

ESKOM Supply and Demand Balance

**SAPP - USEA South Asian Peer
Exchange**

27 June 2006

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Classification of Generation Capacity and Transmission Network Adequacy

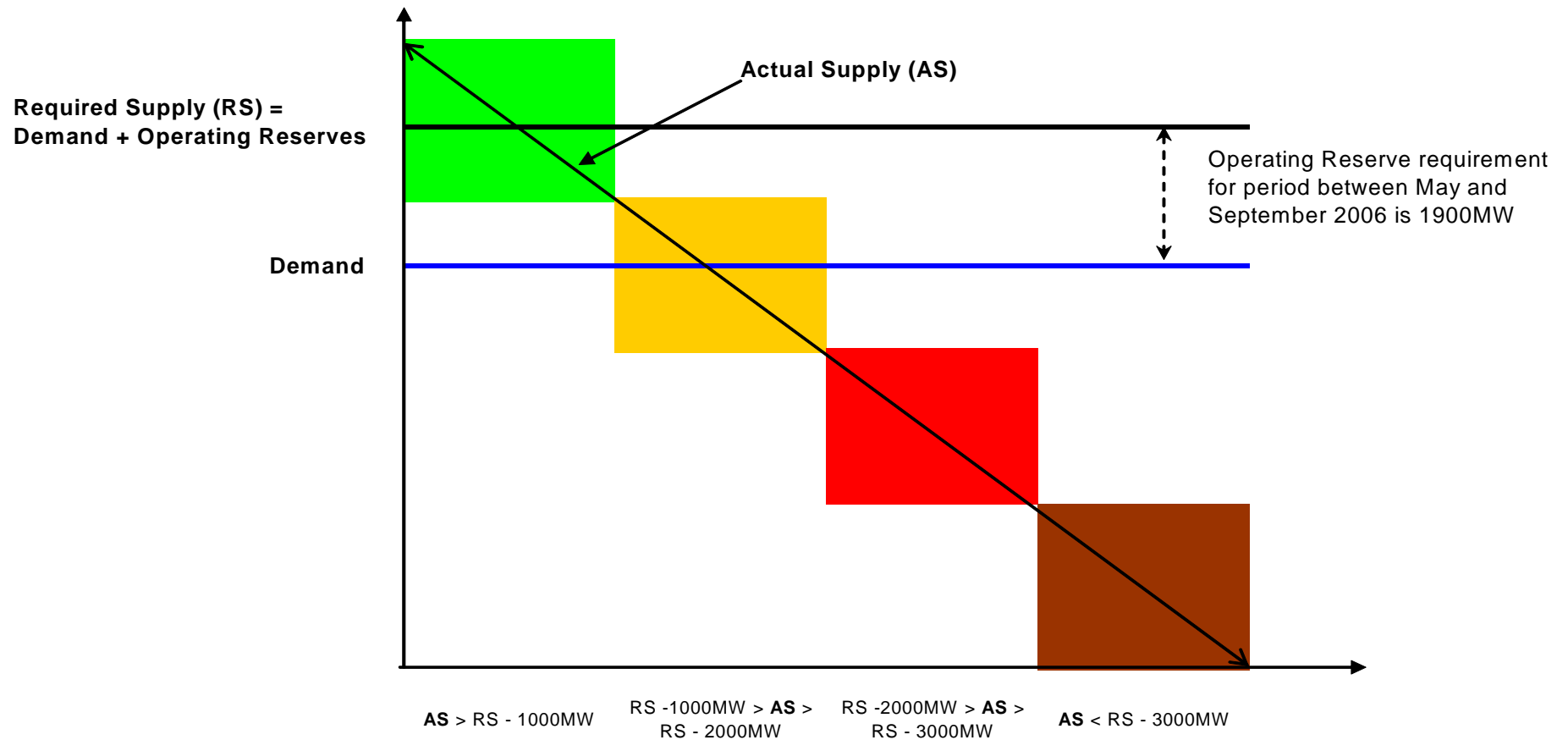
Generation Capacity (MW)

- The weekly maximum Power Demand (**D**) is forecast for 52 weeks.
- The required Operating Reserves (**OR**) is 1 900MW which is needed to manage real time demand variations and sudden loss of import or generation.
- The Required Supply (**RS**) is the sum of Power Demand and Operating Reserves.
- The Actual Supply (**AS**) on weekly basis is the operational capacity in ESKOM less the sum of the plant on planned maintenance and known unplanned or forced outages.

