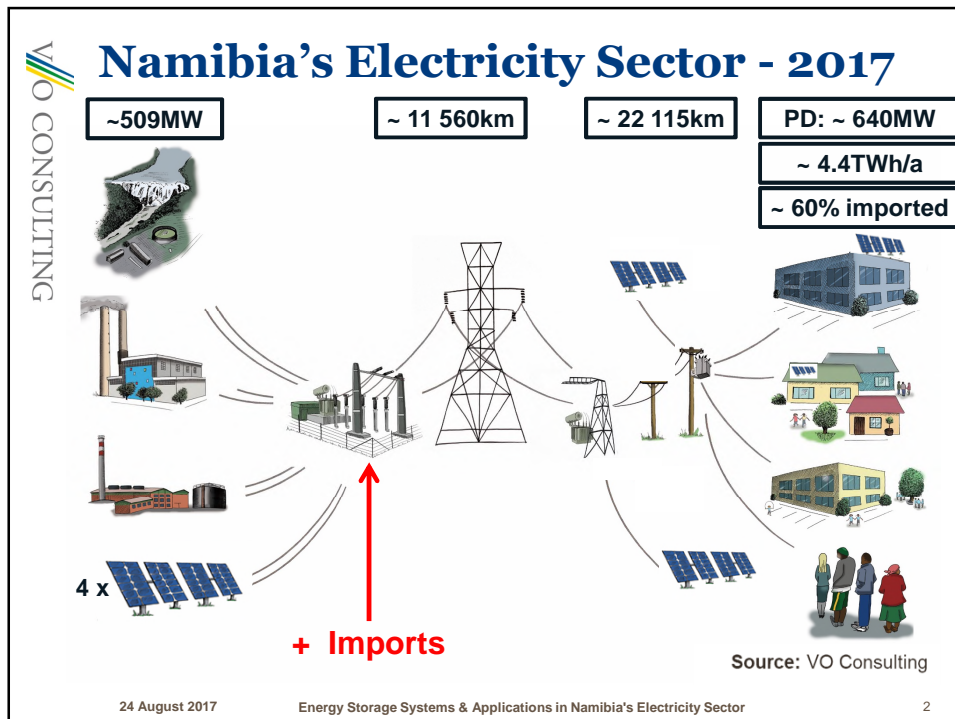



Energy Storage Systems and their Applications in Namibia's Electricity Sector

Konrad Adenauer Foundation
NamPower Convention Centre
Windhoek, Namibia
24 August 2017


Dr Detlof von Oertzen
VO CONSULTING



 **Electricity Sector SWOT**


<p><u>Strengths</u></p> <ul style="list-style-type: none">• Availability• Policy & regulatory frameworks• Cost-reflective tariffs	<p><u>Weaknesses</u></p> <ul style="list-style-type: none">• Affordability• Access• Attracting investments for firm power projects
<p><u>Opportunities</u></p> <ul style="list-style-type: none">• Renewable energy potentials• Localisation potentials• Leapfrog technology use	<p><u>Threats</u></p> <ul style="list-style-type: none">• Security of supply• Institutional inertia• Ongoing currency outflows & forex exposure

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 **Electricity Sector Trends – “ 9 Ds “**

- Decline of RE technology cost
- Decentralisation
- Displacement of traditional supply options
- Decarbonisation
- Demand side measures & responses
- Digitalisation
- Democratisation
- Decoupling consumers
- **Disruption of traditional markets**


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Electricity Sector Game Changers

- Technology cost reductions
- Climate funding – Paris Agreement
- Market liberalisation
- End-user participation
- Electric mobility
- Smart grids
- **Energy storage systems**

