

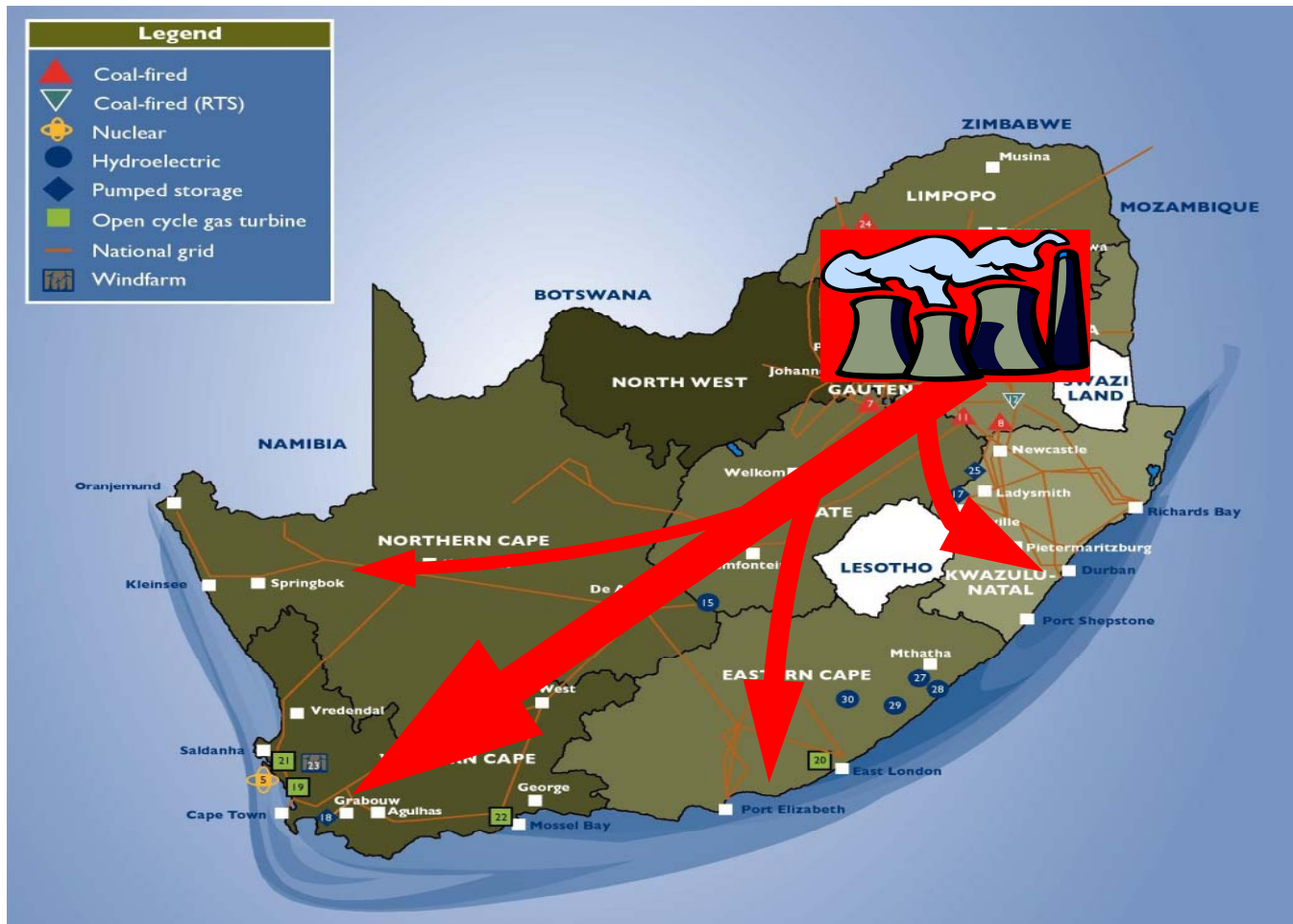


Grid Integrated Storage, Renewables and IRP2

Renewable Energy Africa Conference
Sandton Convention Centre – July 2011

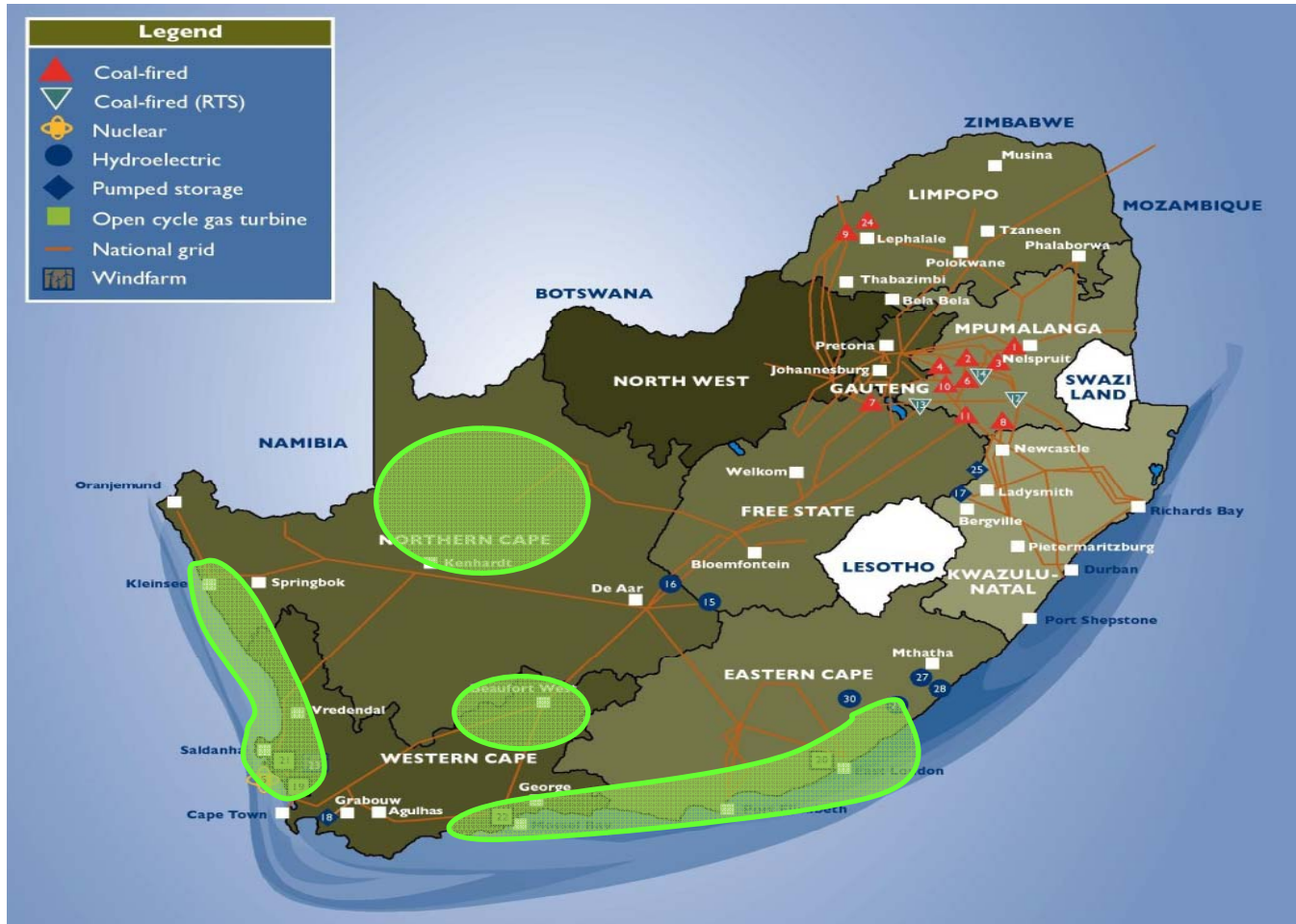


SOUTH AFRICA'S CENTRALIZED GENERATION LEGACY



- Large mega power plants
- Located close to primary energy source
- Significant transmission losses
- Vulnerable
 - Supply interruptions
 - Global commodity pricing
 - Industrial action
- Long lead time to add capacity
- Mismatch between peak demand and installed generation capacity

