POWER & THE ECONOMY

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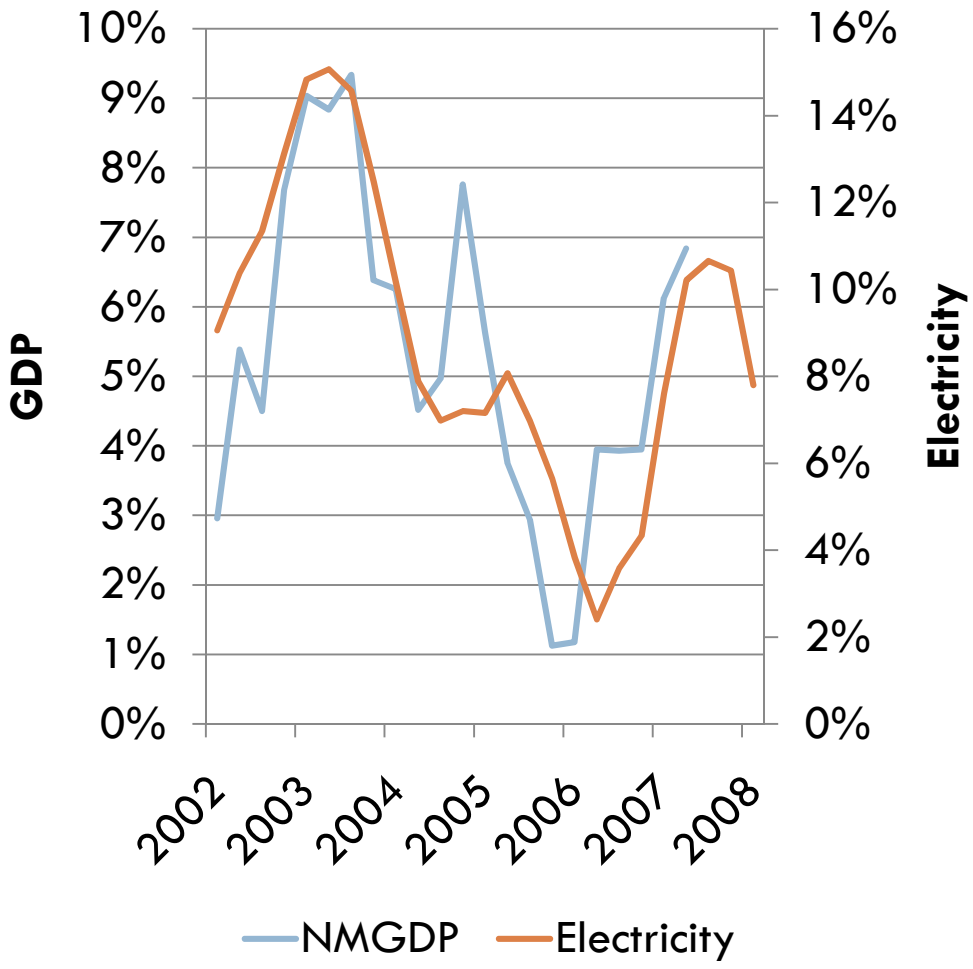
Structure of Presentation

- Consumption Trends – Short and Long-Term
- The Mining Sector
- Supply & Demand Forecasts
- Conclusions

