Bay Port also highlighted potential routes for gas transmission and distribution pipelines in the GSR and GCM areas as per Figure 16[25]:

The following is noted in this regard:

- The indicative route alignment of the main gas transmission pipeline appears to run, for the most part, within the road reserve of the R27.

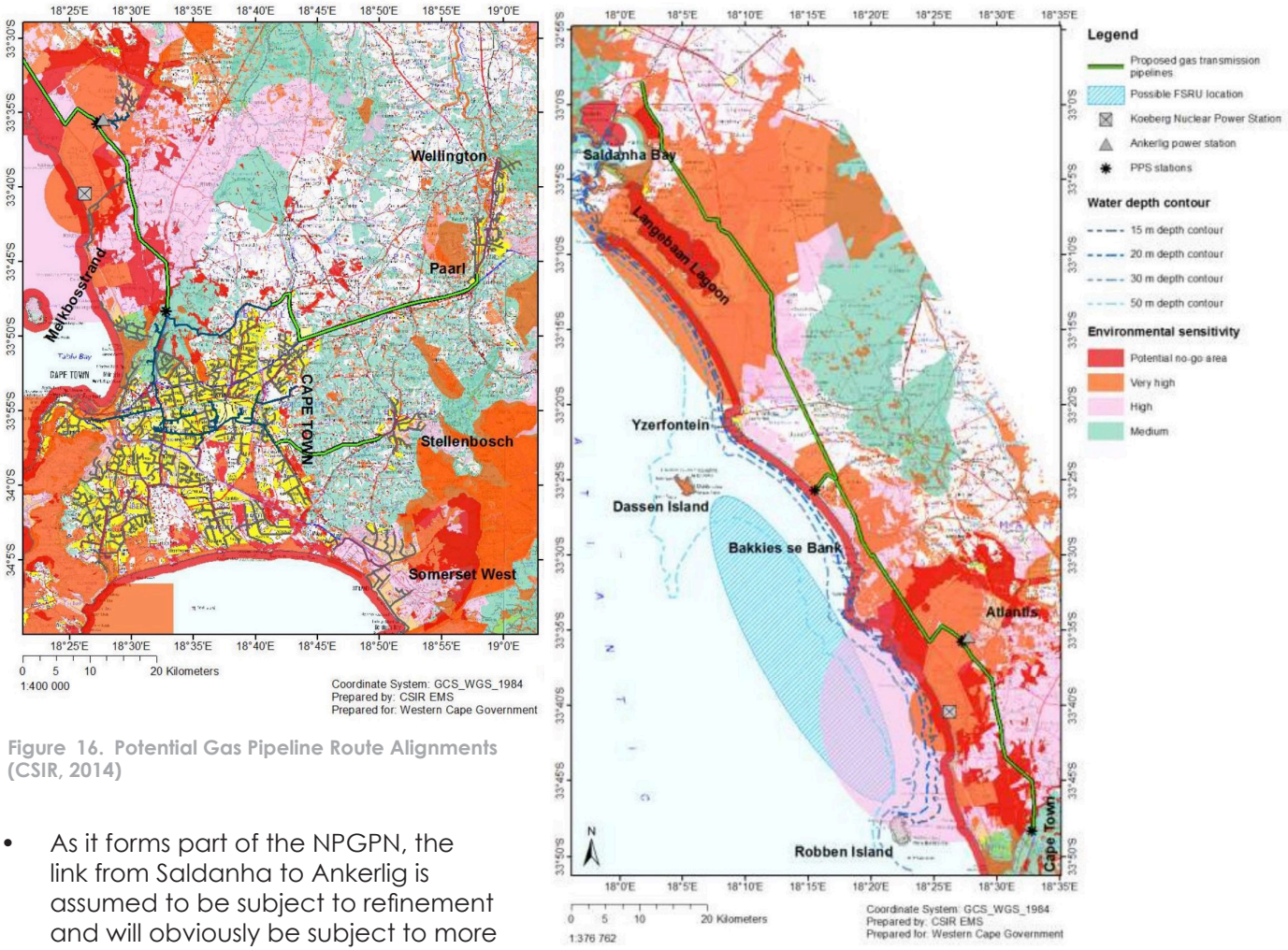

Figure 16. Potential Gas Pipeline Route Alignments (CSIR, 2014)

- As it forms part of the NPGPN, the link from Saldanha to Ankerlig is assumed to be subject to refinement and will obviously be subject to more detailed and individualised planning, authorisation and approval processes in due course.

