



## **The case for new coal in South Africa – where has it gone?**

Pretoria, 27 March 2018

Dr. Tobias Bischof-Niemz

# Agenda

---

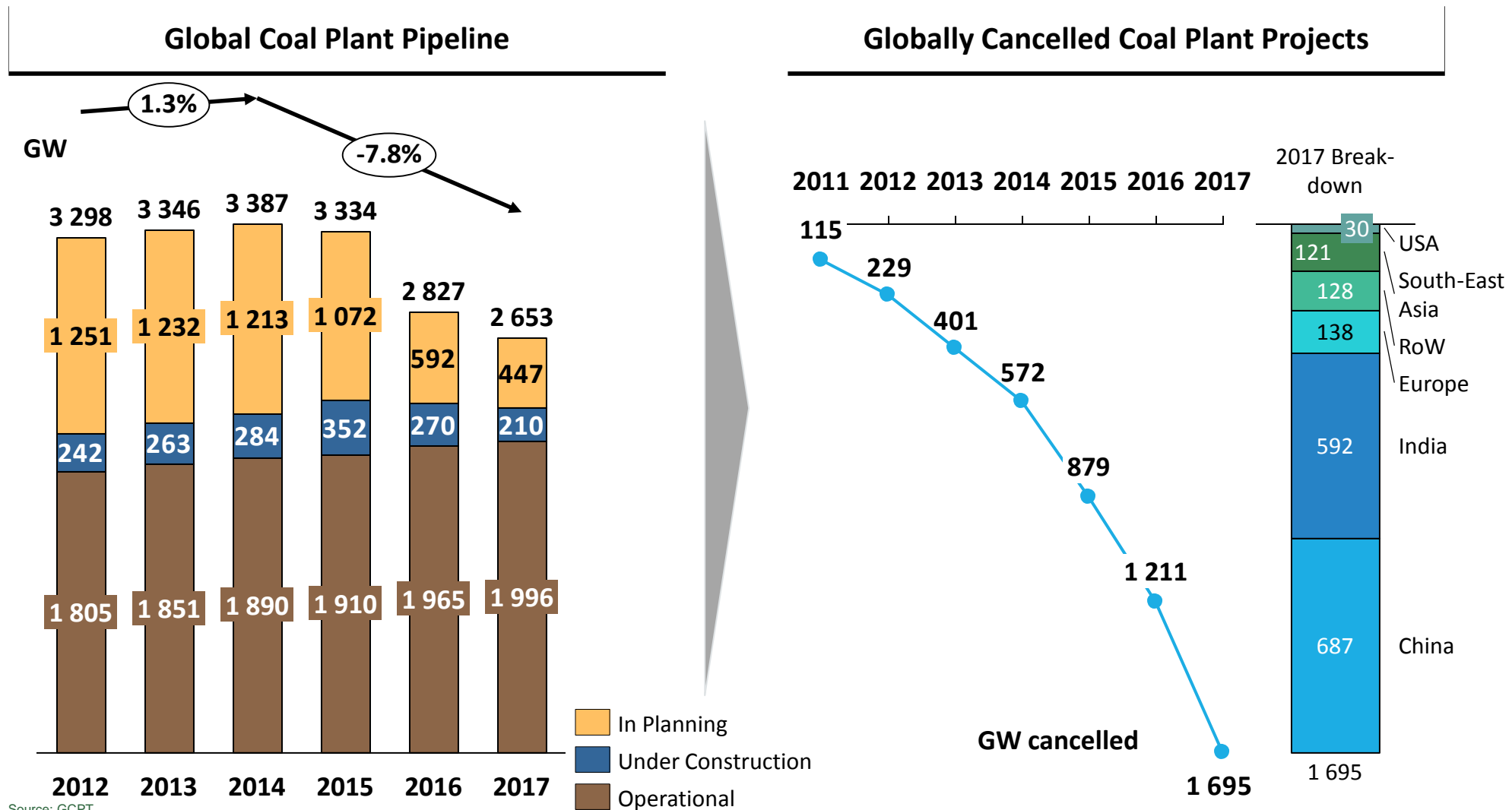
**Coal: a Global View**

New Coal in South Africa: The Cost

Alternatives to New Coal

Summary

# Since 2014, size of global coal pipeline is shrinking with 8% per year



Source: GCPT  
Source: Bischof-Niemz analysis

# 2017 status: national and sub-national coal phase out commitments

Coal phase out has now broken through as a concept understood and acted upon at a political level with commitment timetables and policy and legal frameworks by national and sub-national governments

