Presentation to CTA: Electricity Pricing Assessment for Mozambique

Donald Hertzmark
Nathan Associates

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Electricity Pricing Analysis Objectives

- Assess cost and quality of electricity supply for Mozambican industry
- Compare cost and quality of supply with South Africa, Zambia and another country, in this case, Romania
- Identify key cost elements in Mozambican electricity tariff
- Assess impacts of tariffs on domestic industries vis-à-vis regional competitors
- Identify most effective steps to make electricity supply for industry more competitive

General Approach

- Investigate level and structure of electricity tariffs in the four countries
  - Type of tariff - e.g., cost of service, revenue cap, etc.
  - Cost coverage
  - Impacts on efficiency, trade and investment
  - Treatment of generation
  - Charges for other services

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General Approach

- Compare cost and quality of electricity supply in Mozambique with cost and quality in 3 other countries
  - Impacts on cost structures of industry
  - Impacts on trade & investment in electricity
  - Impacts on trade & investment in electricity-using industries

General Approach

- Assess key impacts of Mozambican electricity pricing vis-à-vis other countries
  - Critical assessment of industry level impacts
  - Identify key strengths & weaknesses of Mozambique as a location for industry
  - Recommend measures to improve competitiveness of country as a location for electricity-using industries

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Background: Electricity Sector in Mozambique

- Electricity generating capacity stands at 2.392 GW,
  - 90% of generation capacity is at the Cahora-Bassa Hydroelectric facility
  - Total generation is ~ 15.1 TWh
- Mozambique exports (net) roughly 35% of its total generation, 10.5 TWh, mostly to South Africa and Zimbabwe (minor)
- The aluminum plant at Mozal accounts for more than 60% of current consumption and almost 100% of imports.
- Current domestic peak demand for electricity in the country is just over 300 MW.

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Background: Regional Power Issues

- Mozambique is member of SAPP, with total generating capacity > 54 GW
- Largest generator in system is South Africa, with >36 GW
- Eskom's transmission system is a vital element in SAPP commerce
- Increasingly, Eskom is unable to export firm power to its "normal" customers, Namibia, Botswana, Zambia, Zimbabwe
- Power supply crisis in South Africa has led to load shedding, voltage reductions and supply insecurity throughout region
- Eskom has been slow to respond, leading to both peril and opportunities for other SAPP members

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Background: Regional Power Issues

- Eskom's supply problems may lead to reduced output from mining industry
- South Africa is not likely to possess significant exportable electricity surpluses again until the end of the next decade
- Other generating countries, including, Mozambique and Zambia, may have short term opportunities in generation
- Costs for next generation coal plants in South Africa will run in excess of US$0.065/kWh at the generation busbar
- Prices for industrial customers in South Africa will need to move to US$0.08 and higher within 2-3 years for Eskom to avoid catastrophic financial losses

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Structure of Electricity Tariffs

Country	Tariff Type & Description	Time of Day Differential
Mozambique	Cost + rate of return - Distribution tariff is unified with distinct charges for customer categories	No
South Africa	Cost + rate of return + revenue cap "clawback", multi-year - Price cap for distinct distribution components	Time of day & seasonal
Zambia	Revenue Requirement - Distribution tariff is unified with distinct charges for customer categories	Industrial only
Romania	Cost + rate of return for large customers, price cap for smaller customers	Time of day

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Level of Electricity Tariffs (USD/MWh)

Country	Industrial	Commercial	Residential
Mozambique	45-60	120	90
South Africa	17-104, in peak season, 12-27 in low season, "normal" tariff is = ~19-34/MWh	75 (average)	70 (average)
Zambia	54	77	38-106
Romania	99	99	87-105

