SOUTH AFRICAN
ACADEMY OF ENGINEERING

PROFILE

Website saae.co.za

SOUTH AFRICAN ACADEMY OF ENGINEERING

SAAE VISION

SAAE to be a reliable and sought after source of expert advice on matters pertaining to global competitiveness and quality of life for the South African nation.

SAAE MISSION

Service to the Nation

To promote the welfare of the nation by marshalling the knowledge and insight of eminent members of the South African engineering profession.

A long-standing aim is to inform National Policy and Development decision-making in an independent, professional way whilst supporting the development of professional institutions in engineering in SADC and sub-Sahara countries by constructive interaction

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SAAE HISTORY

- Founded 28 April 1992 under the aegis of the South African Society of Professional Engineers (SPE) in order to:-
  - provide eminent engineers a forum for communication and service to the nation
  - identify role models for the young
  - promote the engineering profession
- Obtained independence from SPE on 11 March 1995 under own constitution
- Admitted as a CAETS affiliate in 2009 in Canada.

MEMBERSHIP

- Based on peer election process followed by all CAETS members
- At present 200 fellows
- Eminent engineering and technological science leaders from public and private sectors, industry, education, research, etc.

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RSA ENGINEERING CHALLENGES

- In a technology driven global business environment SAAE can assist South Africa to: -
  - remain locally and internationally relevant and competitive with technology and trade.
  - create opportunities for poverty alleviation and quality of life enhancement.
  - strengthen processes of education, empowerment, skills development, job creation and health improvement.
  - foster sustainable rural and urban development.

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SAAE ACTIVITIES

- Australian Academy of Technology and Engineering (ATSE)
  - 1999 Joint Symposium in RSA on PPP's for infrastructure delivery
  - 2003 Joint Symposium in Australia on Water Resources Management
  - 2008 Joint International Symposium in RSA on Engineering Skills Shortage
  - 2010 Joint workshop on Energy Technologies for a Low Carbon Future.
- China Academy of Engineering (CAE)
  - Annual Joint Workshops / Forums in China and South Africa. (Transportation and Water Engineering)
  - Assistance to many PRC Delegations Annually on Engineering related trade initiatives.
- Royal Academy of Engineering (RAE)
  - GCRF Africa Catalyst Initiative Pilot Study for the Africa Catalyst Initiative. The aim of GCRF Africa Catalyst is to strengthen professional engineering bodies in sub-Saharan Africa so that they can effectively promote the profession, share best practice and increase local engineering capacity, to help drive development.

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SAAE ACTIVITIES Cont.

- Present Annual Hendrik van der Bijl Memorial Lecture (since 1963) jointly with the University of Pretoria with eminent speaker on a national engineering topic.
- Present Annual Academy Lecture on engineering topic in different centres in South Africa.
- Present CAETS information dissemination lectures in different centres in South Africa
- SAAE has jointly with ASSAf (Academy of Science of South Africa) recently prepared the following reports:
  - South African's Technical Readiness to Support the Shale Gas Industry
  - Science Action Plan for Shale Gas Exploration in the Karoo Basin
- SAAE arranges public lectures which have included the following topics:
  - Opportunities for Low Carbon Energy Technology for Power Generation
  - The Wicked Challenge of Sustaining South Africa's Water Security
  - Opportunities for South Africa's Electricity Power Sector
  - Karoo Dilemmas: Prospective shale gas development in the Karoo – what is the outlook?
  - Challenges Facing the South African Mining Industry
  - Decolonising engineering
  - The Global Revolution in Energy and What it means for South Africa