3.3.2.2 Gas Pipeline Network Ibhubesi Gas Field

The prospective exploitation of the Ibhubesi Gas Field, which is located offshore off the West Coast of South Africa, envisages the development of the following[26]: -

- A production platform in Licence Block 2A located off the West Coast of South Africa;
- An approximately 400 km offshore production pipeline from the production platform to a southern shore-crossing site at Grotto Bay and a northern shore-crossing site at St Helena Bay East on the Saldanha Peninsula;
- An onshore pipeline between the Grotto Bay shore-crossing site and the Ankerlig Power Station and the St Helena Bay East shore-crossing site and the R45; and

25 CSIR, 2014. Environmental Screening Study for a Proposed LNG Terminal at Saldanha and Associated Pipeline Infrastructure to Atlantis and Cape Town, Western Cape, South Africa

26 CCA Environmental, Pty) Ltd, March 2017. Proposed Development of the Ibhubesi Gas Project: Final Environmental Impact Report – Addendum Report

- An onshore gas receiving facility adjacent to Ankerlig (Site 1b).

These elements are illustrated in Figure 17: -

The EIA Authorisation permits the following: -

- A northern shore-crossing site and pipeline alignment be developed at the identified preferred St Helena Bay East location (Saldanha Bay Municipality);
- A southern shore-crossing site be developed at the identified preferred Grotto Bay location (Swartland Municipality); and
- A gas receiving facility be developed at the preferred Site 1b at the Ankerlig Power Station (City of Cape Town).

It is understood that these spatial arrangements would tie in to the envisaged alignment of the Gas Transmission Pipeline linking Saldanha Bay to Ankerlig (Phase 1a of the NPGPN) and is illustrated accordingly, in Figure 19.