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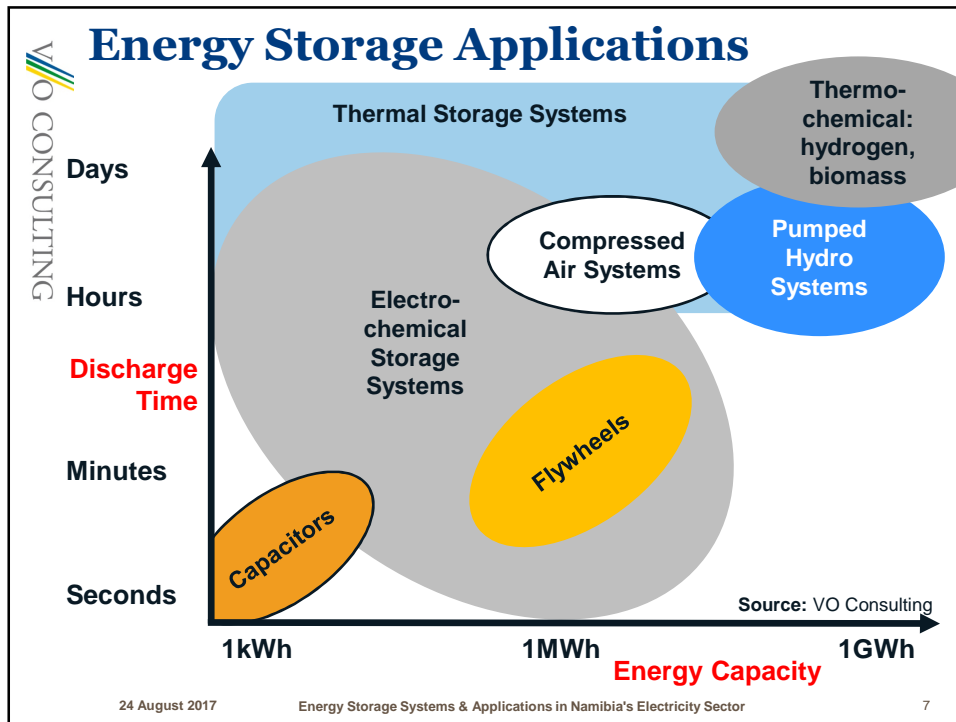


Energy Storage Technologies

Mechanical Electro-chemical Electrical Thermo-chemical Thermal

Source: VO Consulting


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Electrical Services from Storage


<p><u>Domestic & Commercial Users:</u></p> <ul style="list-style-type: none"> • Electrical energy storage • Emergency power • Uninterruptible power supply • Maximum demand control • Energy banking, e.g. charging • Off-grid supplies <p>AND, increasingly, for</p> <ul style="list-style-type: none"> • Mobility 	<p><u>LPU's & Utilities:</u></p> <p>Energy storage plus</p> <ul style="list-style-type: none"> • Time shifting • Peak shaving • Load levelling • Spinning reserve / supplemental reserve • Voltage regulation • Frequency control • Black-start (plant)
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Domestic End-user Applications

Grid-connected uses



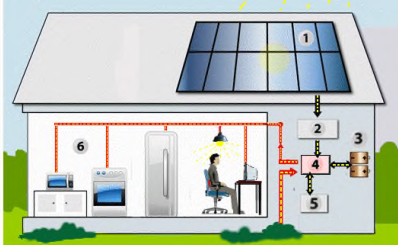
Tesla PowerWall

7 kWh/day

US\$ 6 200 (USA)

www.tesla.com (18Aug'17)

Off-grid applications




Namibian supplier (Aug '17)

10.6 kW solar PV plus

8 kVA Li storage / 8 000 cycles

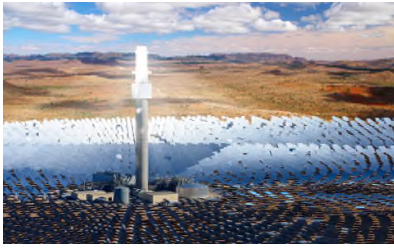
~N\$ 140k (PV) + N\$ 300k (stor.)

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Utility Applications - 1

Intermittent Generation



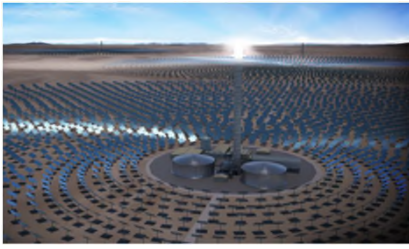
Port Augusta, South Australia

150 MW CSP (Aurora project)

1 100 MWh storage (8 hours)

USc 6.14/kWh (FX: 17 Aug '17)

Intermittent Generation



Tarapacá Region, Chile

450 MW CSP (Tamarugal)

5.8 GWh storage (13 hours)

USc 6.3/kWh

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Utility Applications - 2

Intermittent Generation – ‘The Bet’


Neoen's Hornsdale wind farm, Jamestown, South Australia:

100MW / 129MWh Li-ion battery paired with Neoen's wind farm.



Elon Musk 
@elonmusk

Replying to @mcannonbrookes
Tesla will get the system installed and working 100 days from contract signature or it is free. That serious enough for you?
3:50 AM - Mar 10, 2017
576 replies 5,653 retweets 11,973 likes



Source: Tesla

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Utility Applications - 3



80MW PowerPack substation,
Mira Loma, California, USA

Source: Tesla






20MW Li-ion Aliso Canyon,
California, USA

Source: Tesla

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Mobility Applications

<h3>E-bikes</h3>  <p><u>Namibian supplier</u> 14Ah Li-ion battery up to 40 km range from N\$ 13 225 (VAT incl.) www.suncycles-Namibia.org (18 Aug 2017)</p>	<h3>Electric vehicles</h3>   <p><u>Nisan Leaf (example)</u> 30 kWh battery 172 km range Rand 475 000 (VAT incl.) www.Nissan.co.za (18Aug'17)</p>
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End-User Perspective: Elec. Storage