Overview of the South African Energy Sector

Shanduvan Pty Ltd
Integrated Sustainable Energy Solutions

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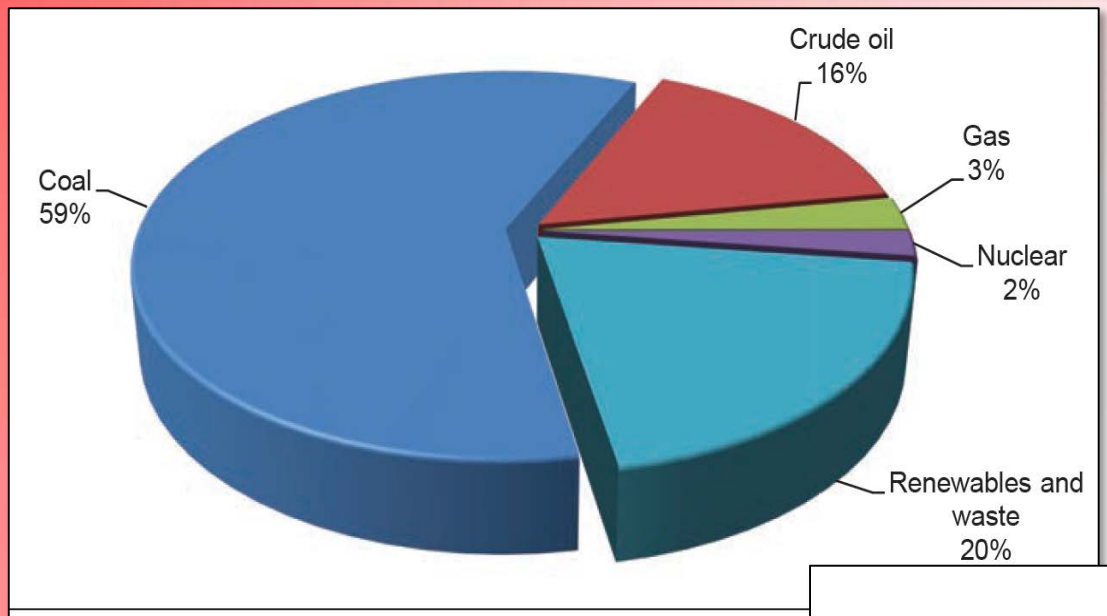
OBJECTIVES FOR THE ENERGY SECTOR

"South Africa will have an energy sector that promotes:

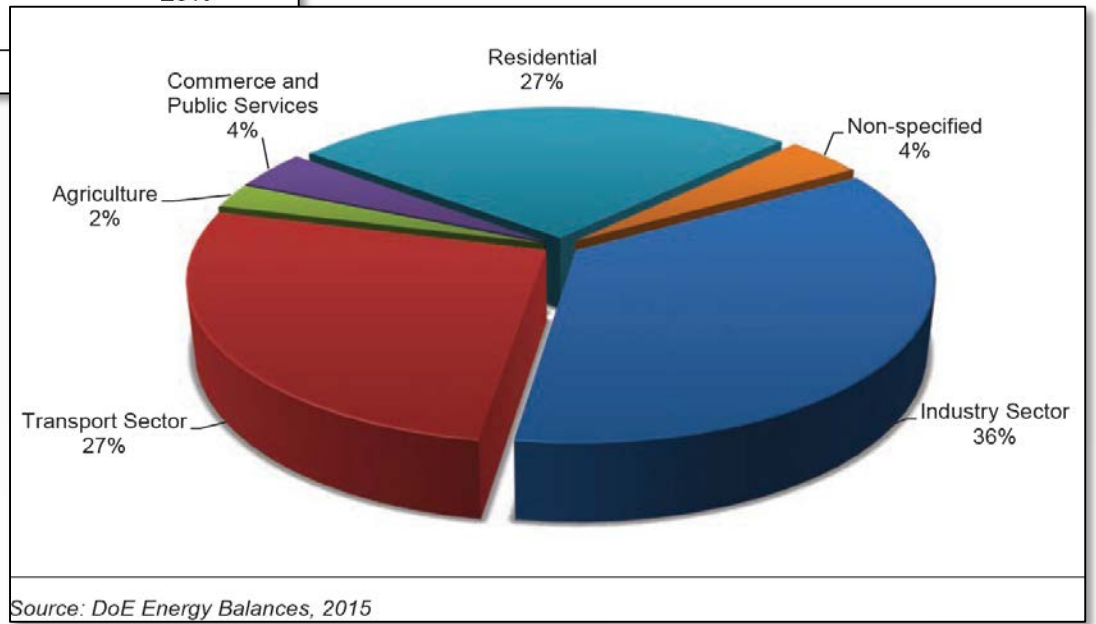
- Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.
- Social Equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households
- Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change"

Extract from National Planning Committee paper, 2018

South African Energy Supply and Demand.