Classification

- **Blue**
 - If the Actual Supply (**AS**) is more than the Required Supply (**RS**) – HEAVEN for a System Operator!!.
- **Green**
 - If the Actual Supply (**AS**) is greater than the Required Supply (**RS**) less 1000MW.
 - Probably use of DMP resources and EL1.
- **Orange**
 - If Actual Supply (**AS**) is between 1000 MW and 2000 MW less than **RS**.
 - Probably use Interruptible loads.
- **Red**
 - If Actual Supply (**AS**) is between 2000 MW and 3000 MW less than **RS**.
 - Probably use interruptible loads and have some mandatory load shedding.
- **Brown**
 - If the Actual Supply (**AS**) is less than the Required Supply (**RS**) less 3000MW.
 - Probably have rotating mandatory load shedding

Classification (2)



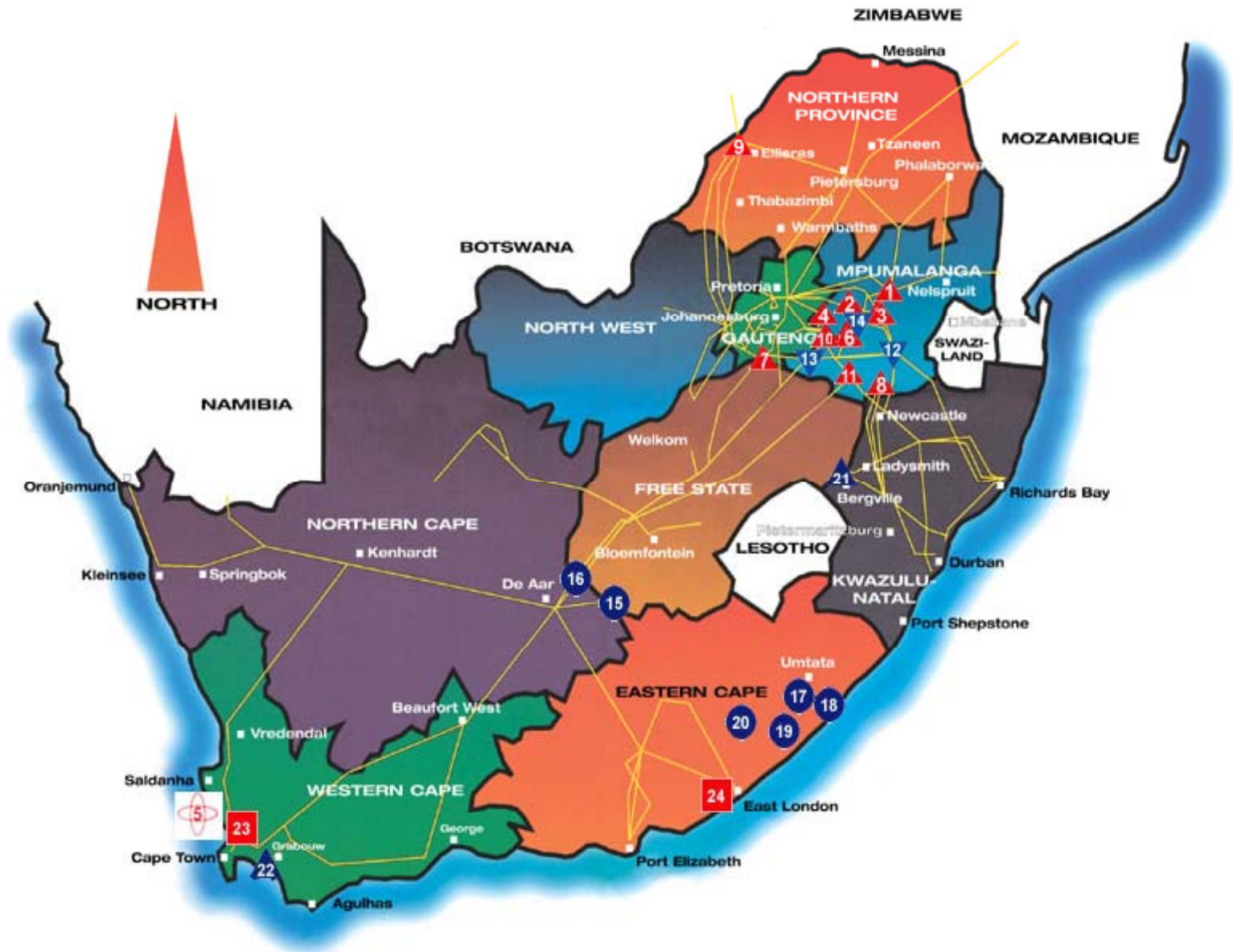
Transmission Network Adequacy

- Transmission Corridors supplying a significant geographical area from the Mpumalanga Generation Pool were identified .
- The demand in these areas has been tracked and the capacity of these corridors assessed through power system studies.
- Each transformation site on the Transmission network has also being assessed.
- Classification is as follows:
 - **Green** : If the corridor/transformation site can supply the peak demand even if a single credible contingency occurs (N-1).
 - **Orange** : If the corridor/transformation site can supply the peak demand if no contingency occurs (N-0) and there is a contingency plan exists to re-configure the distribution network to supply the load. Interruption of supply could occur based on the nature of the contingency and the load will then be restored.
 - **Red** : If the corridor/transformation site cannot supply the peak demand with the existing network and load shedding is required over the peak periods.
 - **Brown** : If the corridor/transformation site cannot supply the demand at peak periods as well as at other times of the day and rotational load shedding is required throughout the day.