PENETRATION OF RE GENERATION CAPACITY



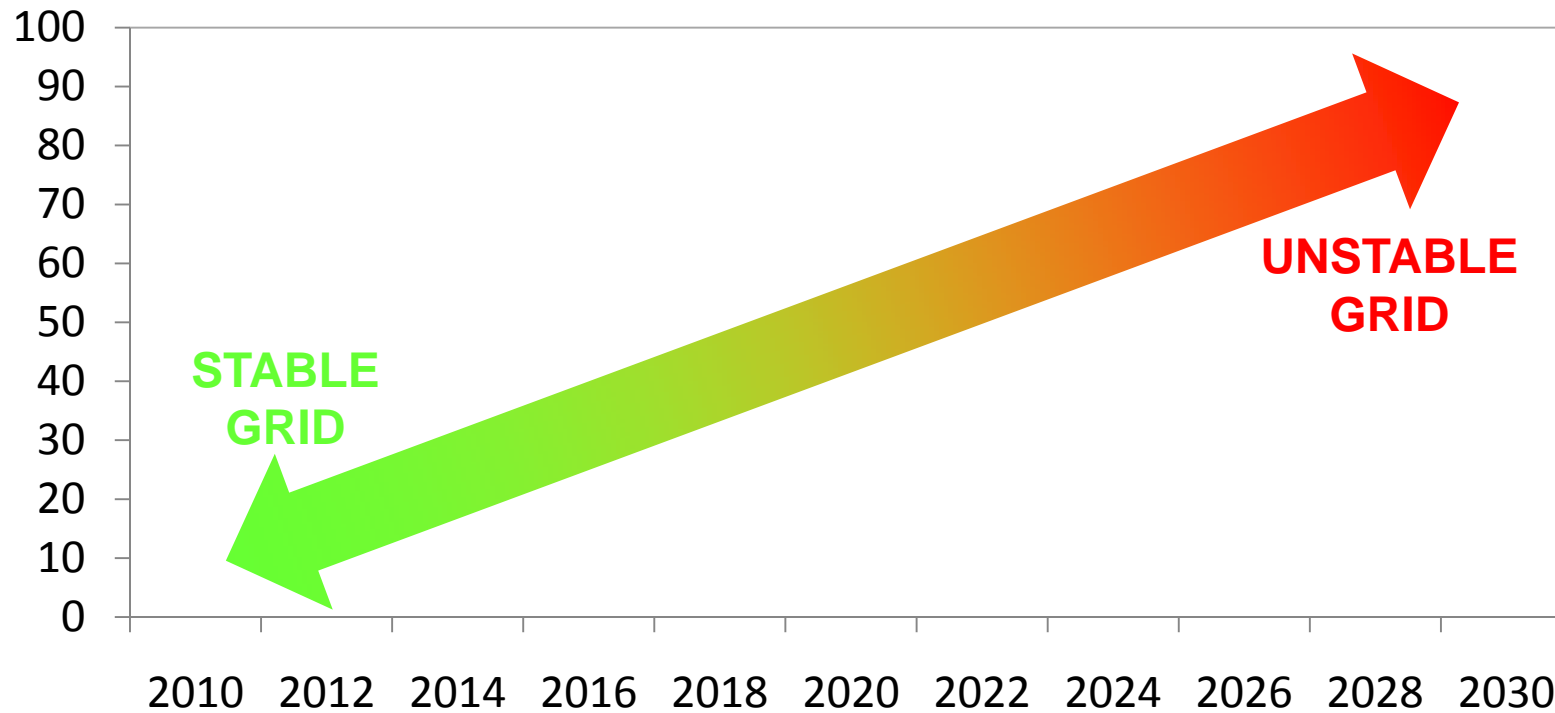
- Greater geographic distribution
- Located closer to load centres
- Reduced transmission losses
- Diversification of generation mix
- Reduced time to commercial operation
- Reduction in GHG emissions