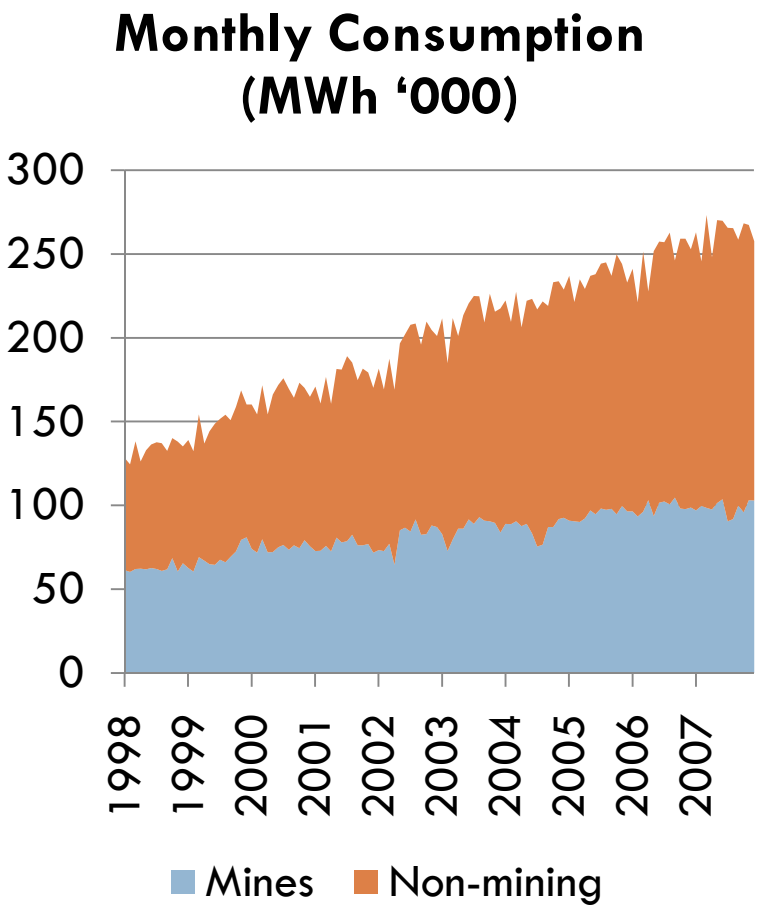
Short & Long-Term Consumption Trends

Electricity Consumption & Economic Growth (Non-mining)



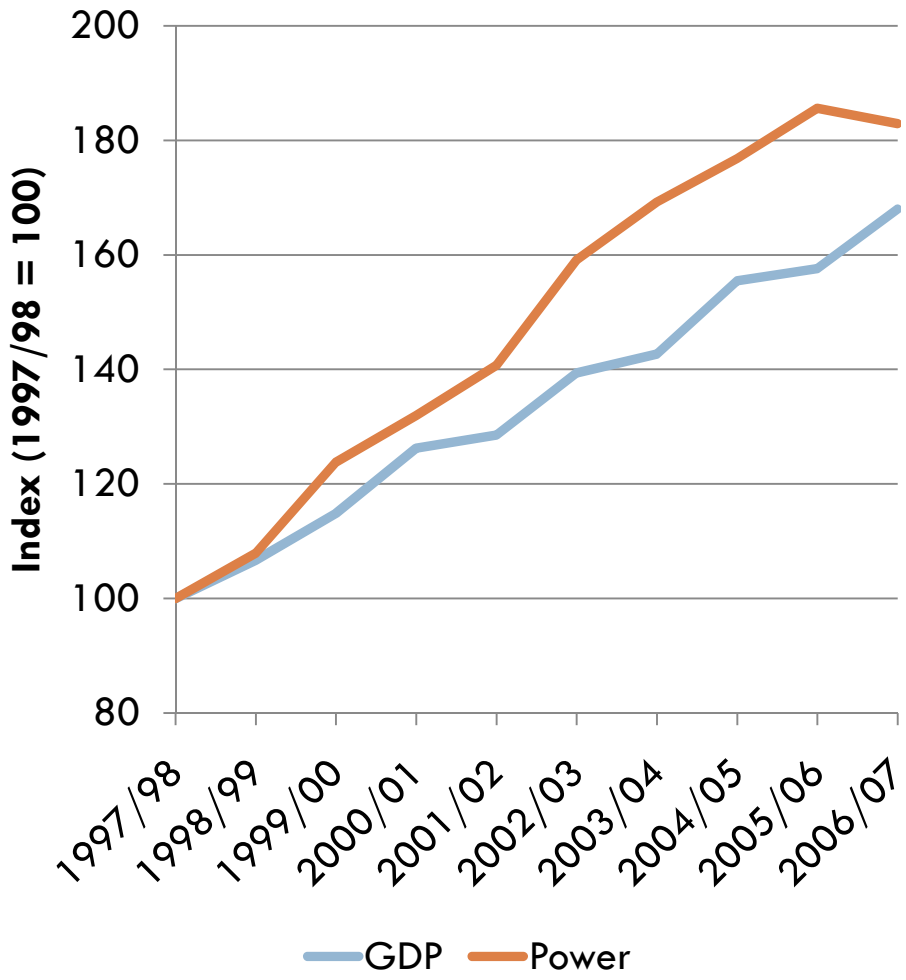
- Chart compares annual growth rates of non-mining electricity consumption and non-mineral GDP
- Both are cyclical (boom & recession)
- Track each other very closely – electricity consumption closely related to growth
- 1% increase in non-mining GDP associated with 1.6% increase in non-mining power consumption
- Makes electricity consumption a useful leading indicator of economic activity
- Sharp fall in power supplies in Q1 2008 will lead to negative GDP impact unless power consumption efficiency increased