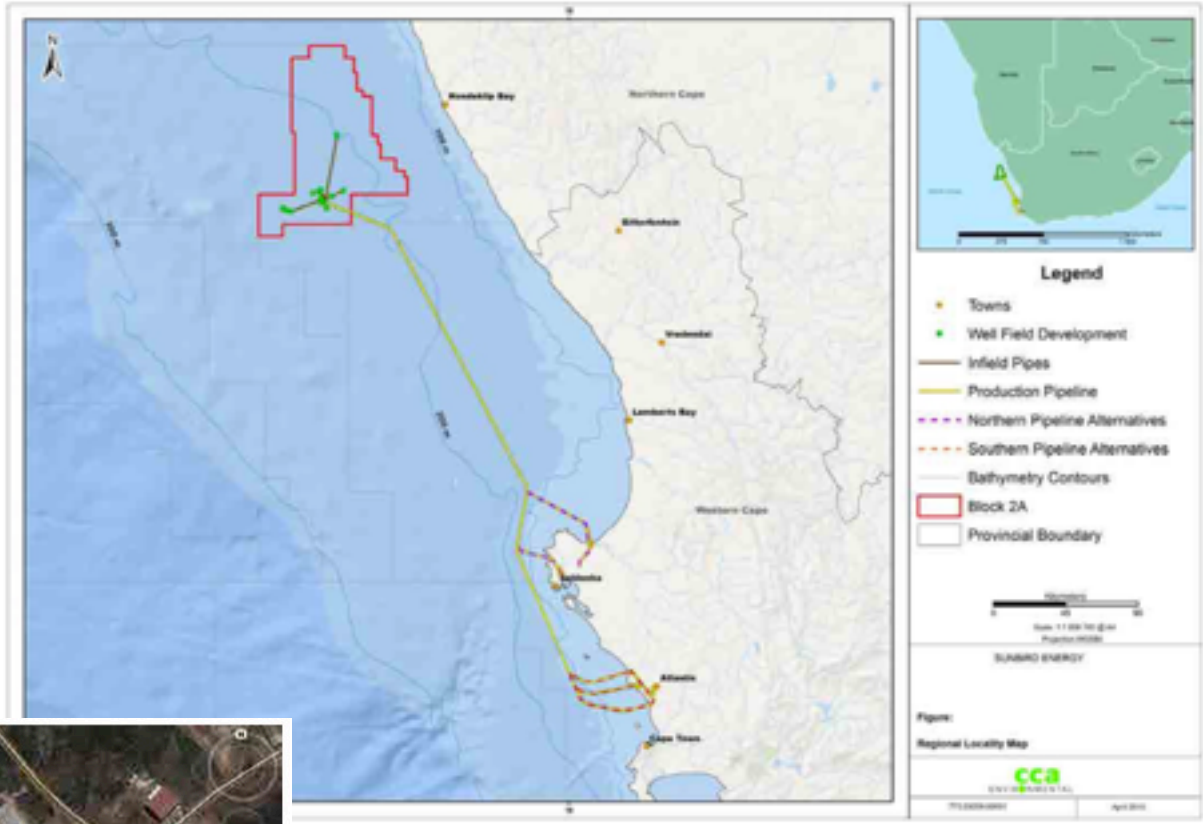

Figure 17. Regional View of Ibhubesi Gas Pipeline Alignment Alternatives

Figure 18. Ankerlig Power Station Showing Potential Onshore Gas receiving Facilities and Proposed Alignments of Gas Pipeline and 132 kV Power Line (Source: CCA Environmental, Pty) Ltd, March 2017. Proposed Development of the Ibhubesi Gas Project: Final Environmental Impact Report – Addendum Report)

Legend

- 400km Off Shore Pipeline
- Phased Gas Pipeline Corridors
- Saldanha Port & Ankerlig Power Station
- Saldanha Industrial Development Area
- Ibhubesi gas field