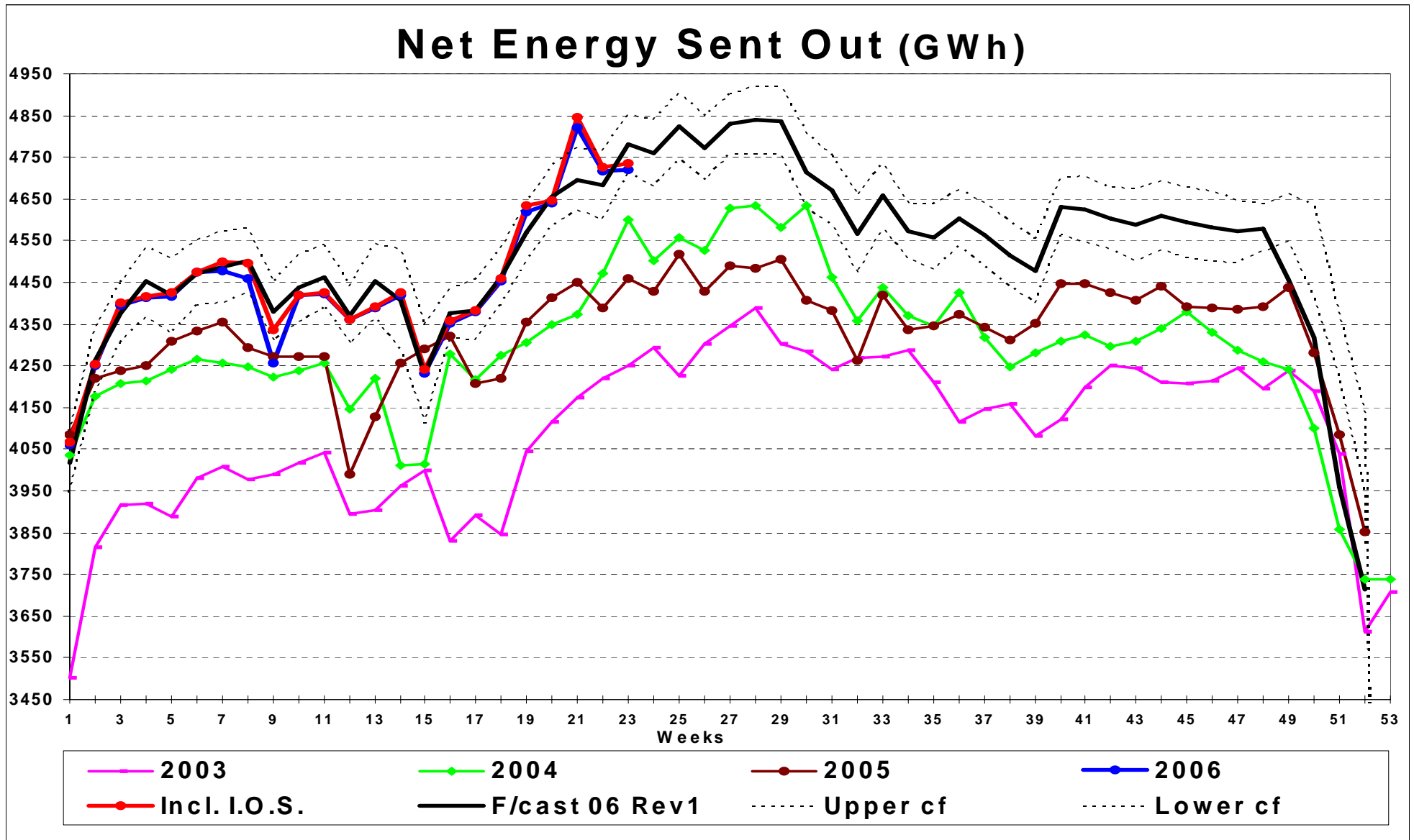
Supply – Demand Balance in South Africa

ESKOM Generation Resources

Resource	Capacity
Coal fired	~ 32 066 MW
Nuclear	1 800 MW
Pumped Storage	1 400 MW
Hydro	~ 600 MW
Gas Turbines	342 MW
Mothballed Coal	~3 600 MW