Long-term Consumption trends



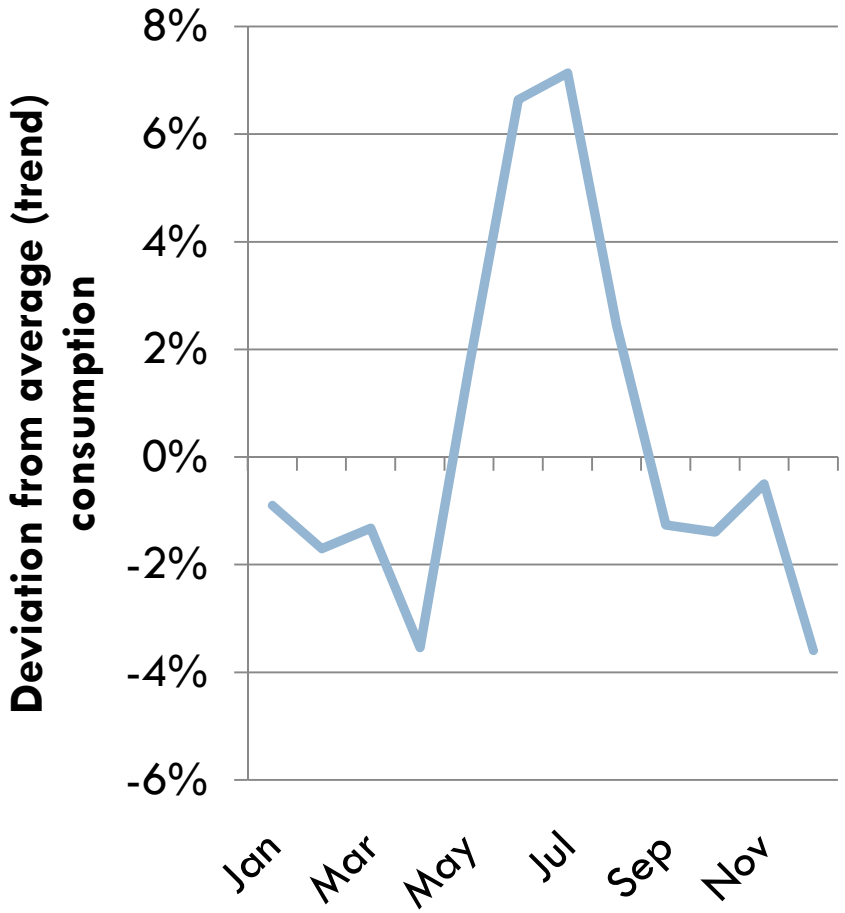
- Very rapid growth in power consumption
  - 1998: avg 134,000 MWh/m
  - 2007: avg 268,000 MWh/m
  - doubled in 9 years
- Average annual growth 1998-2007
  - Total: 7.8% a year
  - Mining: 5.3%/yr
  - Non-mining: 9.8%/yr

Power Intensity of GDP



- GDP growth avg. 5.8%
- Power consumption has grown faster than GDP (except 2006/7)
- Hence units of power consumed per unit of GDP produced has increased
- Increased dependence upon electricity
  - e.g. increased household electrification

Monthly Pattern of Power Consumption (Peak Demand, 1997-2007)