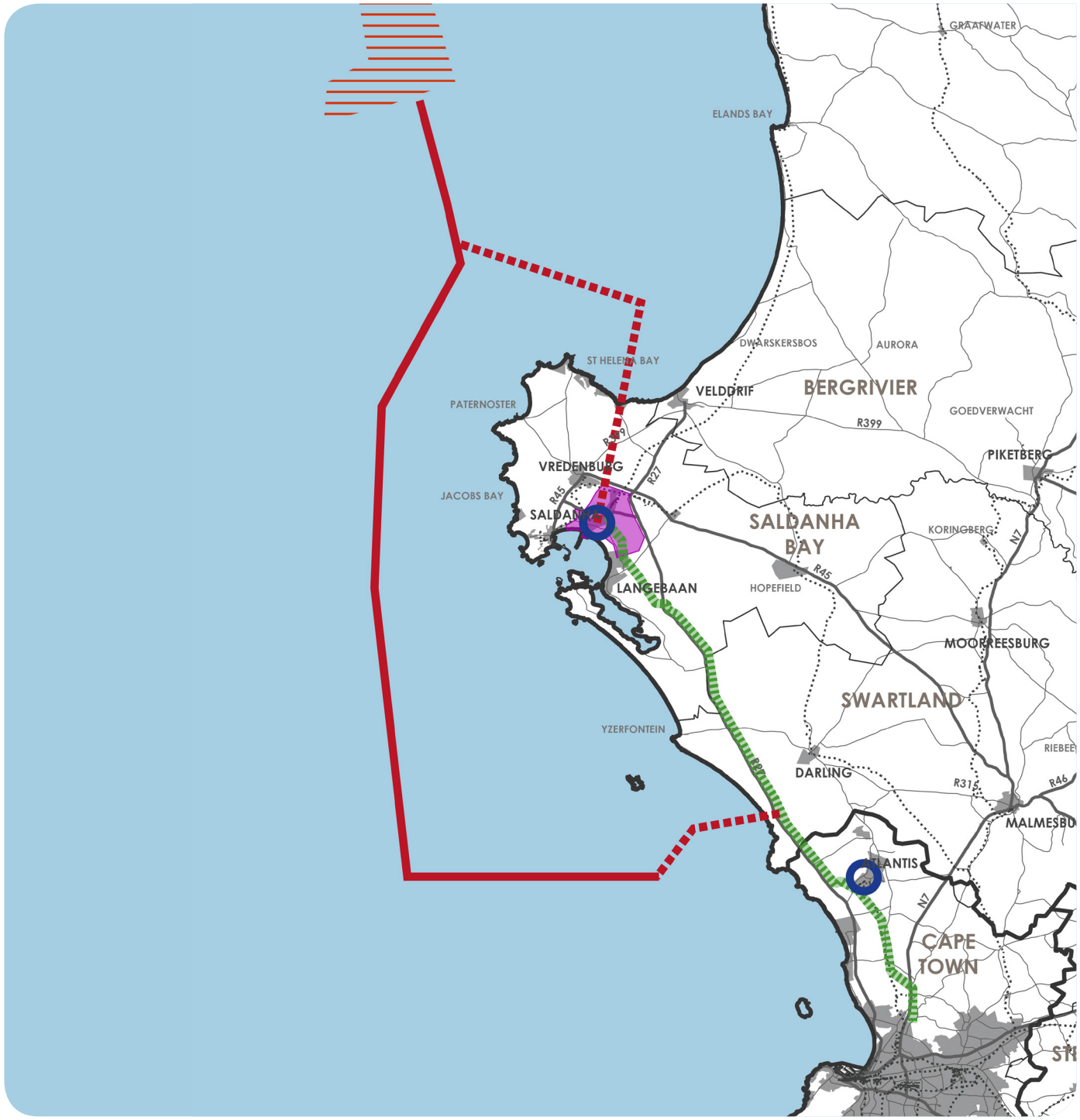

Figure 19. Composite Map of Gas Pipeline Alignments in GSR and GCM

4. Summary Conclusions and Recommendations

The work set out above has highlighted the following key issues: -

Challenges related to the Operational Design of the Electricity Supply Industry

- South Africa's long history of a centralised Electricity Supply Industry (ESI) as embodied in the vertically integrated monopoly that is Eskom, has led to the present situation whereby a so-called Single Buyer Model dictates that only Eskom may purchase and on-sell electricity to its customers via its transmission and distribution networks;
- This arrangement effectively prohibits (public or private) institutions to make electricity supply arrangements (other than individual instances of licensed generation for own use) that might be more flexible, responsive to need and demand, and, importantly, more cost efficient and environmentally sustainable.
- It is common cause that the ESI is experiencing a range of challenges in relation to both planning for future energy security as well as in implementing cost effective solutions to the country's energy needs (leading to steeply escalating costs of electricity for end-users), which appears to be leading towards a situation where, possibly increasingly, the Single Buyer Model is likely to be legally challenged. In this regard, the legal challenge brought by the CoCT against the Minister of Energy is to be noted.

Challenges related to Planning in Regard to the Mix of Energy Sources

- The policy framework underpinning South Africa's planning and implementation of projects and programmes to secure a sustainable and development-facilitating ESI envisages a balanced and multifaceted mix of energy sources, including nuclear-, coal- and Natural Gas-fired electricity generation augmented increasingly by Renewable Energy-based electricity generation;
- The legal framework sets out a requirement for all projects and programmes to be undertaken within the parameters set by an Integrated Energy Plan (IEP) and an Integrated Resources Plan (IRP).
- However, these planning processes have become increasingly contested as the scientific advances in relation to Natural Gas and Renewable Energy-powered electricity generation have reduced costs and mitigated technical challenges associated with these technologies whilst commitments to more highly monetised forms of electricity generation in the form of coal and nuclear fuelled technologies remain strongly supported in certain sectors of the ESI.
- This has resulted in much uncertainty regarding the future likelihood of committed investments in the various energy sources.
- The above factor is enhanced by the decrease in global commodity prices affecting the oil and gas sector, which has also seemingly resulted in trends of slowdown in investment in said sector.