Source: DoE Energy Balances, 2015



Source: DoE Energy Balances, 2015

The South African power sector

- **Recent Developments**
- Draft Integrated Resource plan
- Eskom Medium Term Adequacy Outlook 2018 – 2023
- Eskom Transmission Development Plan – 2018 – 2027
- Eskom Unbundling Announcement

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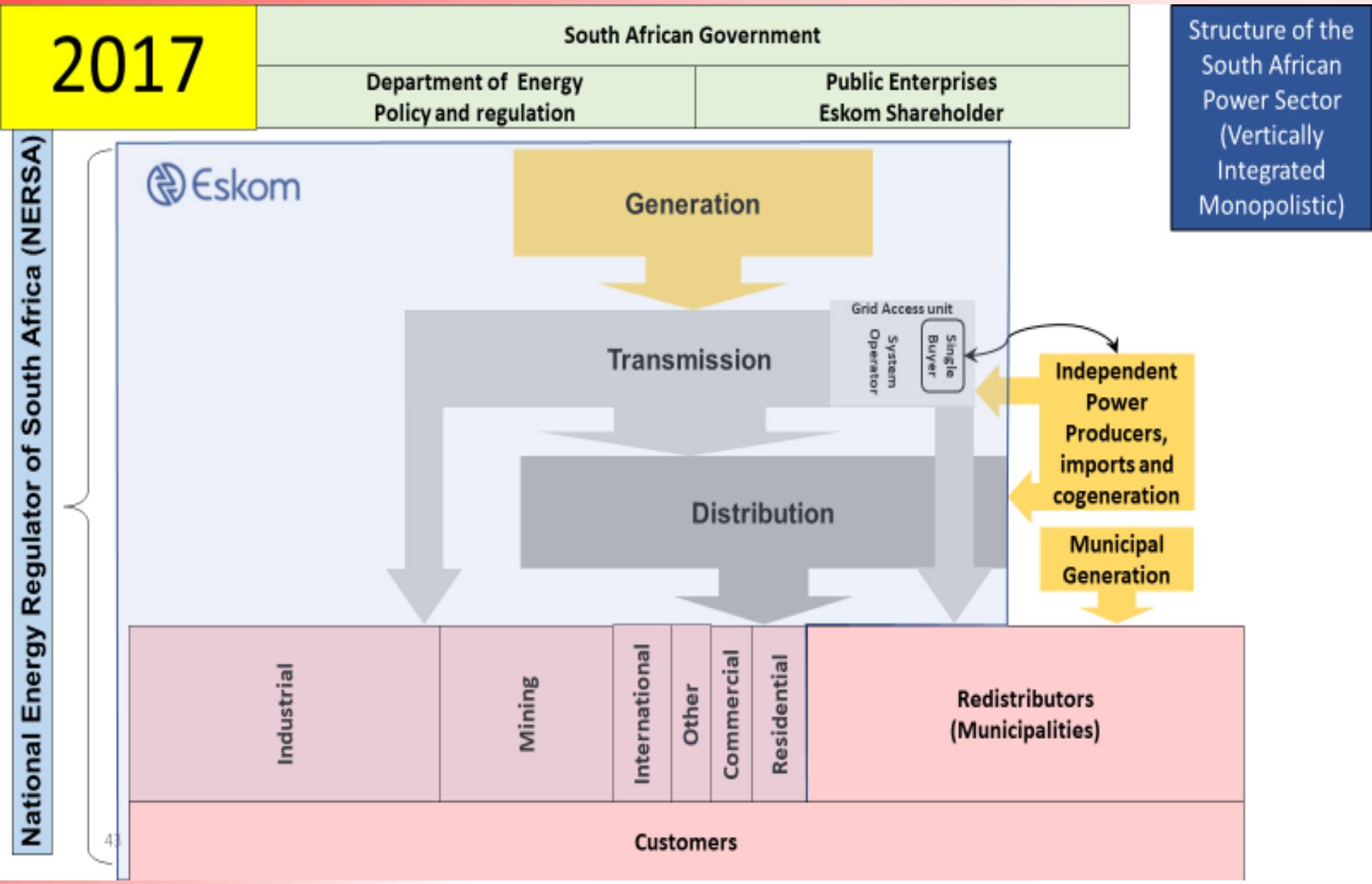
2017



Structure of the South African Power Sector (Vertically Integrated Monopolistic)