BUT

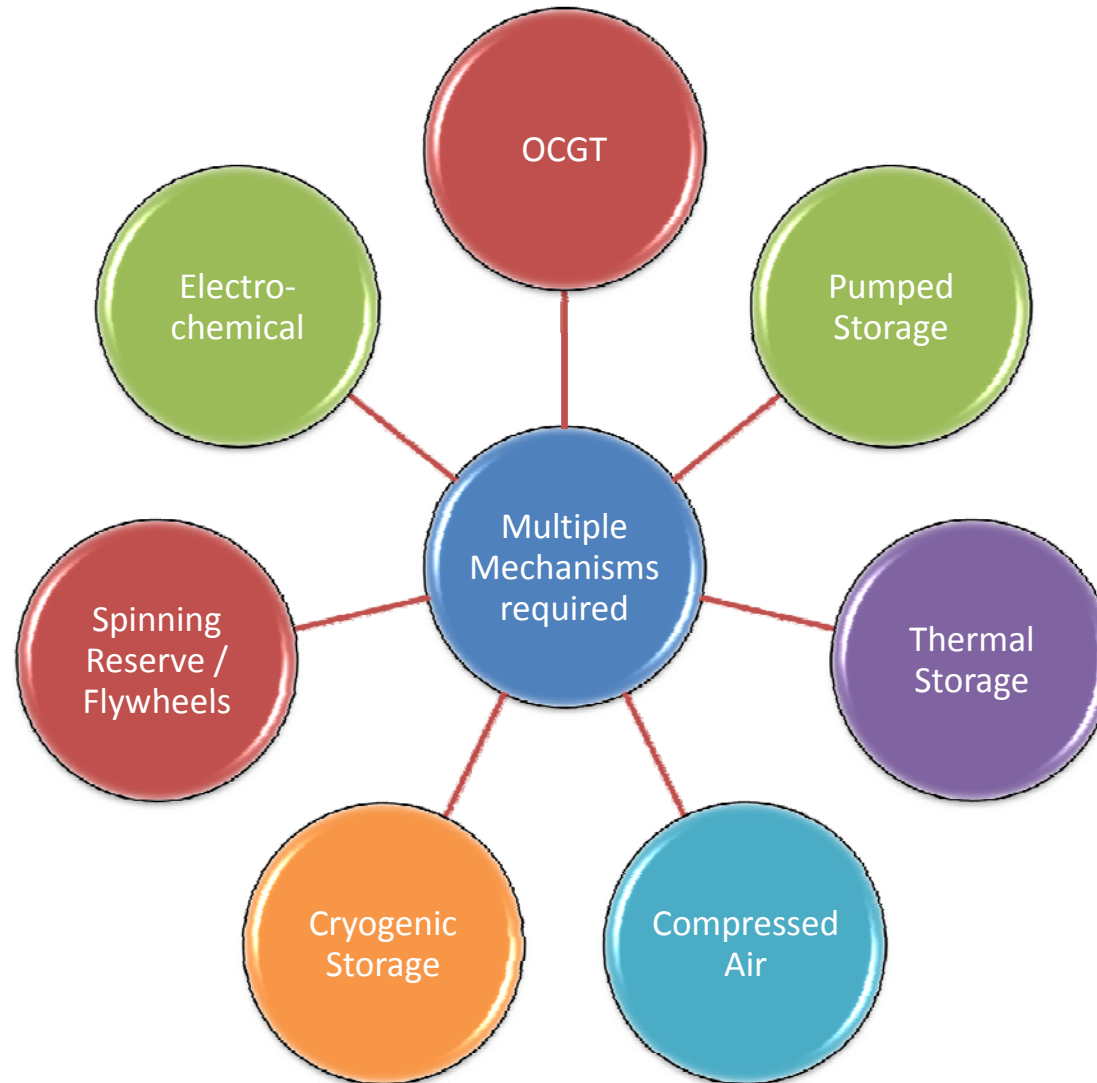
- Intermittent nature of wind & solar decreases grid stability