Key Energy Aspects Related to the GSR

- Recent development trends and planning processes in the GSR, including the West Coast Industrial Plan, the implementation and development of the Saldanha Bay IDZ with its Oil and Gas sectoral focus, positive trends in the primary and secondary sectors related to aquaculture and fisheries processing as well as increasing positive development trends in the Swartland Municipal area (related to its advantageous location within the functional hinterland of the Cape Town Metropolitan area) have had an impact on prospect for an increase in demand for electricity in the area;
- This is amplified by the above trends being seen to harmonise and feed off key programmes of the national and provincial spheres of government such as SIP 5 (the Saldanha – Northern Cape Development Corridor), Operation Phakisa (with its focus on the ocean economy and the Oil and Gas sector) and Project Khulisa (with its focus in the GSR on the Oil and Gas Sector, Agri-Processing and Tourism);
- However, many of the enterprises located within the GSR are battling to remain viable in challenging trading environments and are chafing under the burdens imposed by steeply escalating costs of electricity;
- Moreover, many of the industries that are – or plan to be – located in the GSR area are reliant on carbon-intensive fuels for energy to drive their industrial processes and are keen to migrate, if possible, to cleaner energy sources, such as Natural Gas.
- This appears to be driving a growth in demand for both cleaner energy sources and cheaper electricity in the GSR;
- From a EGI perspective, the greatest need in the GSR is the implementation of the Saldanha Bay Network Strengthening project, which has been designed by Eskom and is at the stage of EIA Authorisation. However, doubts related to the outright demand for electricity in the study area have resulted in Eskom delaying commitments of investment to the project and the resultant timelines are uncertain;

Scenarios Related to a Future Mix of Energy Sources

- The scenarios sketched out in this report highlight the scale of the options that range from a Nuclear Power Station build at Duynefontein to an IPP developed Gas-to-Power CCGT plant at the Saldanha Steel site;
- In all cases, there remain significant obstacles to the implementation of the envisaged infrastructure, with funding commitments, prospective legal and regulatory challenges and sourcing and supply arrangements for Natural Gas feedstock numbering amongst these;
- It may be argued that the solution that has the potential to be "quickest to market" is the IPP Gas-to-Power proposal at the Saldanha Steel site, which would have the advantage of securing in the shorter term the continued operation of the ArcelorMittal enterprise there and, in the longer term, would have the potential to be an IPP on-seller of significance of locally generated electricity;
- However, this project would need to negotiate a complex set of legal and regulatory hurdles in order to be able to become an on-seller of surplus electricity if it were unable to secure a Purchasing Price Agreement with Eskom and/or if it sought to become an on-seller of surplus electricity to individual customers (including municipalities) as is reportedly the intention of the IPP concerned;
- In addition, the project would need to secure a reliable and sustainable supply of Natural Gas, which would, in turn, require the resolution of whether or not the Port of Saldanha Bay would be able to develop the required infrastructure and facilities for the importation of Natural Gas, notwithstanding the current Ministerial Determination prioritising Richards Bay and Coega in that respect.

In summary: securing the most appropriate mix of energy sources to generate electricity and provide energy security that underpins socio-economic progress in the GSR is of fundamental importance, if the envisaged future of the region as a place of balanced and sustainable development in the primary, secondary and tertiary sectors of the economy is to be achieved.