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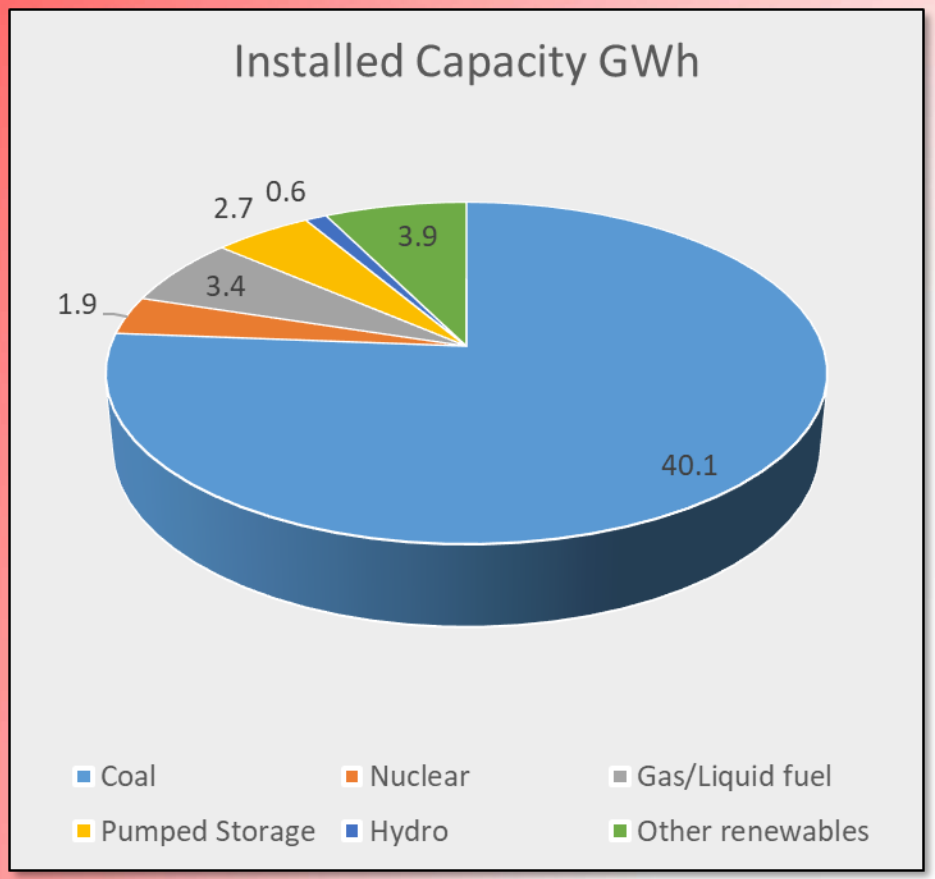
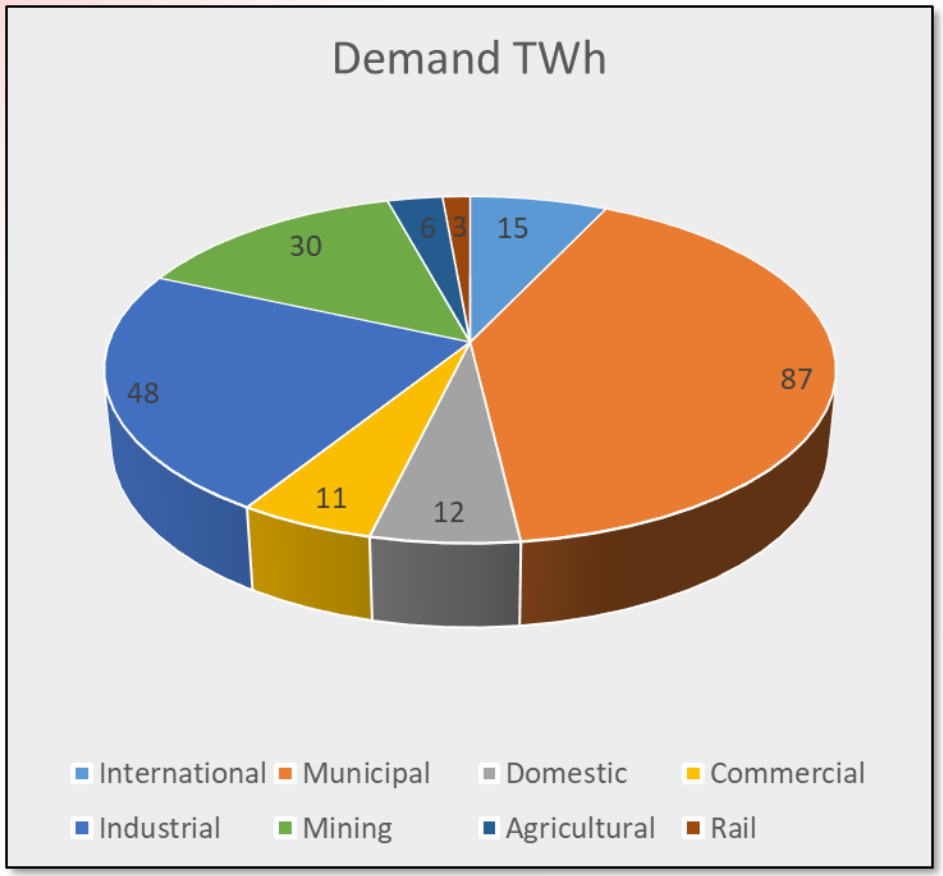
SA electricity supply and demand