## Pre-2017 2017

California  
Belgium  
Ontario  
Scotland

Beijing  
Massachusetts

## 2020

New York  
Oregon

## 2021

Connecticut

## 2022

Hawaii  
New Zealand

## 2023

France

## 2025

Austria  
UK  
Washington  
Italy

## 2030

Canada  
Finland  
New Mexico  
Netherlands  
Portugal  
Sweden

# Agenda

---

Coal: a Global View

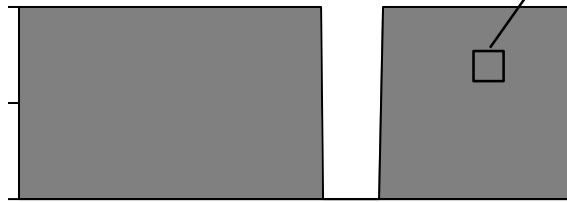
**New Coal in South Africa: The Cost**

Alternatives to New Coal

Summary

# IPP Procurement Programme brought lots of transparency

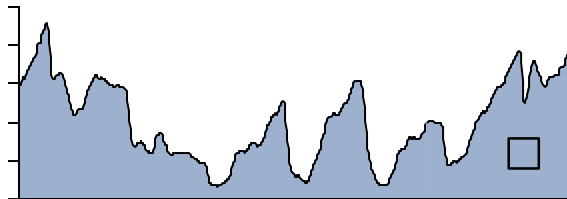
## Baseload Coal



Year

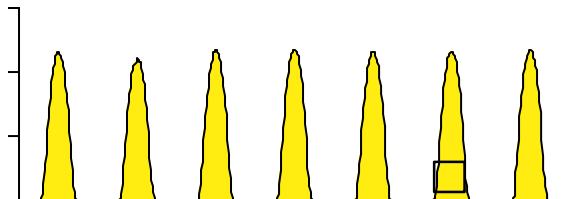
What is the cost of one unit of energy?

## Wind



Week

## Solar PV



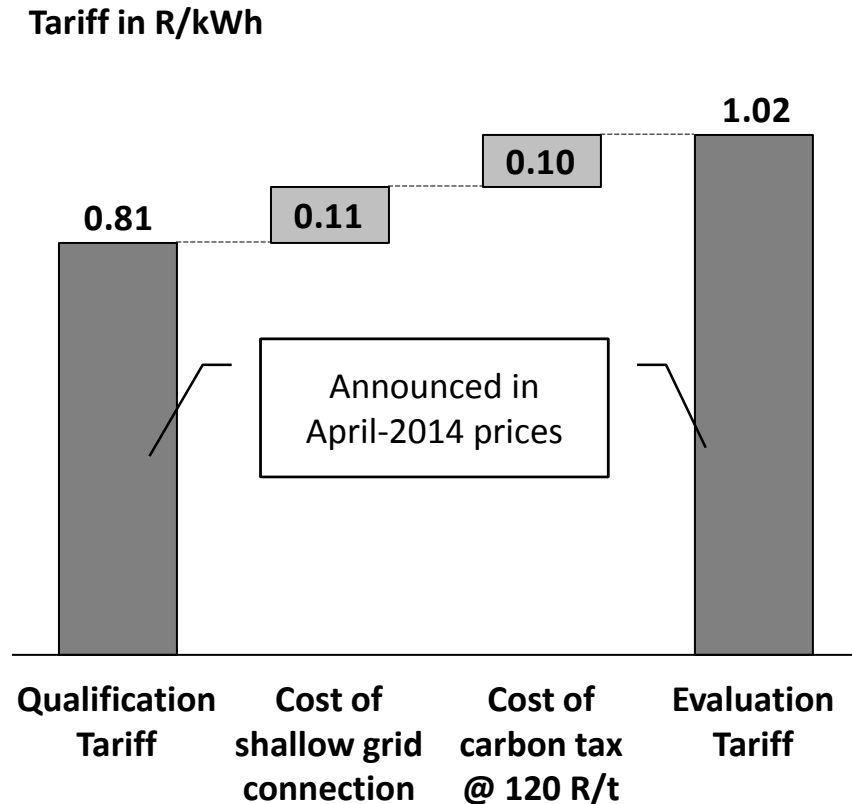
Week

None of the three power sources can supply customer demand on its own

First step to approach the economics: What is the cost of one unit of energy in R/kWh? – irrespective of shape of supply profile

IPP Procurement Programme has uncovered cost per energy unit (R/kWh) in a transparent, comparable manner

# What was announced about coal IPP tariffs...



Coal IPP Procurement Programme was launched in December 2014 to procure baseload power