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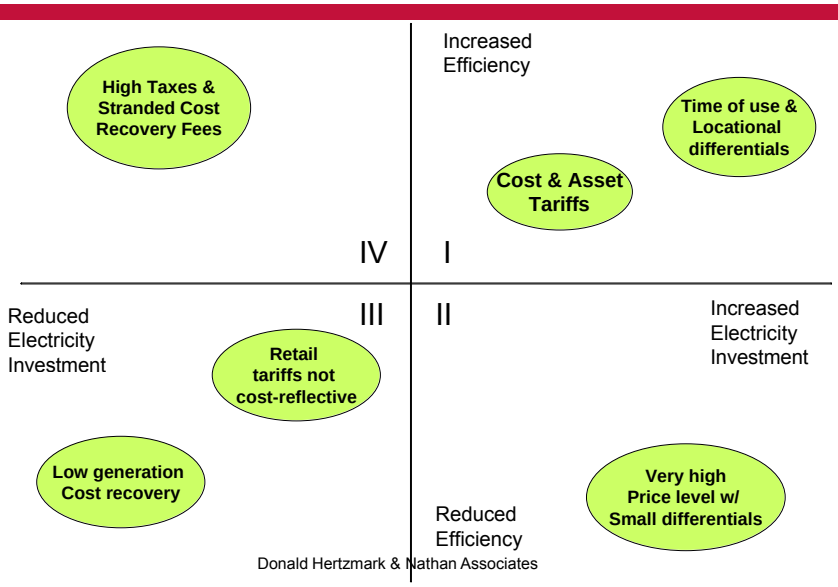
Impacts of Tariff Structure on Efficiency & Investment



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Impacts of Electricity Tariffs

- Distinguish network tariffs from energy and service charges
- Unbundling of tariffs is a key contributor to improved financial stability of utility & appropriate pricing signals to generators & users of network

Trade and investment (network):

- Optimal transmission tariffs, while desirable, are not necessary to stimulate trade and investment
- A “good enough” tariff that covers costs and sends the right signals on congestion and location is an excellent starting point

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Impacts of Pricing Policies on Trade and Investment (cont)

- Subsidizing your customers, especially if they are foreigners, will not stimulate investment from them to improve transmission service
- Transmission and generation prices have asymmetric impact:
  - Effective pricing system is necessary but not sufficient for good outcomes,
  - Inefficient pricing system is sufficient in itself to assure bad outcomes

Impacts of Electricity Tariffs *(cont.)*

Cost Coverage & Efficiency

- Cost coverage in full is a feature of countries that have successfully restructured
- Many countries (NO! make that *all*) use some sort of cross-subsidy to protect certain classes of electricity users
- Where cross-subsidies are significant relative to the overall tariff revenue, potentially beneficial effects of separate tariffication of transmission are lost in the noise of the transfer payments

Brief Summary of the Findings *(cont.)*

Incentives & Efficiency:

- Countries with successfully restructured systems tend to feature more incentive clauses for promoting improved efficiency
- These include locational and/or temporal price differentials and plus some element of ancillary services tariffs
- Successful tariffication of transmission and distribution may require additional capabilities on part of regulators
- Regional goals & timetables can be useful to provide benchmarks for performance

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What is a "good enough" tariff and why does it matter?

- Prices only have to be "good-enough" to stimulate some trade and investment - especially if significant transmission investment is needed.
  - A "good-enough" tariff will
    1. Cover all costs of transmission, including new capacity
    2. Provide "reasonable" signals regarding congestion and location of new generation
    3. Reflect energy policy priorities - renewables, cogeneration, etc.

A few years of "good-enough" can provide enough financial strength to implement a more sophisticated tariff