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Source: Eskom Annual Report 2018

Draft Integrated resource plan

	Coal	Nuclear	Hydro	Storage (Pumped Storage)	PV	Wind	CSP	Gas / Diesel	Other (CoGen, Biomass, Landfill)	Embedded Generation
2018	39 126	1 860	2 196	2 912	1 474	1 980	300	3 830	499	Unknown
2019	2 155					244	300			200
2020	1 433				114	300				200
2021	1 433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1 000	1 500		2 250		200
2027					1 000	1 600		1 200		200
2028					1 000	1 600		1 800		200
2029					1 000	1 600		2 850		200
2030			2 500		1 000	1 600				200
TOTAL INSTALLED	**33 847**	**1 860**	**4 696**	**2 912**	**7 958**	**11 442**	**600**	**11 930**	**499**	**2600**
Installed Capacity Mix (%)	**44.6**	**2.5**	**6.2**	**3.8**	**10.5**	**15.1**	**0.9**	**15.7**	**0.7**	

Installed Capacity

Committed / Already Contracted Capacity

New Additional Capacity (IRP Update)

Embedded Generation Capacity (Generation for own use allocation)

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Eskom medium term system adequacy outlook 2018 - 2023

	2013	2014	2015	2016	2017
Total Installed Capacity (MW)	18	33	96	186	285
Energy Generated (GWh)	18.5	41.5	109.3	241.1	370.8[4]

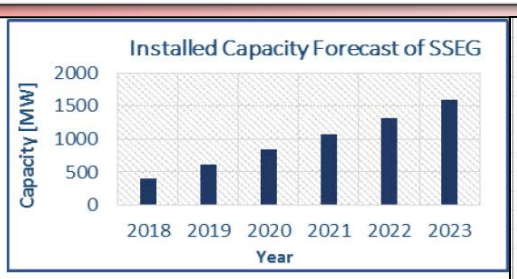
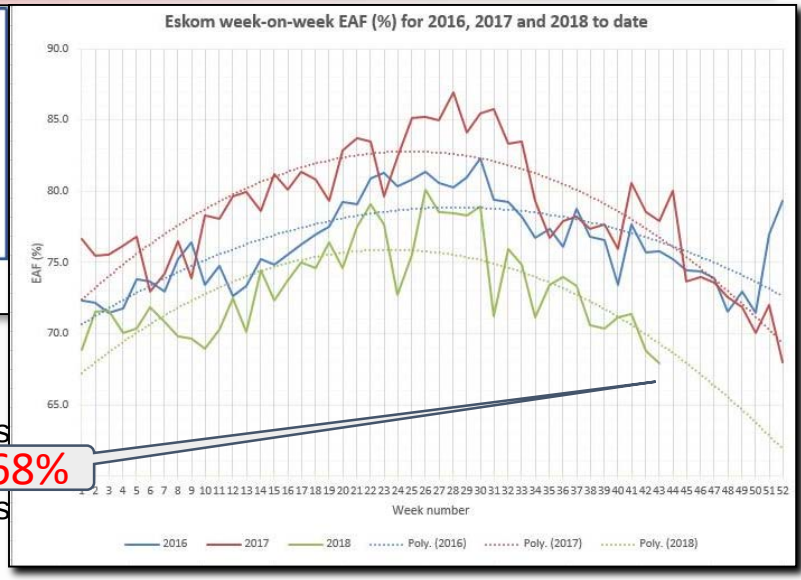
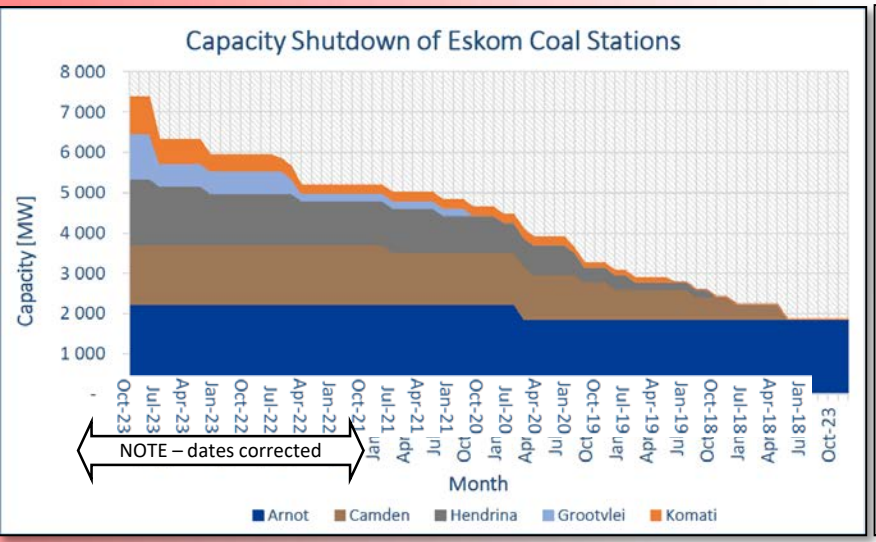