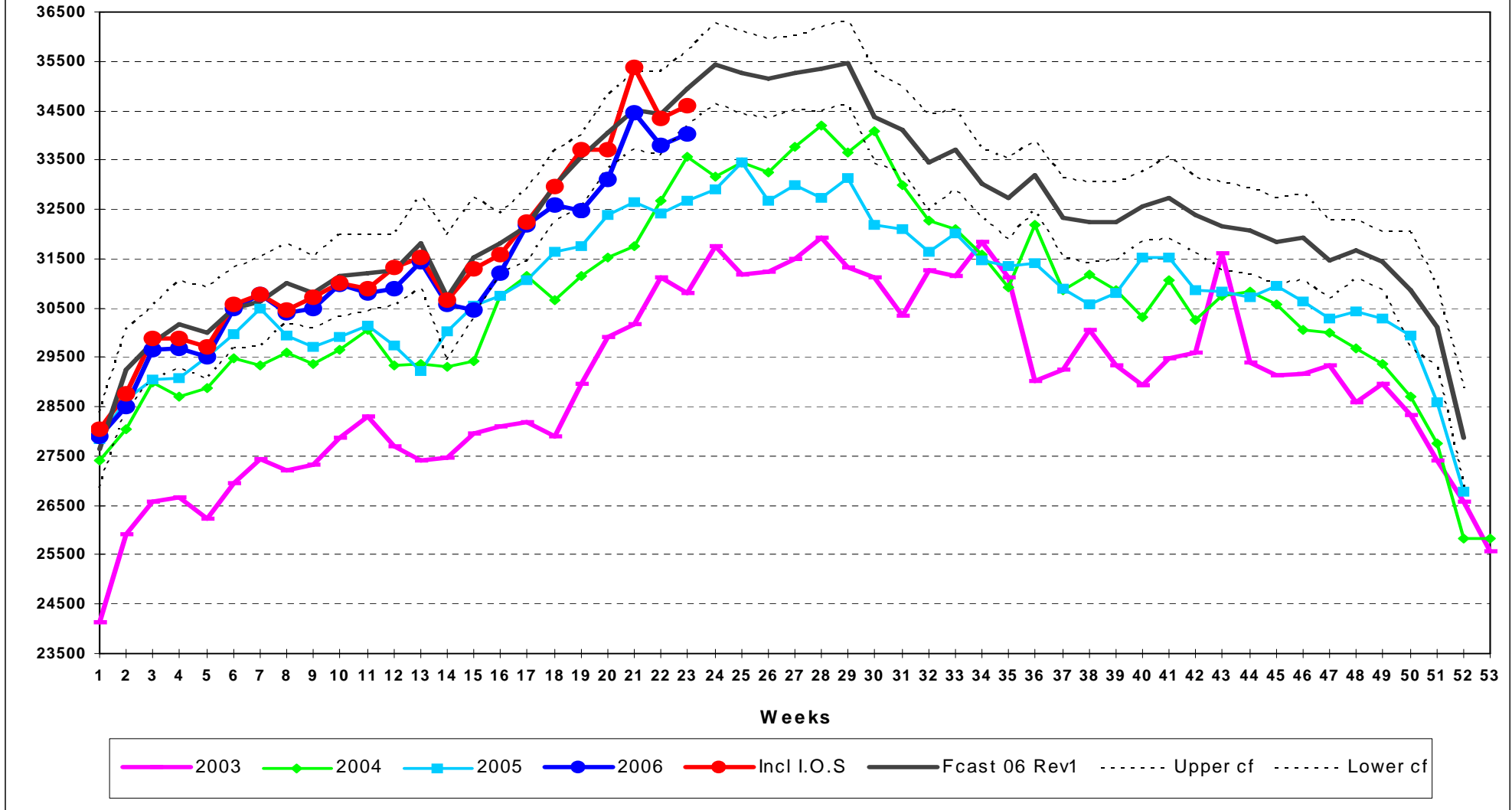


Energy Demand (inc. Interruptible Load)