In order to achieve this, a number of issues need to be addressed. These include:

- Uncertainty in the ESI regarding future policy and thus the future energy mix;
- Uncertainty regarding the future viability of centrally driven energy procurement (Single Buyer Model);
- The apparently rapid onset of climate change impacts raising the imperative to take "emergency" action to reduce carbon footprints might dictate future policy and energy mix away from traditional coal- and nuclear-fired baseload generation and conveyance of electricity over vast distances
- New technologies emerging rapidly: embedded generation and co-generation; RE technology improving and costs being lowered, leading to the possibility of future regionalisation or even localisation of licensed authority to procure energy (for private and public sector);
- The impact of EGI and Gas Corridors on regional environmental and heritage assets; and
- The possible need for a clearing house to facilitate discussions at regional level on energy needs and optimal energy strategies.

In order to deal with the prevailing uncertainties and to attend to the above issues, it is proposed that that the following aspects of regional governance towards a coordinated approach to planning and implementation of appropriate interventions be adopted:

- Institutional Cooperation and Coordination
- Information Dissemination
- Proactive and Strategic Use of Planning Tools and Regulatory Instruments

4.1. Institutional Cooperation and Coordination

From the foregoing, it is clear that planning for – and implementing – the development of Electricity Grid Infrastructure, Gas Pipelines and other critical energy infrastructure is fraught with uncertainty and challenges.

In order to best manage the uncertainties and challenges that prevail in such dynamic circumstances, it is proposed that key stakeholders in the energy sector be enjoined to participate in an appropriate regional structure that facilitates communication and information sharing on matters relevant to planning processes and investment scheduling in the sector. Such stakeholders would include:

- DEDAT (Convenor)
- DEADP
- The Department of Human Settlements
- The City of Cape Town
- The West Coast District Municipality
- Local Municipalities
- EDP
- WC Business Development Forum
- Eskom
- The South African Independent Power Producers Association (SAIPPA)

It is suggested that a structured Agenda could guide the periodic meetings of such a forum, with the Agenda including items on feedback from the National SEA processes as well as a "Clearing House" item where information on current spatial planning, IDP and environmental management processes could be shared.

4.2. Information Dissemination

As is the case with the GCM RSIF, the overall coordination of planning and implementation of development initiatives at regional level would be greatly facilitated if accurate and up to date data were available that permitted the aggregation of local and broader-level information.

With regard to Energy and planning for future EGI and Gas Pipeline Corridors, such data would include:

- Base data on land ownership
- Information collated from completed environmental management and spatial planning processes including SEAs, EIAs and EMFs
- In addition, an accessible registry of current (ongoing) EIA processes would assist all stakeholders to understand the array of activities occurring in different sectors
- Similarly, a registry of current land development applications would assist in integrated development planning at both local municipal and regional level

As with the GCM RSIF, it is suggested that a possible way of taking this issue forward is to extend the CoCT's Economic Areas Management Programme (ECAMP) concept to cover the municipalities of Saldanha Bay, Swartland and Bergrivier.

4.3. Planning Tools and Regulatory Instruments

One of the issues that raises itself repeatedly in discussions related to facilitating development is the need to find appropriate ways and means to streamline planning and regulatory approval and authorisation processes. This is made more complex in circumstances such as prevail in the GSR, where at landscape and local levels there are often cultural, heritage and/or environmental assets that are of critical value to natural processes as well as socio-economic processes.

In addressing this challenge, three potential options appear to present themselves: -