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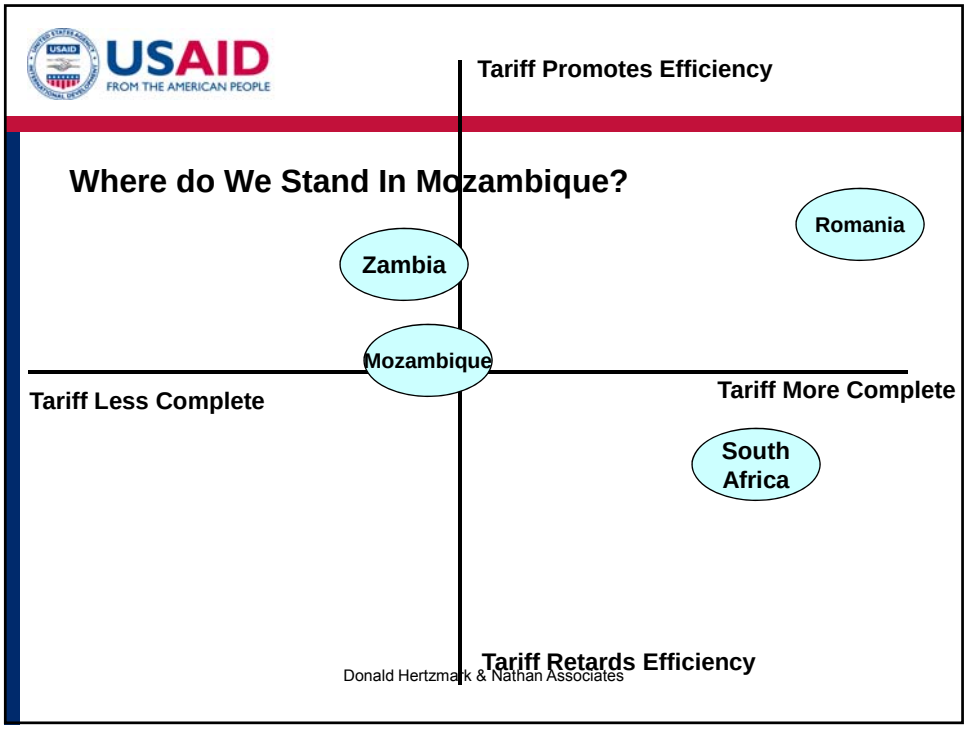
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Tariff Promotes Efficiency
Where do We Stand In Mozambique?
Romania
Zambia
Mozambique
Tariff Less Complete
Tariff More Complete
South Africa
Tariff Retards Efficiency
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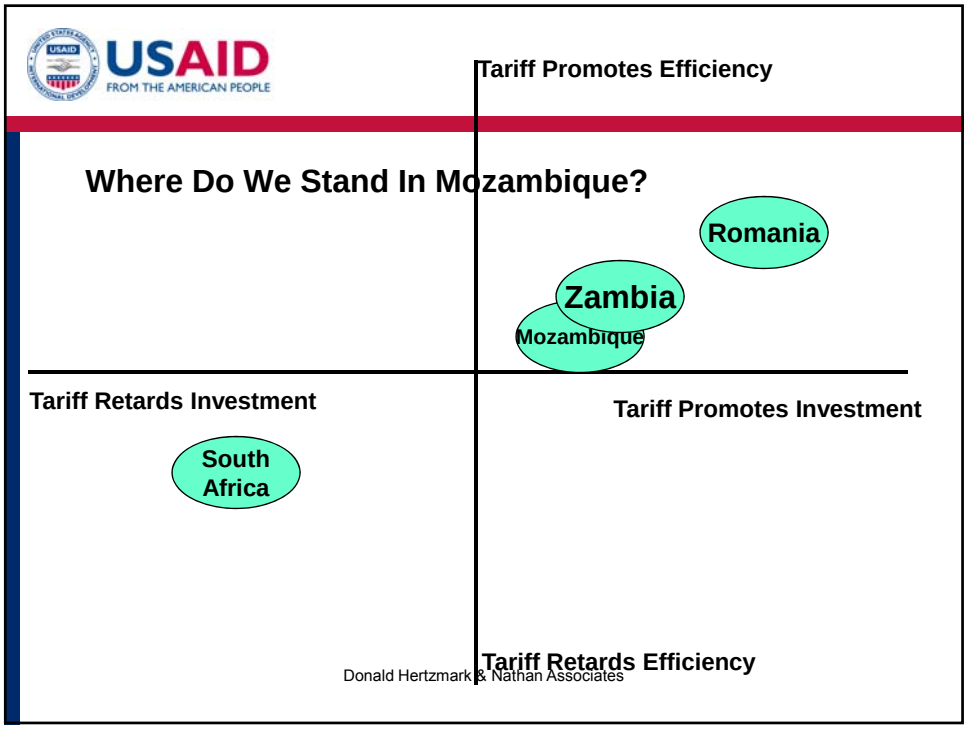
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Energy Tariffs & Treatment of Generation

