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# Modelling the REIPP Round I & 2 -

## Implications

Sebastian Giglmayr

Supervisors:

Alan Brent, PhD

Paul Gauché, MEng

Hubert Fechner, MSC, MAS

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Fakulteit Ingenieurswese • Faculty of Engineering



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- Project Objectives
- Methodology
- Analysis Results
- Conclusion
- Discussion







- Development of a renewable energy forecast for 2015
  - Based on REIPP Procurement Program
  - Includes every approved project of bidding round 1 & 2
  - 'Financial Close' round 2: March 2013
  - Commissioning until end of 2014  $\rightarrow$  Model for 2015
- REIPPPP tenders capacities only
  - Cumulative annual performance required (forecast)
  - Contribution to security of supply?
  - Load behavior during peak demand?







- Thesis determines an initial study
  - Future collaboration between CRSES/STERG and UCT.
  - To advice policy/decision maker
  - Every participant (IPPs, Government, Stakeholder) might benefit







- Time-series simulation
  - Hourly based records
  - Based on 2010 data records by GeoModel
    - DNI, GHI, wind speeds, ambient temperature
  - Representing 2015
- Four different approaches
  - Wind I 304 MW
  - SolarPV I 048 MW
  - CSP 200 MW
  - Hydro Power I4 MW







- Solar PV Model
  - Basic PV Model by Paul Gauché
- CSP Model
  - System Advisor Model by NREL
- Hydro Power
  - Using flow rates by Dep. of Water Affairs
- Wind Model
  - I. Validation of data records via WASA weather masts
  - 2. Extrapolation to accurate hub height
  - 3. Power conversion







- Validation of results by
  - Compare expected figures to operational figures
  - Explore deviation between models
  - Taking expertise of researcher into account













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## Analysis results



• Renewable energy (RE) annual yield: 6.4 TWh

	Wind power	SolarPV	CSP	Hydro power
Delivered energy [GWh]	3 685	1 906	752	99
Maximum actual power [MW]	I 302	900	217	14

- Maximum power: **2 302 MW** (95 % of rated capacity)
- Minimum power: **27 MW** (1.1 % firm capacity)
- Annual RE share of 2 % according to IRP 2010 forecast
- Capacity RE share of **5** % according to Eskom projection







## Analysis results

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- The announced 10 TWh goal by government (adjusted in 2011) for 2015 cannot be met.
  - 9.12 TWh incl. a linear extrapolation of bidding round 3
- Cumulative power supply (January)







#### System duration curve (frequency distribution)





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## Contribution to winter peak demand (7 to 8 p.m.)

• Frequency distribution



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### **Fluctuation characteristics**

- Maximum alternation: 1 073 MW
- Median (108 MW) is 10 % of ceiling alternation
- $\rightarrow$  Tool which enables a comparison of volatility properties



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- Public goal of 10 TWh until 2015 cannot be met
- Wind power contribution sometimes almost 0
- CSP offers a greater degree of freedom in terms of peak load contribution
- Distinct deviation between summer and winter contribution
- High system volatility since wind and solar PV dominate the capacity contribution







- Focus on each technologies contribution for a more detailed forecast
- Assessment of set assumptions for error minimization
- Closer collaboration with GeoModel in terms of wind speed time series simulation
- Additional examination of weather data in terms of long period data records to reduce influence of unforeseen weather phenomenon's
- A prospective ongoing evaluation of the models results









# Thank you for your attention, questions?