1. As is noted above, one of the ways being explored by the Department of Environmental Affairs and the Department of Energy in dealing with this is the commission of Strategic Environmental Assessments (SEAs) at landscape level, as is evidenced by the current SEA processes related to the identification of REDZ, and EGI and Gas Pipeline Corridors at National and regional scales. In so doing, it is the intention that these SEAs would be able to streamline the environmental authorisation processes for Renewable Energy projects, gas pipeline and EGI alignments by identifying specific areas as being less sensitive to the negative impacts associated with the development of such infrastructure. This should, ideally, incentivise potential developers to plan and develop in those identified least sensitive areas. Additionally, such SEA processes would also be envisaged to provide a platform for coordination between the various authorities responsible for issuing authorisations, permits or consents and, in so doing, would further contribute to a more streamlined environmental authorisation process
2. In a similar vein, where warranted, it should be contemplated that, in areas of particular strategic importance, DEA&DP could partner with relevant local government authorities in developing Environmental Management Frameworks (EMFs) as contemplated in Section 24(3) of the National Environmental Management Act (NEMA – Act 109 of 1998), which could serve to identify instances where it may be more appropriate to undertake listed activities as opposed to other areas where sensitivities may require more rigorous EIA processes.
3. Finally, it is anticipated that the current process (September 2017) of consultation by DEA in terms of NEMA on Draft Regulations Laying Down the Procedure to be Followed for the Adoption of Environmental Management Instruments may lead to the potential future use of any of the possible Environmental Management Instruments as contemplated in Section 24(5)(bA) of NEMA for the purposes of identifying appropriate instances where EIA requirements may be moderated in regard to certain listed activities.

4.4. Possible Catalytic Interventions

Given that much of the decision-making powers in relation to energy sources and Electricity Grid Infrastructure are currently centralised at national government level and are subject to much contention, there are no clear-cut project-level interventions related to infrastructure build identified herein that could be advanced outright by either the Western Cape Government or the municipalities in the GSR.

From a regional perspective, however, there are two possible areas where what might be termed catalytic interventions could be prioritised. These are noted as:

1. The development of a LNG Importation Facility at the Port of Saldanha Bay
2. Obtaining legal approval for prospective independent purchasers of electricity to contract with IPPs outside the framework of the current Single Buyer Model

4.4.1. LNG Importation Facility at Saldanha Bay Port

Given the potential demand for Natural Gas to meet local energy needs in the Saldanha Bay industrial area and to fuel Gas-to-Power CCGT plants proposed at the Saldanha Steel site in the Saldanha Bay Municipality (1,400 MW) and at Ankerlig Power Station in the City of Cape Town

(2,000 MW), a process to facilitate the development of a LNG Importation Facility at the Port of Saldanha Bay and the development of associated transmission Gas Pipelines (Phase 1a of the National Phased Gas Pipeline Network from Saldanha Bay to Ankerlig) may be considered a key catalytic intervention.

Accepting that a Ministerial Determination has been issued to the effect that the ports of Richards Bay and Coega are to be prioritised for the development of LNG Importation Facilities as part of an integrated Gas-to-Power solution at those locations, this intervention is likely to require a multi-lateral approach to develop a strong Business Case for the pursuit of the Saldanha Bay option as an alone-standing opportunity with strong commercial fundamentals and potentially positive regional development spinoffs.

4.4.2. Challenging the Single Buyer Model

Noting the current legal challenge that has been launched by the City of Cape Town against the Minister of Energy, challenging the Single Buyer Model currently in place whereby only Eskom may purchase electricity from IPPs, it is considered that a successful challenge to Eskom's monopoly in this regard could conceivably free up the market in the Greater Saldanha and Greater Cape Metro regions and that this would likely lead to the enhanced viability of the Saldanha Steel IPP Gas-to-Power project as well as, potentially, other IPP initiatives.

That in turn could lead to more competitive pricing of electricity for end-users, including the CoCT and other local municipalities.

Such competitive pricing and market-driven competition in the Electricity Supply Industry in general could well see the further adoption of cutting edge technologies and a growth in IPPs on-selling electricity to individual customers.

A fall in electricity costs could also be seen to facilitate a number of profound benefits for the GSR and the GCM:

- The increasing competitiveness of businesses and other enterprises based in these regions;
- the longer-term integration of desalination plants as a feasible and sustainable water supply solution, particularly for coastal settlements.

In addition, any growth in the REIPP sector that might be facilitated by a move away from the Single Buyer Model could well result in broader regional benefits, including:

- Improved prospects for the Atlantis SEZ, focused on Green Energy and renewables; and
- Improved prospects for smaller municipalities to negotiate directly with IPPs to secure their electricity supply needs in a contractual framework of cost certainty over specified time frames.

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