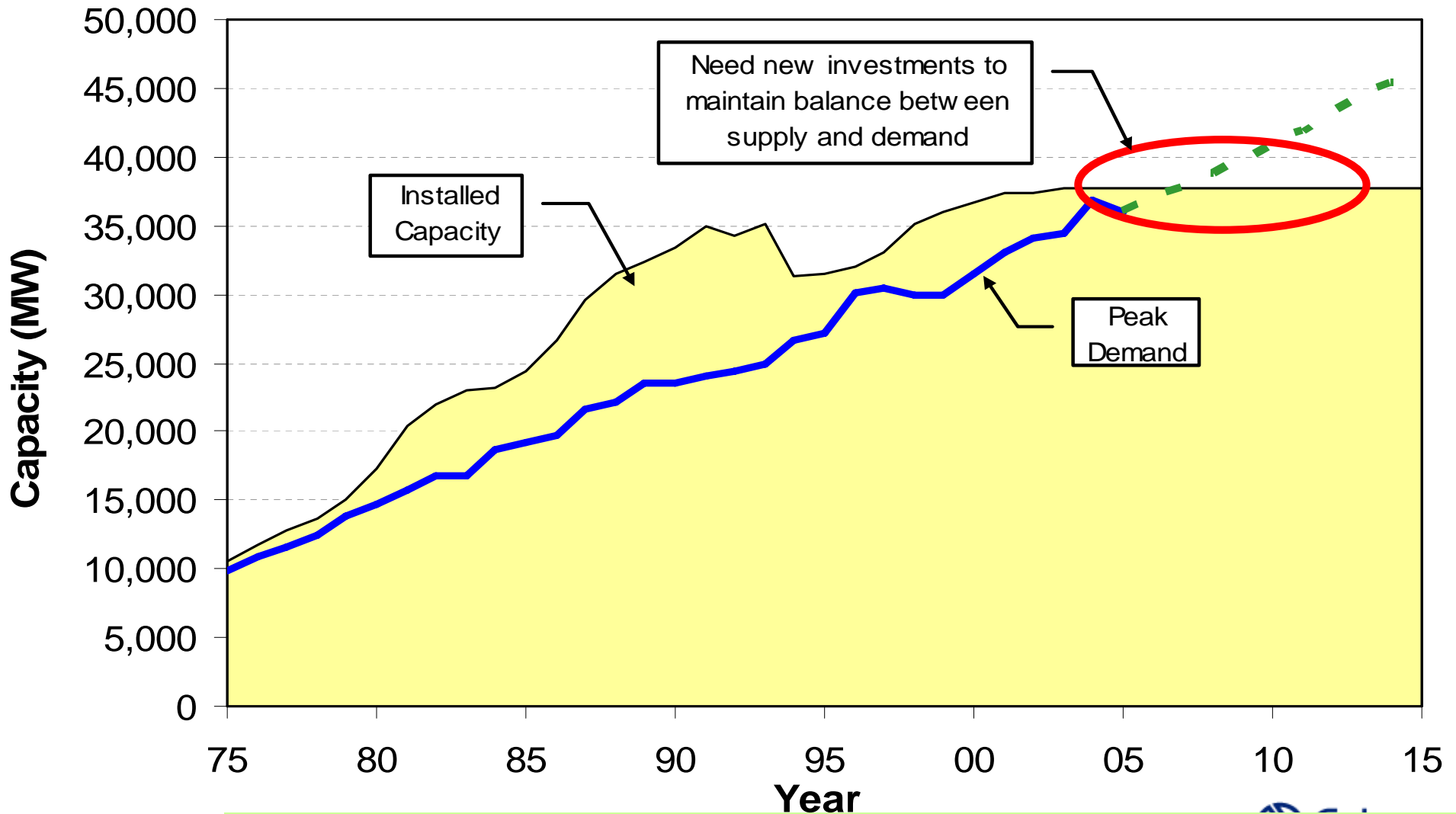


Power Demand (inc. Interruptible Load)