PENETRATION OF RE GENERATION CAPACITY

Future RE Generation as % of Total Generation Capacity



MECHANISMS TO MANAGE GRID STABILITY

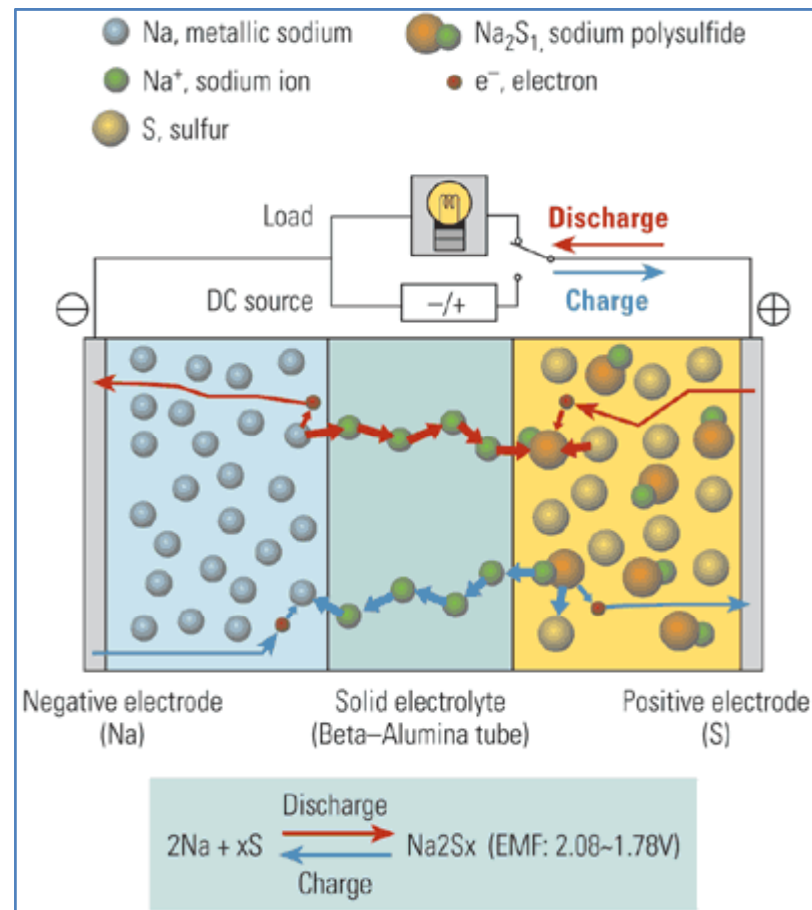


- Mix of “fast response” systems, “bulk” storage facilities and “peaker” plants;
- Fast start-up Peaker Plants to meet short periods of peak demand;
- Bulk storage facilities to utilise off peak baseload power or day time solar thermal energy;
- HPESS – High Performance Energy Storage Systems to meet instantaneous (millisecond) stability requirements

ELECTROCHEMICAL STORAGE TECHNOLOGY

NAS Sodium Sulfur Battery

Energy Density	3 x lead acid
System Capacity	2.0 MW / 12.0 MWh
Life Span	15 years / 4500 cycles
Efficiency	85% Round Trip
Operating Temp	300 °C
Response Time	2 ms
Memory Effect	Zero
Gaseous Emissions	Zero