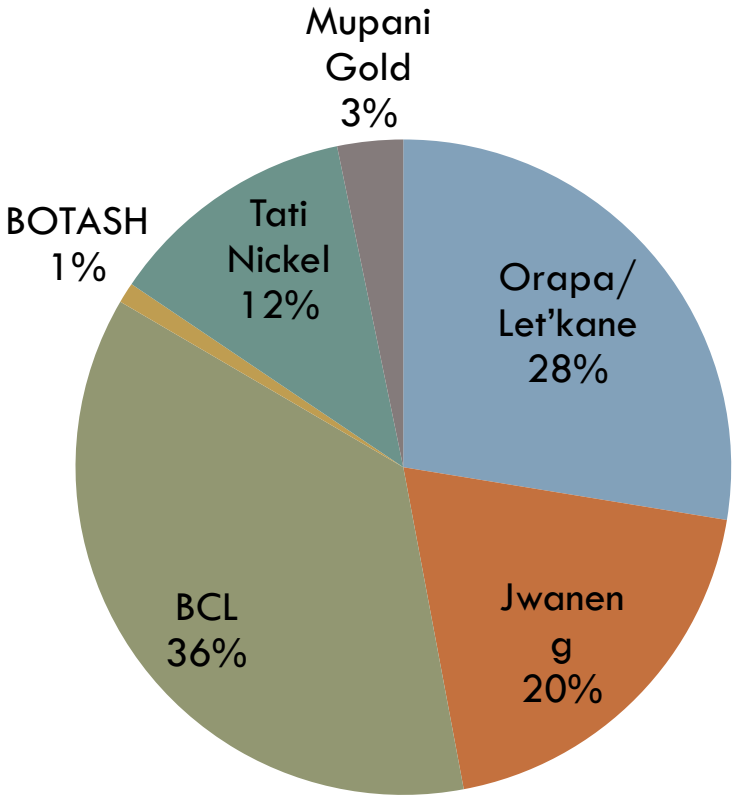


- Regular pattern of peak power demand
  - Lowest in summer (Jan-Mar)
  - Highest in winter (Jun-Jul)
- System stress is most intense in peak periods
- Maintenance planned for summer period, but can be caught out by unexpected events (rain, cold)