Coal IPP tariffs were announced on in October 2016

Tariffs were announced in April-2014 prices (tariffs are adjusted with CPI on 1 April each year)

Two tariffs were announced:

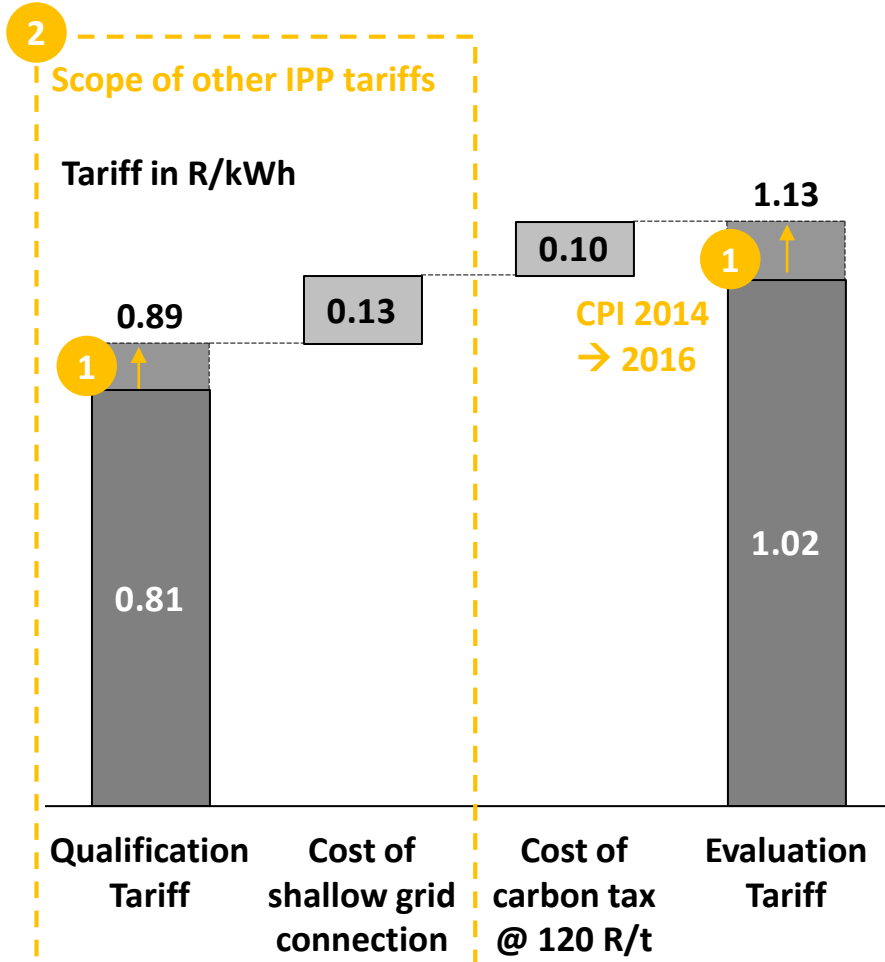
- Qualification tariff
- Evaluation tariff

Evaluation tariff included cost of shallow grid connection (up to next available grid point)

It also included the pass-through cost of an anticipated carbon tax at 120 R/t

<http://www.energy.gov.za/files/media/pr/2016/Coal-IPP-factsheet.pdf>

# ... and what must be done to make it comparable to other IPP tariffs



Latest renewables IPP tariffs from so called Bid Window 4 Expedited were announced in November 2016

They were announced in April-2016 prices

Hence, two adjustments need to be made to the announced coal IPP tariffs in order to make them comparable to RE:

- 1) Inflation of announced numbers with CPI from April-2014 prices to April-2016 prices
- 2) Inclusion of shallow grid connection costs in the scope (i.e. exclusion of carbon tax cost from evaluation tariff)

→ Comparable Coal IPP tariff in April-2016 prices:

**Evaluation Tariff – carbon tax  
= 1.03 R/kWh**

<http://beta2.statssa.gov.za/publications/P0141/CPIHistory.pdf>

[http://www.ee.co.za/wp-content/uploads/2016/10/New\\_Power\\_Generators\\_RSA-CSIR-14Oct2016.pdf](http://www.ee.co.za/wp-content/uploads/2016/10/New_Power_Generators_RSA-CSIR-14Oct2016.pdf)