ELECTROCHEMICAL STORAGE TECHNOLOGY

NAS Sodium Sulphur Battery

51 MW Wind Farm / 34 MW Storage – Rokkasho Japan



Source: NGK Insulators Ltd

ELECTROCHEMICAL STORAGE TECHNOLOGY

NAS Sodium Sulphur Battery

5 MW PV Plant / 1.5 MW Storage – Wakkanai Japan



Source: NGK Insulators Ltd

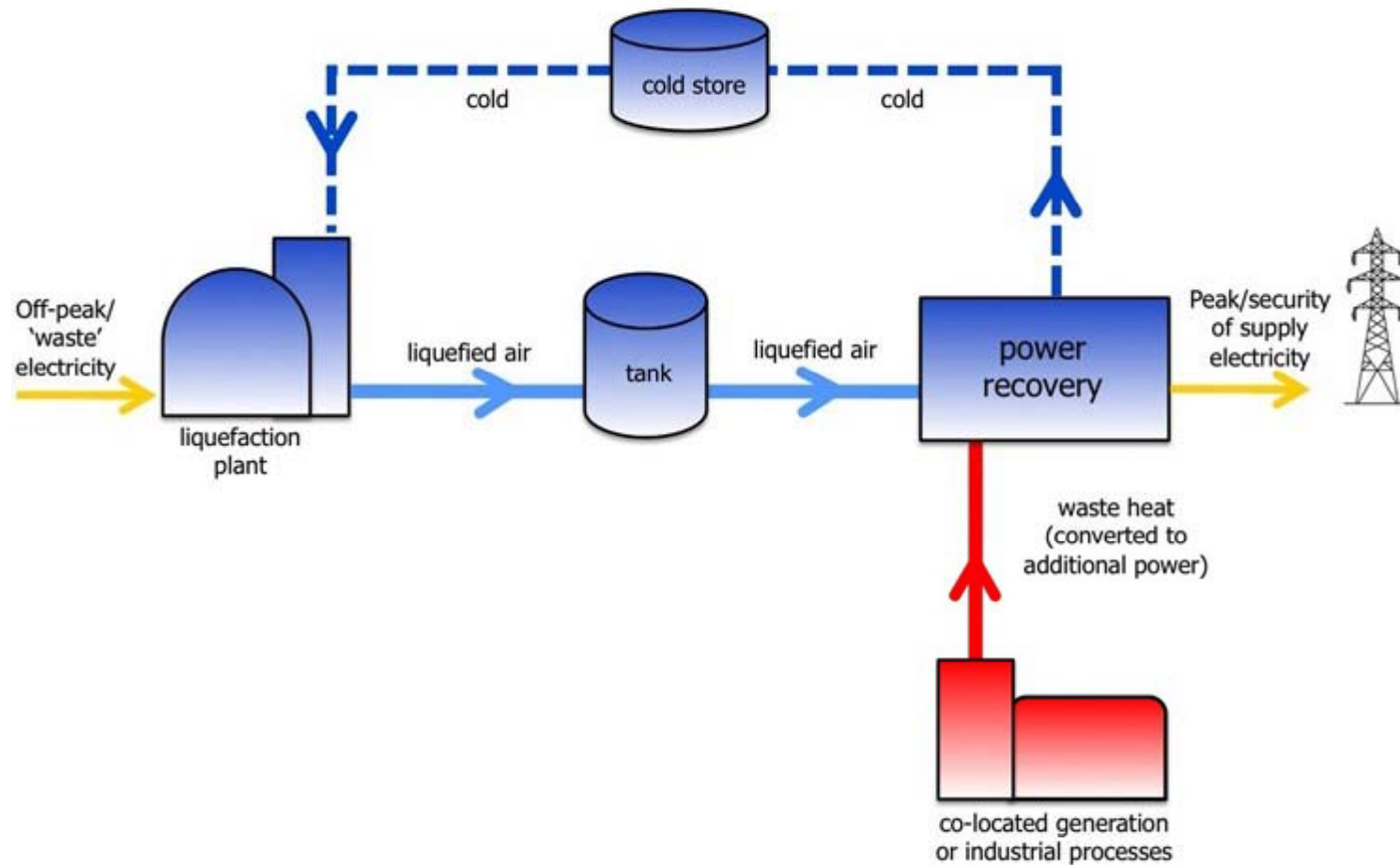
ELECTROCHEMICAL STORAGE TECHNOLOGY

NAS Sodium Sulphur Battery Application

- Dynamic load-frequency control
 - 2 ms response time
- Wind and PV generation fluctuation smoothing
- Peak shaving
- Spinning reserve replacement
- Distributed storage
 - Reduced transmission losses
 - Reduced unplanned outages
 - Optimized baseload generation utilization
 - Off peak charging, peak period discharge
 - Reduced peaker plant requirement