- No separate charge for generation in Mozambique
- South Africa has fully unbundled tariffs
  - Significant departures from full cost coverage
  - Small charges for capacity
  - Baseload period charges too low
- Zambian situation is similar to Mozambique, but with greater customer subsidies
- Romania passes through energy costs of generation so current prices rising rapidly

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General Assessment of Industrial & Commercial Tariffs in Mozambique

- Commercial customers carry heavy burden
  - Includes small “industrial” facilities
  - Industrial tariff needs to make further distinctions according to voltage, power factor, etc
- Industrial customers are currently disadvantaged relative to South Africa, on par with Zambia
  - Industries that operate around the clock in SA will pay, on average,, less than half what industries in Mozambique pay for electricity
  - BUT (and this is a BIG but), prices in South Africa are set to rise by greater amount than prices in Mozambique

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Impacts of High Industrial Tariffs

- Consider a firm with a demand for 2 MVA and a load factor of 80% (1,152,000 kWh/month)
- In Mozambique an industrial customer will pay US$51,840-69,120/month
- In South Africa an industrial customer will pay US$28,296 (low season) to $56,569 (high season)
  - Weighted average monthly bill is US$35,365
  - Savings over Mozambique is ~$US 16-24k per month
  - South African firms enjoy a 32-49% cost advantage
  - New tariff structure for Eskom should eliminate this differential

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Impacts of High Industrial Tariffs

- Zambian firms will pay slightly more, on average, than will Mozambican firms
- In Romania industrial tariffs are considerably higher than Mozambican levels

Finding 1: Average industrial tariffs in Mozambique have put the country's industry at a distinct competitive disadvantage in the past vis-à-vis South Africa, but not against other regional countries

Finding 2: The competitive advantage of South Africa is about to disappear

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Service Quality Issues

- Industrial customers in Mozambique are subject to frequent short outages and voltage fluctuations
- Until recently, domestic grid instability was main cause of service quality problems
- Impacts of service quality deficiencies include
  - Inability to use continuous processes
  - Damage to electronic components
  - Additional costs of backup generation and power conditioning

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Service Quality Issues

- Network problems in South Africa now contribute to network problems in Mozambique
- Grid problems in Zambia on way to solution through significant investments in new transmission

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Strengths & Weaknesses of Mozambique as an Industrial Location

- Long coastline favors bulk trade
  - Increasing output of primary commodities favors country, but:
  - Poor condition of ports plus poor inward rail/road infrastructure make competition with RSA ports difficult
- Limited transmission grid reduces possible locations for factories
  - Northern part of country is virtually off limits for electricity-using industries
  - Natural gas output not adding significant value to national economy

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Strengths & Weaknesses of Mozambique as an Industrial Location

- Electricity system needs much work to become a competitive asset
  - Network infrastructure needs significant expansion
  - Sub-transmission needs strengthening & broadening
  - Long distance transmission relies too much on single lines
- Generation does not take full advantage of domestic resources
  - Gas not used well to improve & expand network capability
  - Coal needs to be further developed for Northern grid system

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Strengths & Weaknesses of Mozambique as an Industrial Location

- Interconnections with RSA and SAPP need to be looked at more strategically
  - East-West links v. North-South ones
  - Need to address"*who-whom*" questions for coal, gas & new hydro
    - Who is going to develop new capacity?
    - Who is going to pay for new capacity?
    - For whom is this capacity being developed?
  - What is going to be role of private sector?
  - Why should gas-fired CCGT power plants be built in RSA instead of Mozambique?

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Appendix: Risk Analysis of Power Costs in Southern Africa