Figure 6: Estimated and forecasted small- to medium-scale embedded generation (solar PV)



- At an EAF of 71%, the system is inadequate, regardless of demand growth.
- At an EAF of 73%, the system is inadequate for moderate demand growth.
- At an EAF of 75%, the system is adequate for all demand forecast scenarios considered.
- At an EAF of 80%, the system is adequate for all demand forecast scenarios considered.



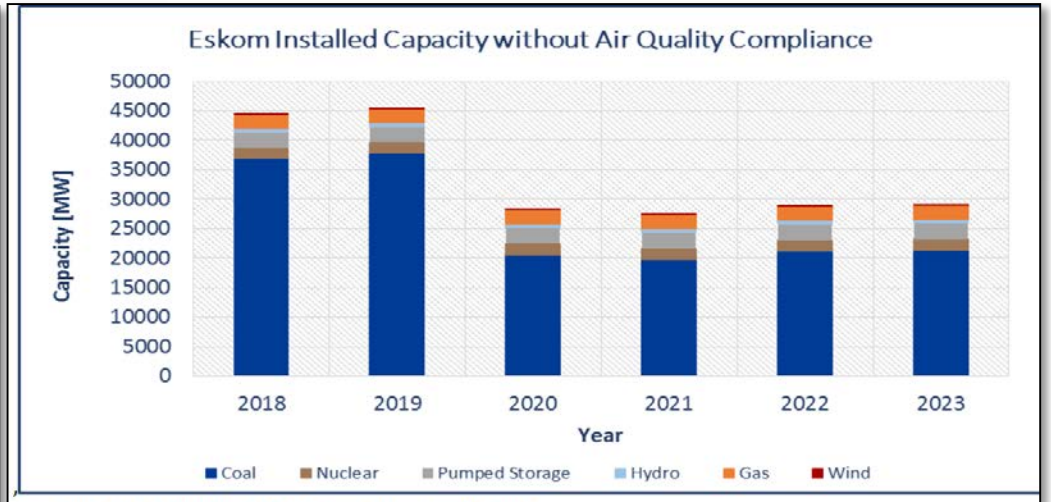


Figure 8: Capacity reduction due to air quality non-compliance

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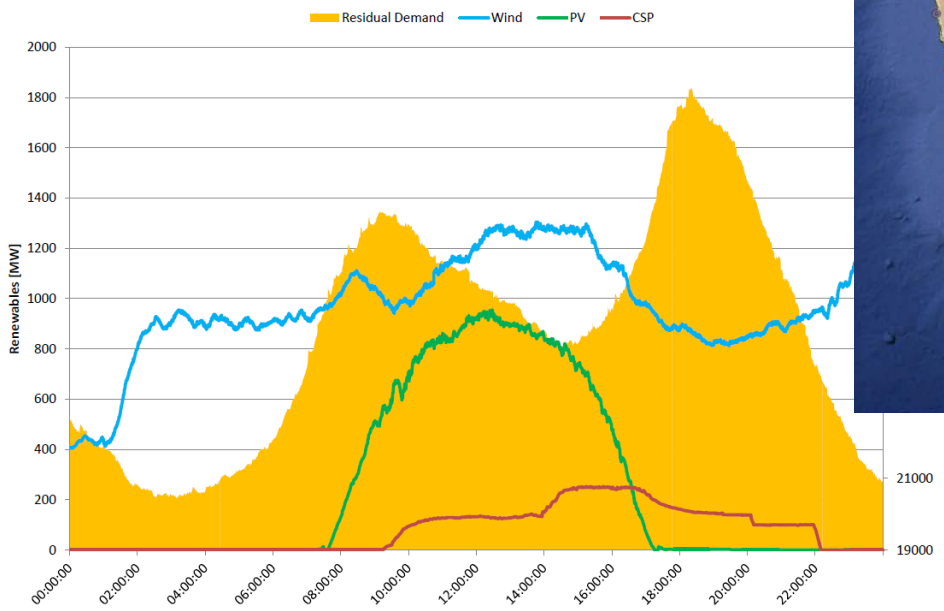
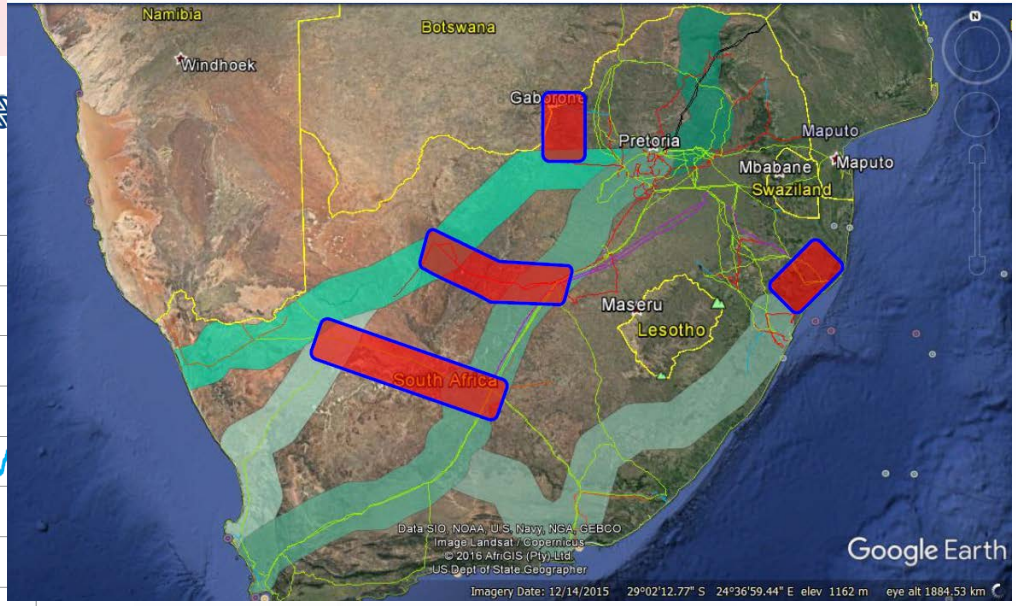
Eskom transmission development plan