CRYOGENIC ENERGY STORAGE TECHNOLOGY

Highview Power CES System



Source: Highview Power Storage

CRYOGENIC ENERGY STORAGE TECHNOLOGY

Highview Power CES System

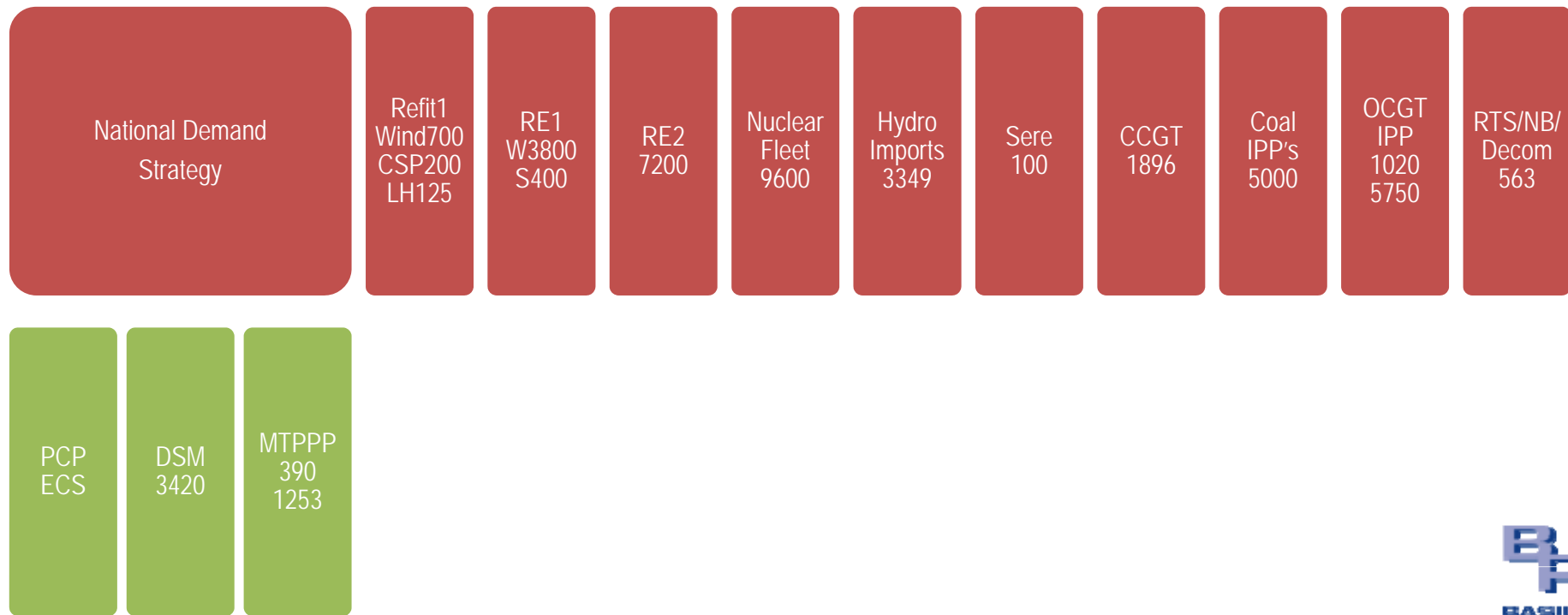
- Alternative to pumped storage
- Not geographically limited
- Utilizes readily available industrial technology
- Round Trip Efficiency 50%
- Waste heat recovery increases efficiency to 70%
- Capital Cost
 - 25% of NAS Battery System
 - 30% - 50% of Pumped Storage