Peak Demand (MW)



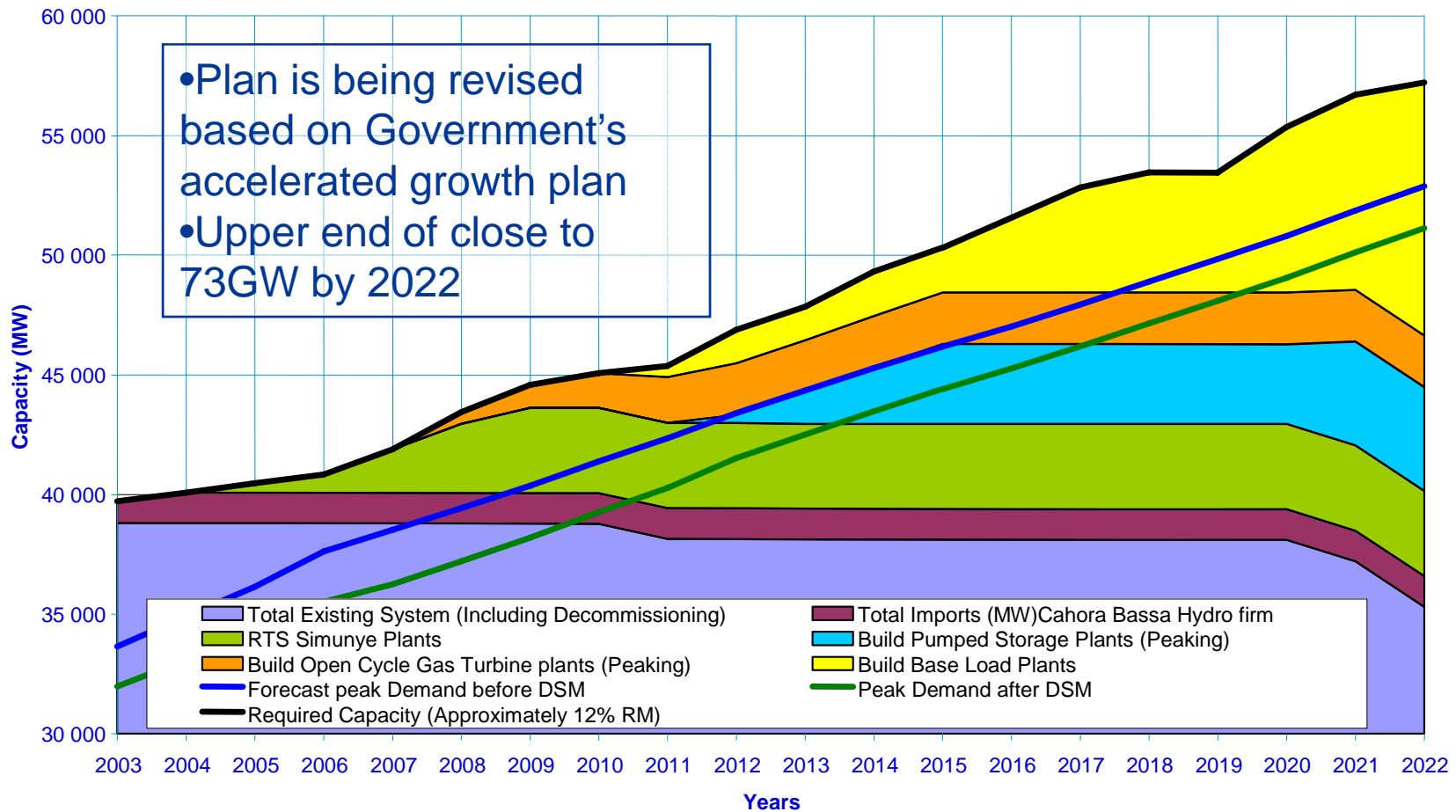
South Africa needs new capacity



SA's demand for electricity will outstrip demand in the next few years if no new capacity is added. (Note the SAPP – USEA Per above demand line excludes provision for reserves. Future demand estimate is based on NIRP)

