Inclusion of Energy Storage in the IRP 2019

Presentation by Mikhail Nikomarov, Board Chair, SAESA

SAESA South African Energy Storage Association

SAESA Technical Forum

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Contact: info@saesa.org.za
www.saesa.org.za

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The South African Energy Storage Association (SAESA) is committed to strict compliance with all laws and regulations, and to the highest ethical standards in the way we conduct our operations. This includes strict compliance with antitrust laws, to protect and enhance our country's free, competitive economy.

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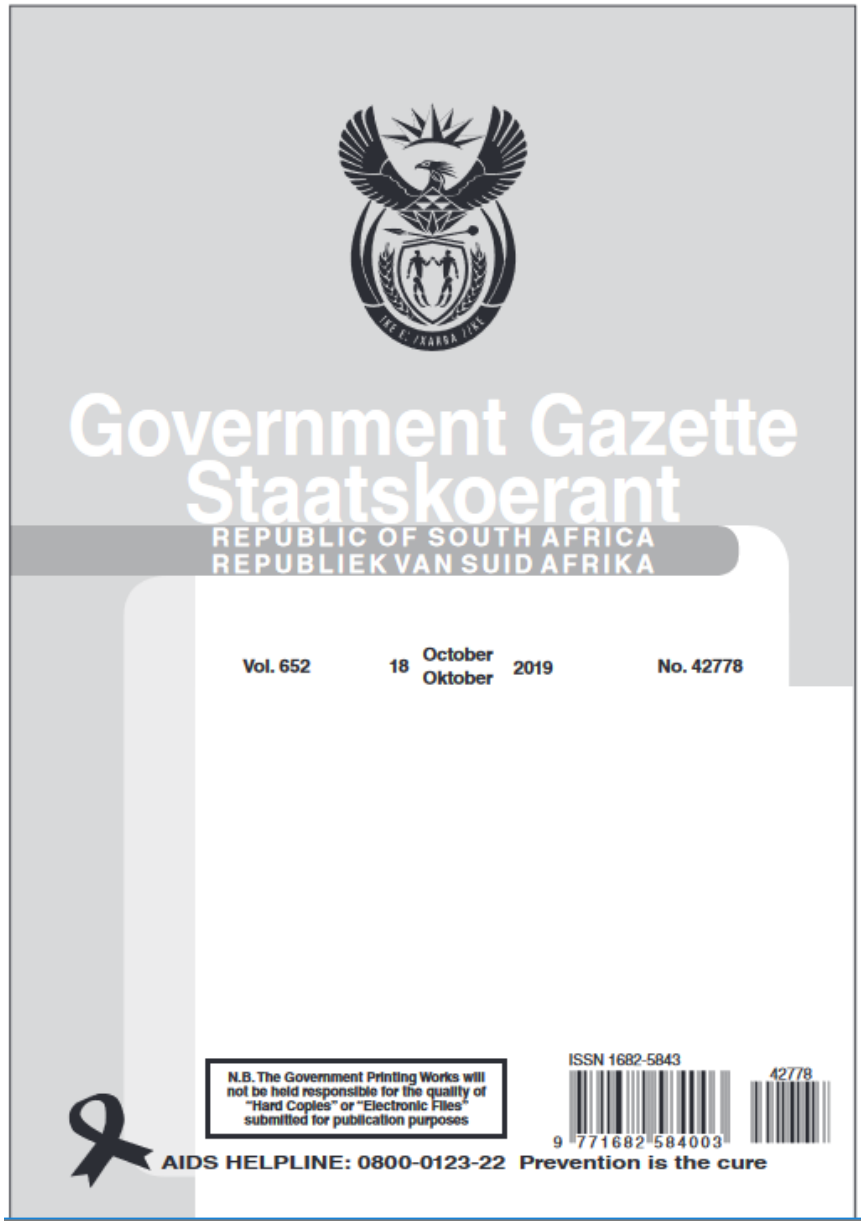
Information which companies must not exchange at Association meetings includes but is not limited to:

- Information or agreements on prices, price components, discounts, pricing strategies or price calculations or planned price changes;
- Terms of delivery or payment and any other contractual provisions in contracts with customers/suppliers provided they have competitive implications;
- Information on business strategies or on current or future market behaviour ("signaling");
- Information not yet lawfully published concerning current business developments or business expectations (in particular sales/turnover figures), even if such information provides no indication of the market position of individual products;
- Information on profits, profit margins, market shares or planned investments which is not in the public domain;
- Information on internal research and development projects;
- Information allowing coordinated action vis-à-vis players on the other side of the market (customers or suppliers), in particular relating to offers to third parties (for example, if parties respond to a call for tenders: which lot to tender for; degree of interest in winning the contract);
- The division of geographic or labour markets or sources and express or implied agreements on supply, purchase or other boycotts of specific companies.
- Demands from customers or suppliers including the company's own response to these or the response of competitors;
- Verification of information received from a customer or supplier;
- The joint discussion and analysis of statistics permitted pursuant to item a) above, in particular the disaggregation of aggregated data.