Example of Daily Renewable Generation



Transmission integration plans for future IPPs - Additional SEA Corridors



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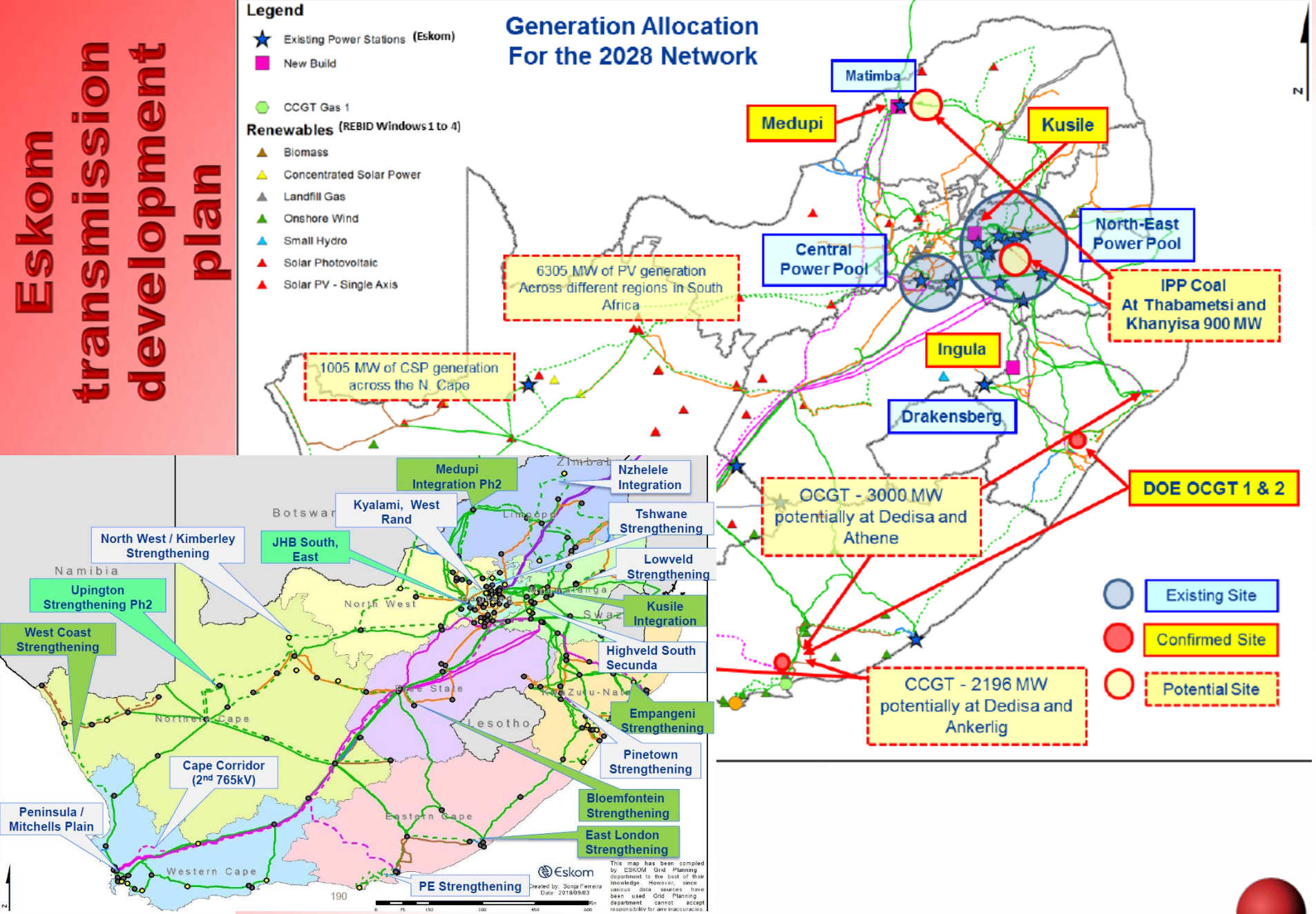
Eskom transmission development plan



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Challenges for the Sector

- Demand Forecast accuracy
- Technology Costs – especially renewables and storage
- Electricity pricing – legacy vs new entrants
- Existing Plant Performance
- Environmental performance
- Variable Capacity from Renewable Sources
- Fuel Costs – especially coal and diesel
- Import hydro options
- Viability of Eskom – unbundling announced
- Availability of capital for Grid development
- Utility death spiral

The Utility Death Spiral

Ageing assets and increased demand drive new investment and increased debt.
Unit costs increase

PV cost reduces and becomes competitive with grid Power

Revenue drops, fixed costs remain the same and so unit costs increase.

Regulatory response – increase fixed cost component of tariff (connection fee)

Decreased driver for PV

Revenue drops, fixed costs remain the same and so unit costs increase.

Grid defection

Low cost battery storage

Revenue drops, fixed costs remain the same and so unit costs increase.

Further Grid defection

Micro trading

COMPETITION

Shareholder debt bailouts
Social and economic costs
Stranded assets and garage sales

Future Outlook

- Restructuring of the SA power sector.
- Creation of an electricity market.
- Greater role for private sector – willing buyer willing seller.
- Micro trading and mini grids.
- Energy storage – grid based and decentralised.
- Potential for between 25% and 65% CO2 emission reduction by 2050.