Long-Term Energy Forecast

Capacity Outlook 2003 to 2022



Transmission Network

Constraints

- System Operator has defined security criteria to guide its operators in real time.
- Where these criteria are violated, a decision has to be made whether to pre-emptively shed load in order to reduce the risk of a cascading outage or to manage the risk by reducing the chance of it occurring.
- Current Constraints
 - 41 single line contingencies which may potentially result in loss of load
 - 35 substations which are unfirm and load may be shed while contingency plans are being implemented
- Mitigation
 - Thorough risk analysis before critical outages & outages being done at night
 - Comprehensive programme for cleaning of servitudes especially in light of heavy rains – weekly monitoring at NETOPS
 - Satellite tracking of fires & SMS to field staff increased to 5 km to allow more reaction time to fires
 - Review all contingency plans
 - Pre-winter oil level checks
 - Infra-Red scanning of substations
 - Emergency and permanent tower spares

Merit Order for Managing Transmission Power Transfer shortages

- To bring an unplanned local power demand/transfer capacity situation into balance the following principles are applied
 - Where possible the National Control centre engages actively with key customers to reduce demand with large customers before mandatory load shedding is instituted.
 - If no other option is available National Control will instruct the local distribution centre to prepare for mandatory load shedding
 - The local distribution control centre exercises discretion within the customer base to reduce the required demand
 - If the imbalance is expected to be more than two hours, a rotational load shedding program will be engaged
 - If the imbalance is expected to be long-term, the local distribution control centre will engage in more interaction with their customer base to determine optimal priority.
- If a planned outage requires load reduction, extensive customer engagement takes place (e.g. the integration of Matimba-Witkop 2 which impacted two countries, three provinces and required limited consumption in Polokwane)

Principles of Managing Shortage of Supply

Principles

- **Supplying energy at the lowest cost is a key driver**
 - Optimize supply side resource usage specifically on the primary energy side and the high availability of our generation units
 - Creation of innovative demand side products
- **Supplying high quality energy to our customer base is a key driver**
 - Well defined system reliability (security & adequacy) requirements
 - Tight operational control with primary focus on grid security
- **Equitable execution of supply and demand side options to meet lowest cost and high supply quality drivers**
 - Clear operational procedures for scheduling & dispatch
 - Operational discretion in special circumstances
 - Merit order of resources to use to meet supply mismatch
- **Shortage of Supply does not automatically equate to blackouts!**
 - One can predict shortfalls and schedule emergency resources and if that runs out have controlled load shedding managed by regional control centres.
 - Sudden loss of generation due to faults are managed through the utilisation of operational reserves and automatic under-frequency load shedding schemes which prevents cascading outages.
 - Load is then restored in a controlled fashion.

Resources & Criteria for Energy Management

Requirements	Source of Capacity	Criteria for Utilization
Emergency reserves: at least to cover loss of largest power station (3600MW)		
Mandatory Load shedding	Operational guidelines for non-essential loads	Based on system security & equitable load shedding in ESKOM control area
Gas Generation	Municipal/ Eskom	If available
Interruptible loads	Contracts	Cost of supply optimization.
EL1: Eskom generation at MCR	Eskom Generation	All machines that are capable and available.
Eskom generation: Energy constrained water resources	Eskom Generation	Based on Water resources in SA.
Demand Market Participation Contracts	Contracts	Contractual Cost optimization.
Operational Reserves: 1900MW requirement		
Supplemental reserves: Demand + Generation	International & National (DMP) non-firm contracts & generation supply	Contractual costs optimization & generation production cost optimization
10-minute reserves	Generation supply & contracted national DMP	Contractual costs optimization & generation production cost optimization
regulating reserves	Generation supply	Generation production cost optimization
Instantaneous	Generation supply & Nation non-firm contracts (DMP)	Contractual costs optimization & generation production cost optimization
Demand: Variable MW from day to day		
Peak load	Generation supplies	Cost of production
Base load	Imports & Generation supplies	Cost of production