Yes, we have an IRP2019



SOURCE: SA IRP2019

Yes, the IRP2019 has a dedicated allocation for energy storage

Table 5: IRP 2019

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400 1000	1600			
2023	750	-555				1000	1600			500
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
Committed / Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030
- Koeberg power station rated / installed capacity will revert to 1926 MW (original design capacity) following design life extension work.
- Other / Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility
- Short term capacity gap is estimated at 2000 MW

SOURCE: SA IRP2019

The allocation is significant - over 2000MW of new capacity within 10 years

	Storage
Current Base	2 912
2019	
2020	
2021	
2022	513
2023	
2024	
2025	
2026	
2027	
2028	
2029	1575
2030	
TOTAL INSTALLED CAPACITY by 2030 (MW)	5000
% Total Installed Capacity (% of MW)	6.35
% Annual Energy Contribution (% of MWh)	1.2*

Existing capacity in South Africa of 2,912MW, principally Pumped Hydro (PHS)

New capacity of 513MW in the next 4 years

- 350MW likely under the announced Eskom programme;
- A further 163MW available that is not allocated;

Further 1, 575 MW capacity of 513MW over the following 7 years

- Despite allocation in one year, may well be distributed over preceding years;
- May change over time, if newer IRP versions are promulgated in future;

- Total capacity of 5,000MW or 6.35% of entire power system;
- 1.2% of total electrical energy will go through storage in South Africa.

SOURCE: SA IRP2019

5GW in 2029 implies 3.84 TWh of energy will be carried through storage

% Annual Energy Contribution (% of MWh)	1.2*

Some implications of 1.2%

- The median demand forecast in the IRP expects around 320 TWh of electrical energy consumed in 2029, implying that 1.2% is 3.84 TWh;
- Although this detail is not provided, all storage is unlikely to be used every day (most will be used during the weekdays extensively; some, depending on location, could be used more on weekends or holidays). Based on usability assumptions and the 5GW total expected installed base, we can derive the required average duration required from the storage:
    - If 200 days, per annum, then 19.2GWh is used per day, equating to an average of 4 hours per GW;
    - If 250 days, then it equates to 2.7 hours per GW;
    - This is a simplistic calculation, as pumped hydro schemes form nearly 60% of the capacity and may offer 12+ hours of storage but be unable to recharge on a daily or hourly basis;

SOURCE: SA IRP2019

Could there be more storage beyond the dedicated allocation?

The answer is yes, though it depends on:

- Regulatory interpretation of standalone versus co-located storage;
- Power system needs and user needs
- Future design and implementation of the Renewable Energy Procurement Programme

	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	1 474	1 980	300	3 830	499
2019		244	300		Allocation to the extent of the short term capacity and energy gap.
2020	114	300			
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2024		1600		1000	500
2025	1000	1600			500
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2028	1000	1 600			500
2029	1000	1 600			500
2030	1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	6.3	17.8	0.6	1.3	

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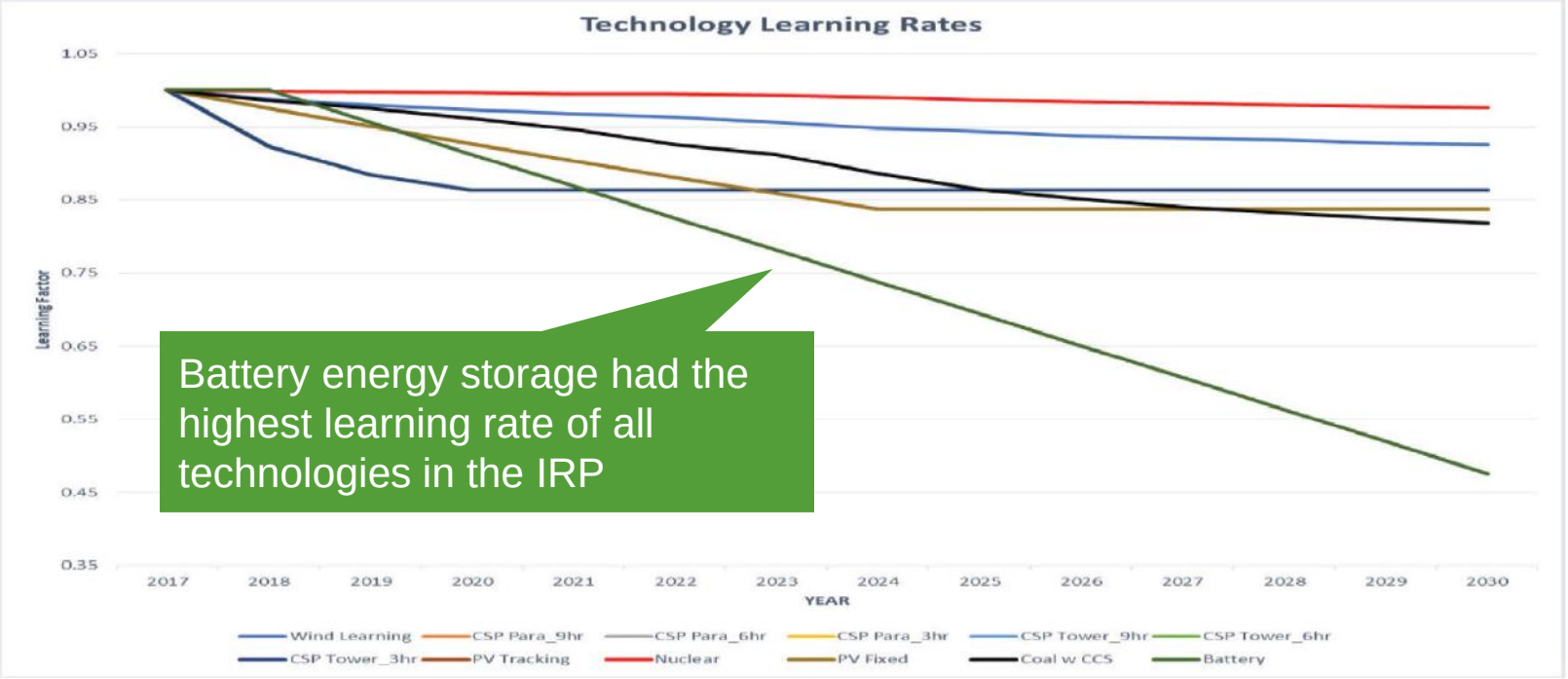
- The actual upside for storage within the IRP could be quite higher.
  - There is no detail on whether new storage is standalone or whether it includes storage that may be co-located with a generator.
  - Eskom's battery programme features both, with most of the storage in Eskom's plan standalone.
- There are three sources of potentially even higher amounts storage through co-location with:
  1. Solar PV – which is expected to add a further 6800 MW in generation through 2030;
  2. Wind – which is expected to add nearly a further 16000 MW in generation through 2030;
  3. Embedded generation –is an opportunity for small and medium sized storage.