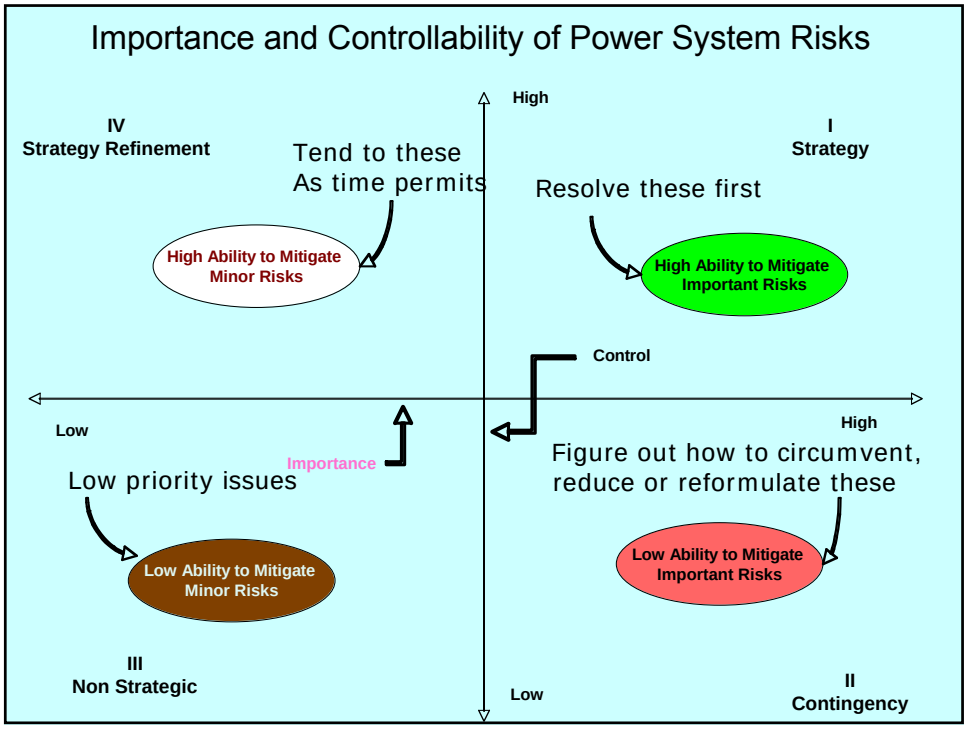
Future Electricity Costs in Southern Africa are Highly Uncertain

- Planners need a framework that can help them assess:
  - Relative importance of various cost drivers
  - Controllability of key cost drivers
  - Degree of certitude about information
  - Relative riskiness of different cost drivers

Generation Cost Analysis

- Investment involves risks & uncertainties
  - Many factors contribute
  - Some are controllable, some not
  - Some are important, some less so

It is critical to identify and categorize risks in generation planning. The following framework provides a way.



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Analytical Framework for Risk Mitigation

- Figure out where your project stands in the risk matrix
  - Figure out the key attributes of the risks that you face
  - Figure out the tools that you will need to
    - Identify
    - Quantify
    - Mitigate

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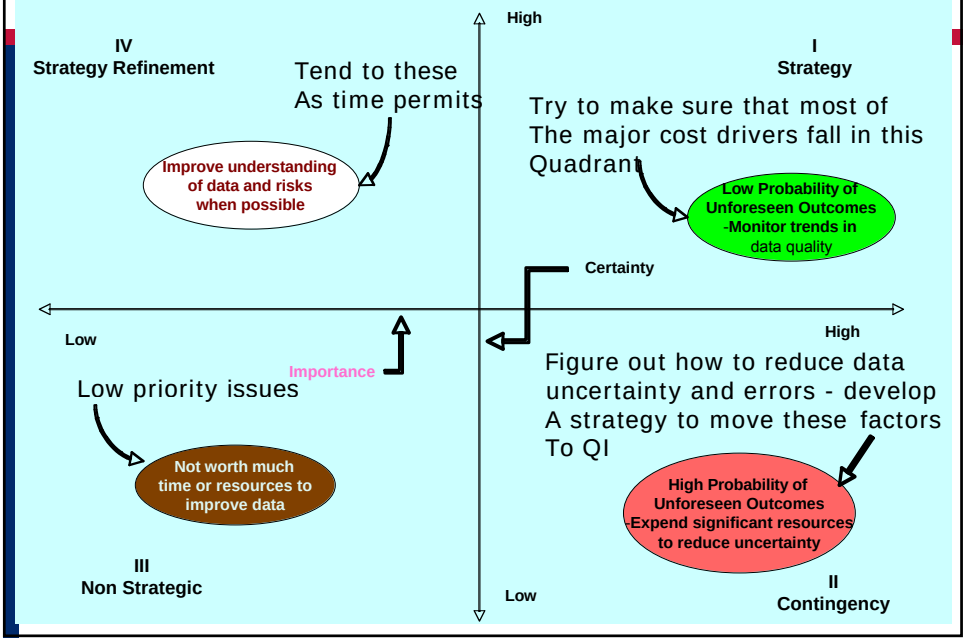
Importance and Certainty of Power System Cost Drivers