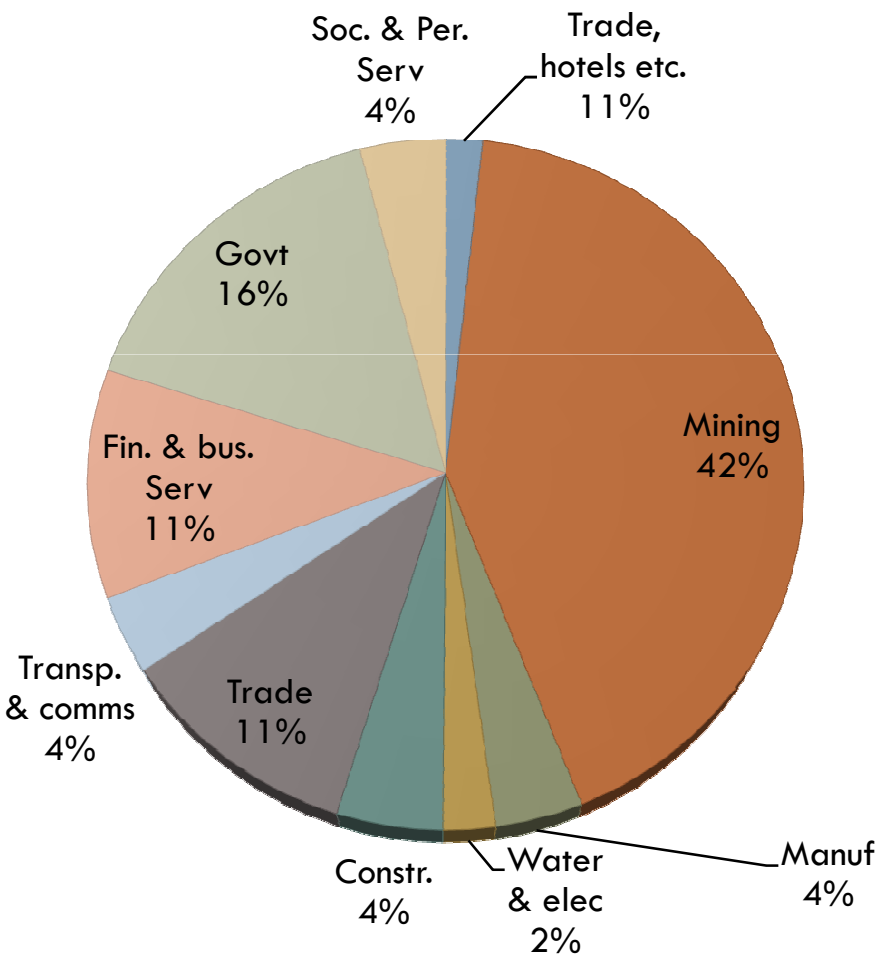
Mining Sector

Mining Power Consumption

- Mining sector is major power consumer
  - 41% of total in 2007
  - down from 47% in 1998
- Major consumers:
  - BCL – copper/nickel smelter (Selibe-Phikwe) – 36%
  - Debswana – Orapa/Letlhakane – 28%
  - Debswana - Jwaneng 20%

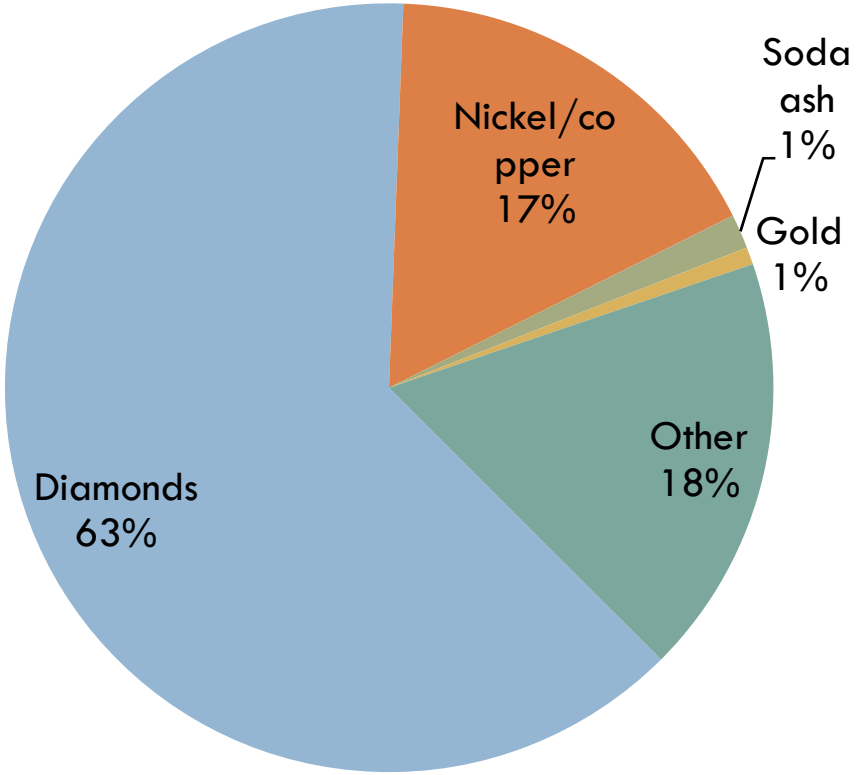


Mining in the Economy - GDP



- Mining dominates GDP
- 42% of total in 2006/07
- Share of power consumption in line with contribution of mining to the economy

Exports (2007)



- Minerals comprise 82% of exports
- Diamonds dominate at 63% (but lower than in recent past)
- Nickel & copper second largest
- Gold & soda ash relatively minor mineral exports
- Importance of minerals in exports means that power supplies to mining sector are a priority