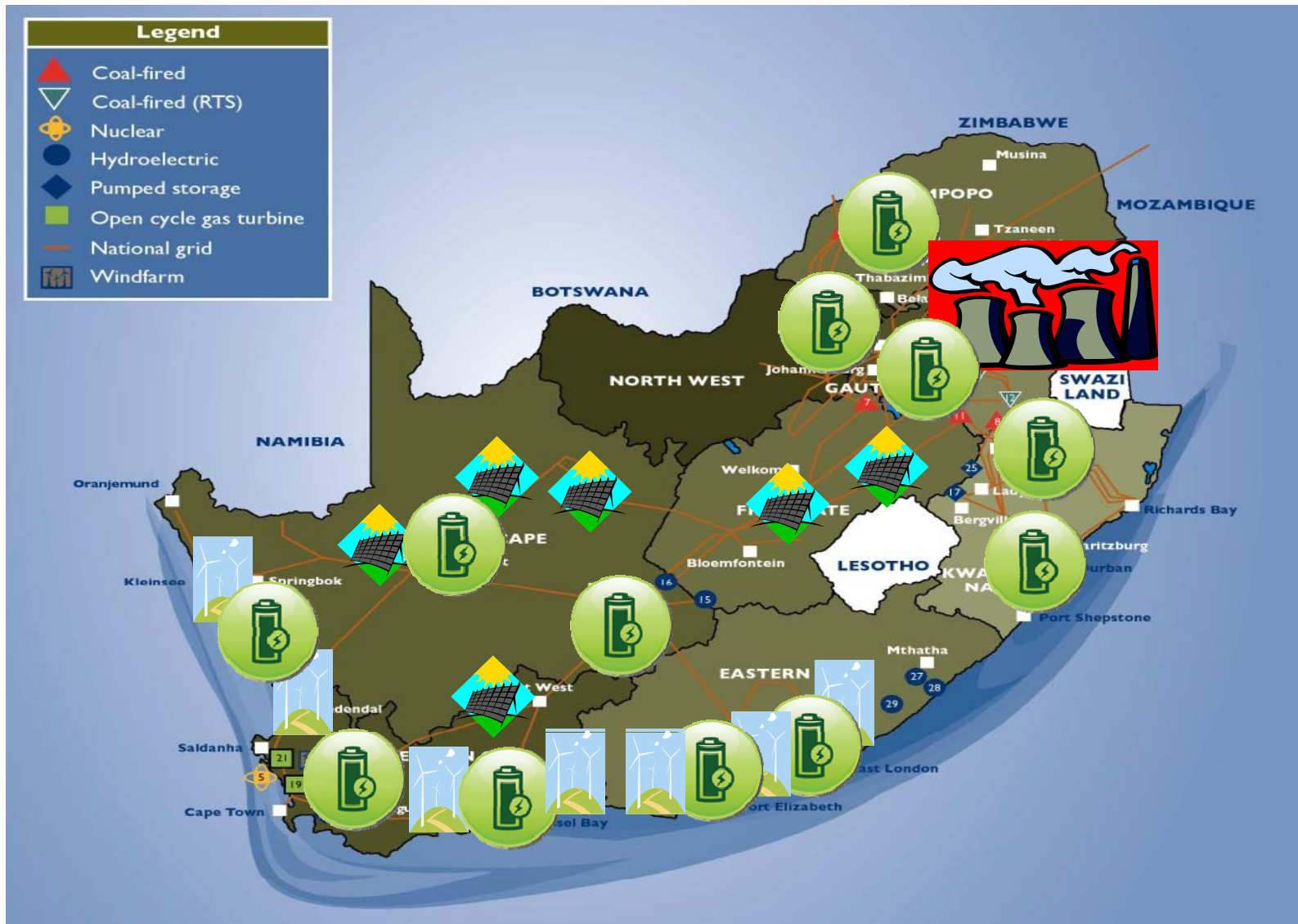
Source: Highview Power Storage

IRP2 2010 SUMMARIZED

IRP2 2010 41,346 MW



CONCLUSION



REFERENCES

- Eskom annual reports, presentations and publications
- World Alliance for Decentralized Energy publications (WADE)
- Younicos – www.yunicos.com
- Grid Stability Battery Systems for Renewable Success, Charles Vartanian, A123 Systems
- NGK Insulators Ltd, NAS Sodium Sulphur Battery Energy Storage System
- Highview Power Storage – www.highview-power.com

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