SOURCE: SA IRP2019

What changed to make storage so prominent in the IRP2019?

- The IRP2019 explains that storage became a lowest cost option after:
  1. Energy storage costs were updated to reflect current market pricing,
  2. Consideration of the “longer gas infrastructure lead time”
  3. Modelling the “extent of the wind and solar PV option in the IRP”.
- In addition, the IRP lauded the benefits of storage, including
  1. Its ability to accelerate the formation of “Smart Grid systems;”
  2. Buffer South Africa through the disruption to the “traditional power delivery model;”
  3. Bridge the power generation gap that comes from the “reality that the timing of [renewable energy] production might be during low-demand periods.”
- A technology that lost out to storage is gas, which was more prominent in pervious drafts.



SOURCE: SA IRP2019

There are more opportunities to improve the evaluation of storage in South Africa's IRP going forward

- The IRP is envisioned as an evolving document, and SAESA needs to motivate that **the IRP is updated every 18 to 24 months**. This is especially important for energy storage, whose **improvement in costs and technical performance are more rapid** than other electrical energy technologies.
- When the next iteration of the IRP is developed, SAESA and SAREC will motivate for several additional factors to be considered:
  - The **IRP needs to value more benefits of storage** than it currently does. This could be done by expanding the capability of the IRP model to include spatial modelling for low and middle voltage networks or by commission a study of the benefits of storage beyond system balancing and capacity support. Specific examples of currently unaccounted benefits of storage include:
    a. **Offset or optimisation of transmission infrastructure costs**, including network stability and expansion deferral;
    b. Stability, lowered technical losses and expansion **deferral** within Eskom and municipal **distribution networks**;
  - Energy storage should be treated and modelled as **its own class type and not as generation**. Storage is a net consumer, not a net producer of electrical energy. This requires capacity planning for storage to include both power (MW) and energy (MWh) capacity metrics;
  - With over **3 million South Africans without access to grid-based** electricity, the role of storage should be highlighted as a means to **provide "round-the-clock" energy access** by strengthening and expanding off-grid and micro-grid options;
  - More **storage technologies should be included among the areas for further "Research and Development**," with only hydrogen mentioned in the 2019 IRP. This will enable South Africa to compete in the global opportunity for storage technologies, grow new industries and **support a just energy transition.**

The role of storage in the IRP is a major achievement of SAESA to be celebrated; however, much more support is needed in our industry

The current SAESA Board

Vice-Chair & Treasurer: Norman Jackson

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Sherwin Harris

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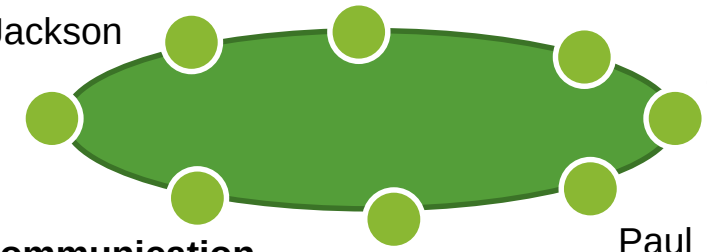

Theo Fischer

Communication Officer: Jo Dean

Avesh Padyachee

Paul Vermeulen

Ongoing support from current and new members is critical to us maintaining momentum

- Paul was instrumental in our progress with support of the Policy Subcommittee
- All this despite use still not having a good photo of him

SOURCE: SAESA