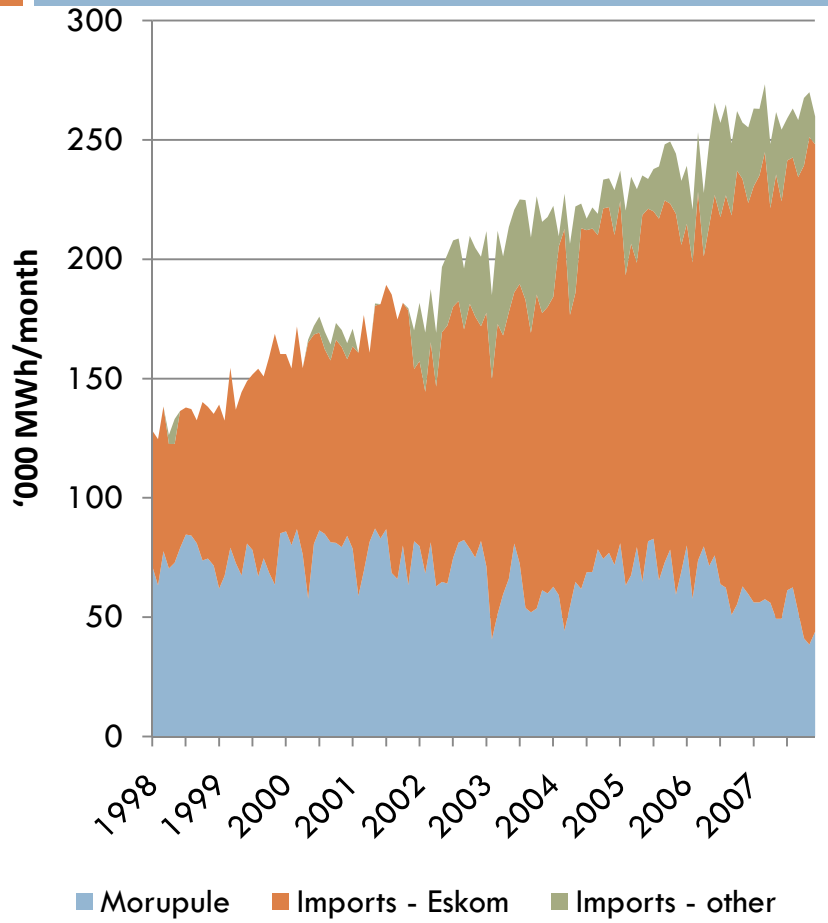
Major Mining Projects

- Major mining developments under way
  - BMR Activox refinery (Tati)
  - Tati Nickel expansion (Selkirk)
  - Debswana – Orapa & Jwaneng expansions
  - Mowana copper mine (Dukwe)
  - Lerala diamond mine (Diamonex)
  - AK6 diamond mine (Orapa) (African Diamonds)
  - Gope diamond mine (CKGR)
- 80% increase in power demand projected over next 5 years

BPC Projections		
Project	**Current**	**5 years**
Tati Nickel	39	113
BCL	65	65
Orapa	44	93
Jwaneng	41	77
Mowana	7	??
Lerala/AK6	??	??
TOTAL	**216**	**390**