Value proposition:

- Enhance emergency power supply / UPS capacity
- Optimisation of self-consumption
- Shift consumption in time to save when on ToU tariffs
- Maximise the value of electric vehicle(s)
- Incentivise self-supply & enable grid defection
- Enhance lifestyle / image

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Utility Perspective of Storage

Value proposition:

- **Improve power quality management & control**
- **Provide ancillary services**
- **Avoid / delay grid expansion**
- **Reduce capex & opex of spinning reserve**
- **Reduce line losses**
- **Enhance capabilities to manage maximum demand**
- **Improve network efficiencies, and others**

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IPP Perspective of Storage

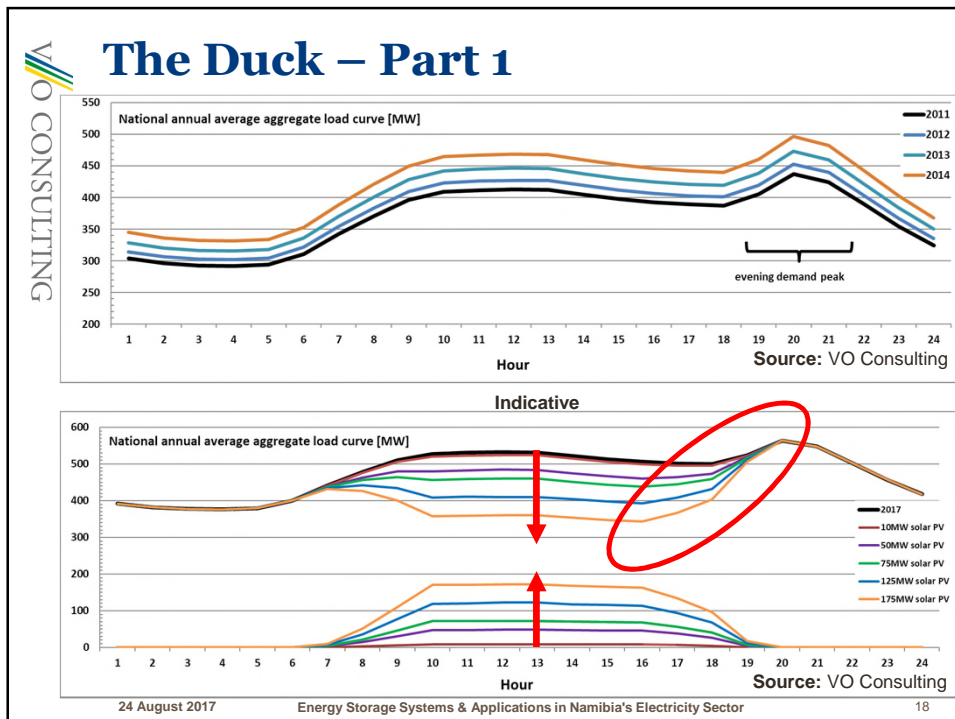
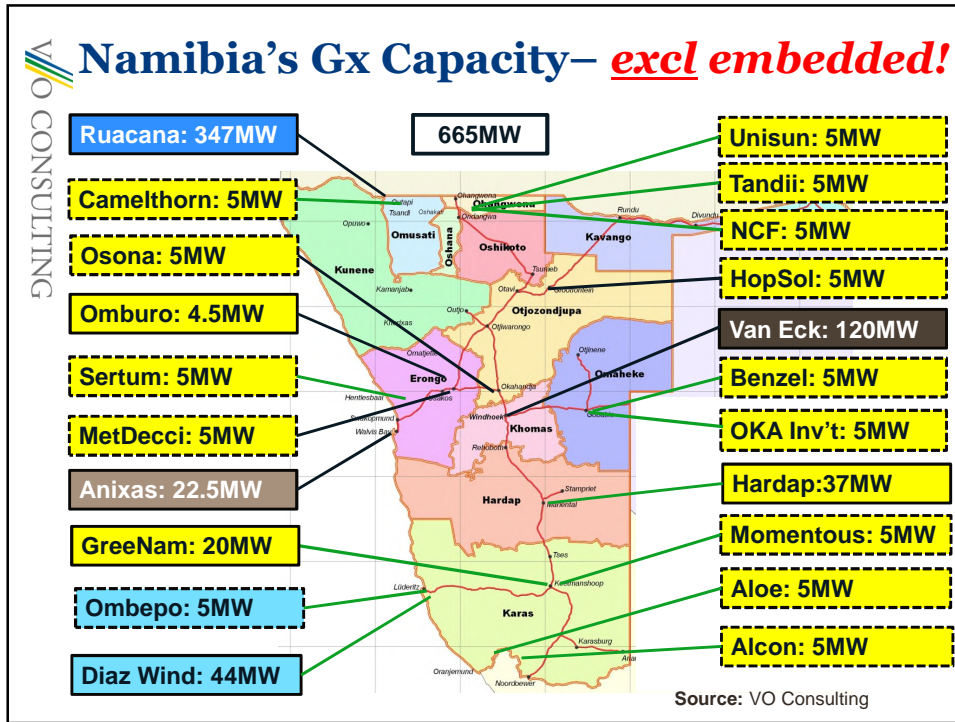
Value proposition:

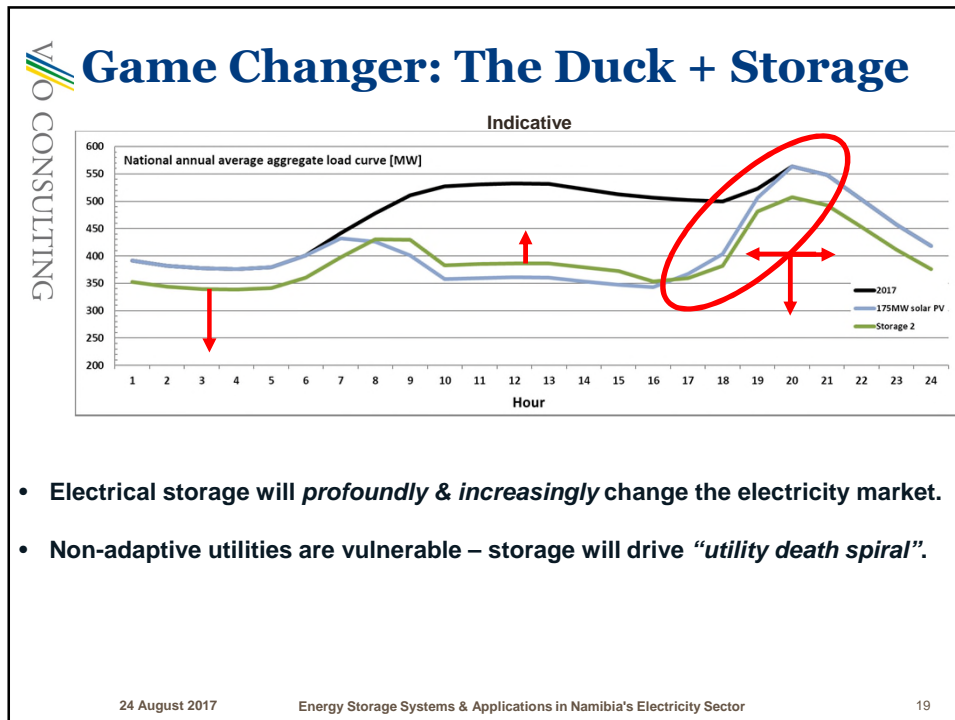
- **Optimise resource availability, e.g. from RE supplies**
- **Shift time of supply & enhance revenues (TOU tariffs)**
- **Increase response capability and capacity**
- **Provide ancillary services to grid operator, and others**

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-
- ## What should Namibia do to benefit?
- **Create legal and regulatory provisions** for the uptake of energy storage technologies across the entire electricity value chain.
 - **Create transparent pricing mechanism** for the multiple grid services that can be provided by energy storage technologies.
 - **Adopt international best practice** to guide the implementation of storage technologies, including planning (NIRP, Tx MP, REDMP).
 - **Design transmission and distribution infrastructure by** incorporating storage systems as support & control measures.
 - **Prepare for the rapid uptake of energy storage technologies** by commercial, industrial and private electricity consumers.
 - **Avoid investments** that turn obsolete once XXL storage is here.
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Take Away Messages

- Energy storage technologies *will affect utility business models.*
- Storage will further *incentivise grid defection.*
- Utilities without an adaptation strategy to *future-proof their business in a rapidly changing environment* will be challenged.
- Namibia will more optimally benefit from plentiful RE endowments if we pro-actively prepare for the arrival of XXL electrical storage – *which will influence the electricity sector value chain in its entirety.*
- Storage costs are decreasing, and combined with RE cost developments, *the repercussions for non-RE generation are considerable.*
- The value proposition of “*intermittent REs plus storage*” fulfills more and more of the “9 Ds” – *which will be hard to beat.*
- Storage will profoundly influence the uptake & use of intermittent RE technologies – *we must turn it into a benefit for Namibia.*

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Thank you!

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