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Analytical Framework - What to Do About Risk

- **<u>Every</u> cost driver is subject to risks of varying controllability, importance and certainty**
- **But some of these cost drivers can play a greater role in success or failure than others**
- **Some issues just keep coming up**

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Analytical Framework - What to Do About Risk

- Fuel prices
- Plant dispatchability and load concurrence
- Construction cost
- Environmental standards
- Technology concerns
- Diversification (or its absence)
- Other operational factors
- Market risk – consisting of both supply-side and demand-side risks

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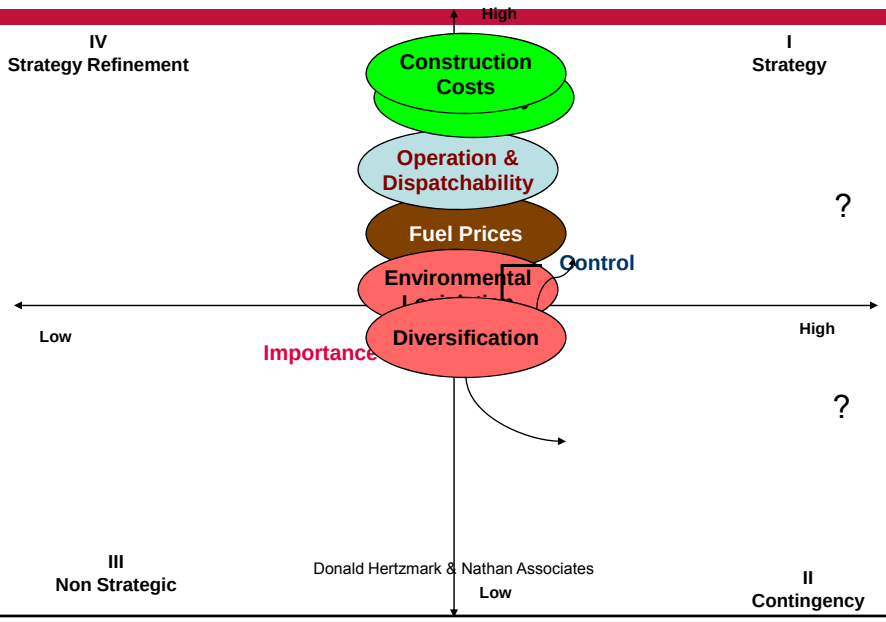

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Risk Identification & Mitigation - What to do?

- Eskom identified more than 80 distinct cost drivers for its future generation program
  - Most were important
  - Most were not seen as controllable
- 80 cost drivers is parameter overload
  - How to simplify
  - Can simplification lead to identification of mitigation measures?

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Risk Identification & Mitigation - What to do?

- Globalization
  - Contracting for P_{90} expansion program
  - Identification of measures for less likely outcomes
- Massive System Expansion
  - Super-normal duty cycle for existing plants
  - Scarce resources devoted to construction or maintenance of 6 □ quality control
- Skills Shortages
  - Staff skills development
  - Dedicated staff for P_{90} expansion requirements

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Risk Identification & Mitigation - What to do?

- **Environment**
  - Clarification of governmental policies & priorities
  - Fuel & technology choices stabilized
- **Quality of Service**
  - Pricing quality of service
  - Improved load management