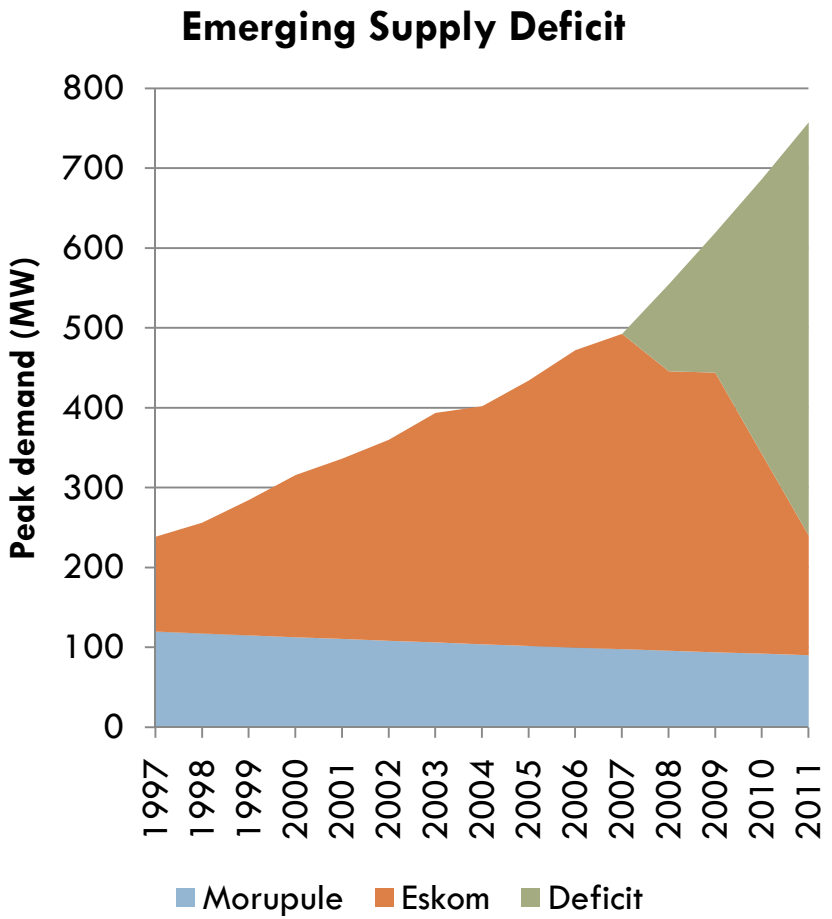
Supply & Demand Forecasts

Sources of Supply



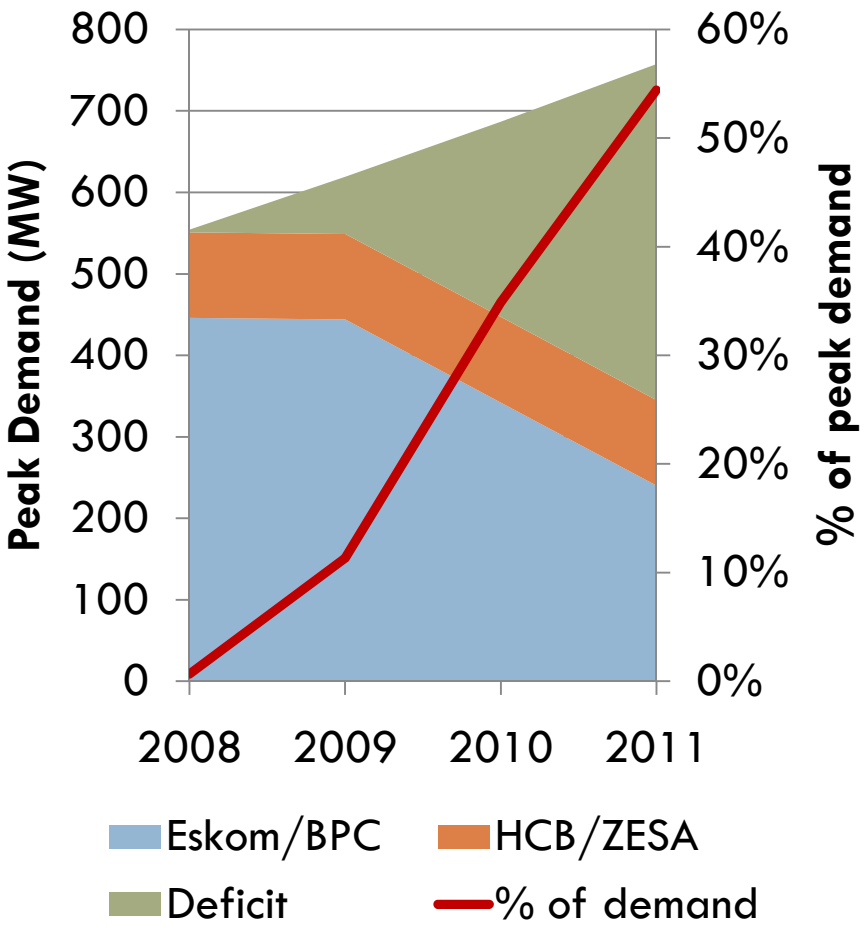
- 3 main sources:
  - Morupule
  - Eskom
  - Other imports (ZESA/HCB/EDM)
- Shares in 2007
  - Morupule 20%
  - Eskom 72%
  - Other 8%

Power Supply Issues



- Peak demand increasing at around 11% p.a. 2008-2011
  - Non-mining 9.8%
  - Mining as per BPC ests.
  - Over 750MW in 2011
- Eskom firm supply reducing from 2008-2011
  - 2008,9: 350MW
  - 2010: 250MW
  - 2011: 150MW
- Eskom can cut up to 10% if load shedding in SA

Power Supply Deficit



- Anticipated shortfall on existing trends:
  - 2008: 0 MW
  - 2009: 70MW
  - 2010: 239MW
  - 2011: 412MW
- Remember:
  - peak demand is in winter!
  - Eskom may be unable to supply contracted amounts

Supply Options

- Short-term
  - Mozambique (via Zimbabwe)
    - HCB – 60MW contracted in 2008
    - 2009 - ?
    - EDM - ?
    - SA (Eskom), Malawi, Tanzania chasing the same power
  - Zimbabwe (ZESA)
    - Send Botswana coal to Bulawayo and share power 50-50 (45MW)
- Medium-term
  - Diesel
    - Available, flexible – but expensive
  - Coal-bed methane
    - Not yet exploited
    - Needs substantial investment in extraction
  - Solar (PV/steam)
    - Resources plentiful (sunlight)
    - Large-scale generation still experimental internationally
    - With current technology, not competitive with coal for grid power
    - Competitive for remote/off-grid settlements
    - Technology changing fast

Supply Options

- BPC tender for 240MW from IPP by 2009
- At tender review stage:
  - Coal-bed methane (1)
  - Diesel (3 proposals)
- Medium/Long-term
  - Morupule B (expansion, BPC)
    - 600MW
    - Tender award stage
    - BPC timelines appear highly optimistic
  - Mmamabula (CIC/IP)
    - 2100-2400MW, 2013?
    - BPC entitled to 25% offtake
    - Bogged down in tariff negotiations with Eskom
  - Morupule C
    - A further 600MW - 2015?
  - Aviva, others

Price Impact

- Current BPC **retail** tariff
  - 40t/kWh
  - Approx 6 USc/kWh
- **Average** Eskom tariff
  - Approx. 18 c/kWh (2.5 US c/kWh)
  - Steep price rises programmed, to fund new investment
  - Will still be cheap by international standards
- Cost per kWh of different options (**new capacity**, US c)
  - Hydro
    - 2 – 4 c
  - Coal
    - 6 – 8 c
  - Small-scale Diesel
    - 25 – 35 c
  - Solar
    - 15c?
- Major tariff increases inevitable
- Short-term capacity (diesel/gas) likely to need large government subsidies

Conclusions

Concluding Points

- 2008 supplies should (just) balance demand, assuming no major Eskom problems, but winter (June-July) will be tight
- 2009 – 2011 supply/demand balance worsens sharply, both in Botswana and in SA
- Supply to diamond mines must be fully maintained
- Power cuts have major negative impact on:
  - productivity
  - business confidence
  - investment climate & new investment
  - economic growth
- Solutions:
  - Supply Side Enhancement
    - Expedite Morupule B ("national emergency!")
    - Businesses - invest in expensive standby generators
    - Actively encourage IPPs
    - Short-term solutions (Diesel generators)
  - Demand Side Management (DSM)
    - Defer major projects?
    - Mothball BCL smelter (Selebi-Phikwe)?
    - Rationing of industrial/ commercial/residential consumers
    - Time-based metering/tariffs
    - Energy-saving awareness
- Significant price increases inevitable:
  - funding expensive new capacity, both long-term and short-term
  - encourage more efficient consumption

Long-term Prospects

- Much more positive outlook for Botswana & region
  - Mmamabula
  - Other major coal-fired generation projects
  - Botswana and SA have major unexploited coal reserves
  - Rehabilitation of capacity in Zimbabwe, Zambia, DRC
  - Grand Inga hydro (DRC)/ Westcor (30 000+MW)
- In ten years could have surplus of cheap power again – unexploited hydro and coal resources
- BUT
  - Global warming/ climate change issues may impact on coal-fired generation
  - Obligatory carbon pricing / sequestration would add to costs of coal-fired power
  - Would make hydro, solar (& nuclear) much more attractive
  - Economics of power generation in flux!

Thank You