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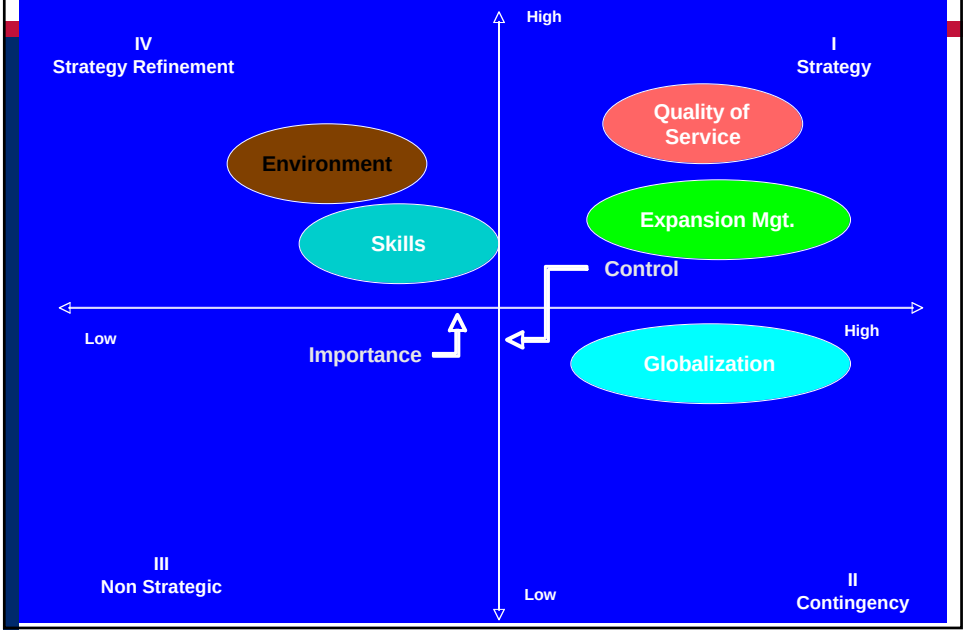
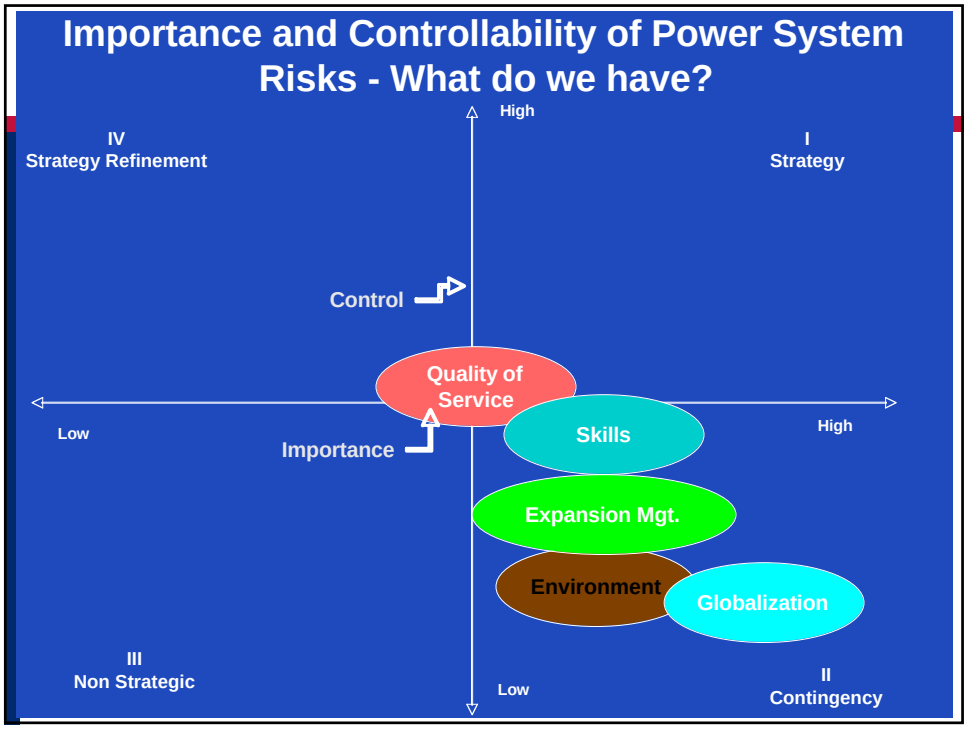
Importance and Controllability of Power System Risks - What do we want?





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Suggested Approach

- Associate cost drivers with themes - what goes where?
- Assess controllability, importance, certainty
- Assess potential mitigation measures - how can these uncontrollable and very important cost drivers be brought under better control?

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Thank you for your attention

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