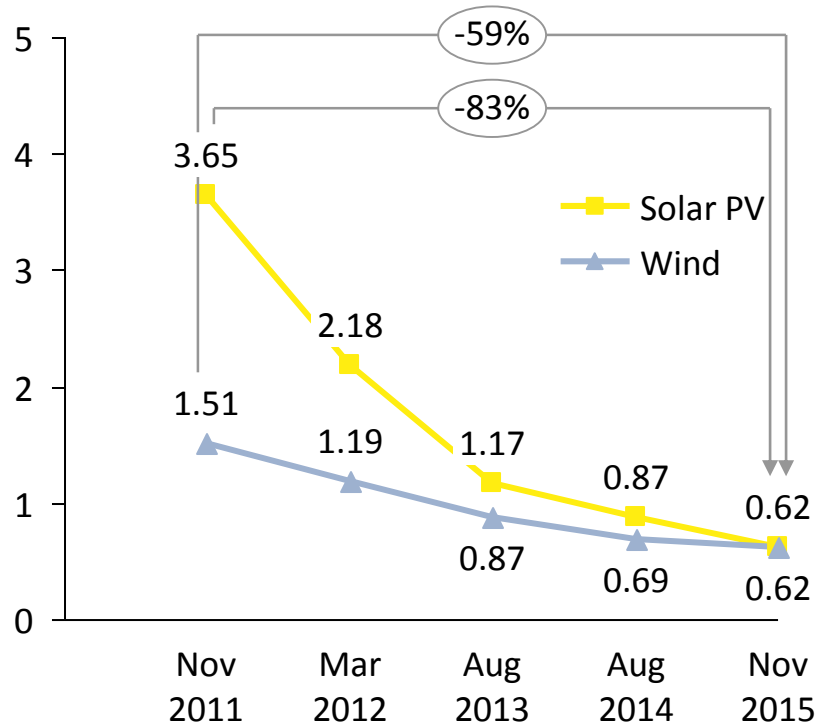


# REIPPPP results: new wind/solar PV 60-80% cheaper than first projects

Results of Department of Energy's RE IPP Procurement Programme (REIPPPP) and Coal IPP Proc. Programme

## Significant reductions in actual tariffs ...

Actual average tariffs  
in R/kWh (Apr-2016 prices)



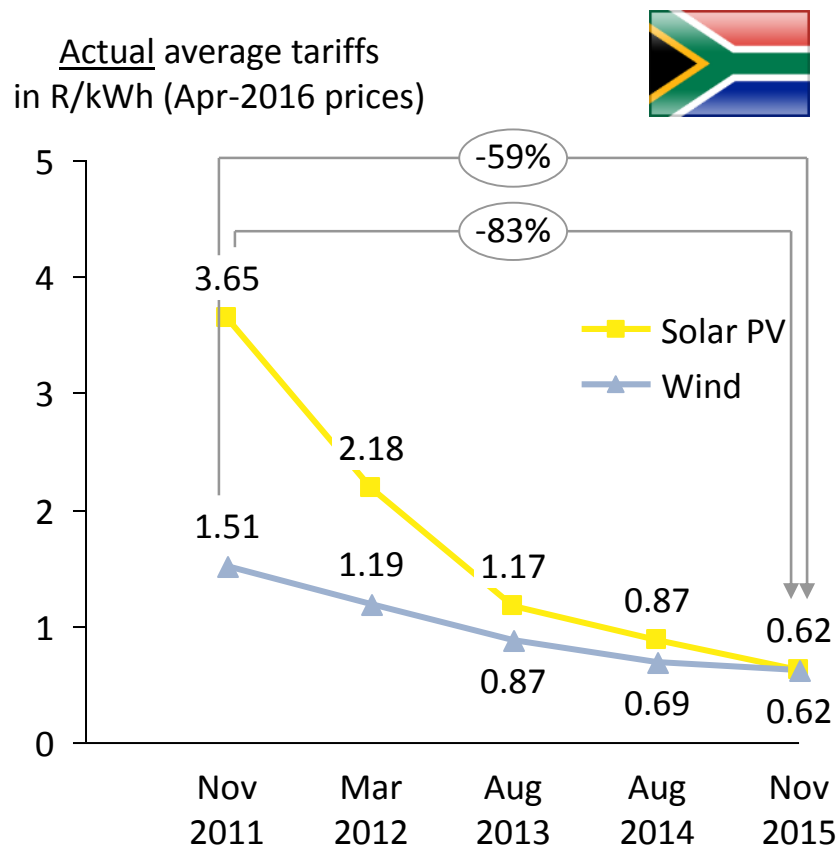
Sources: <http://www.energy.gov.za/files/renewable-energy-status-report/Market-Overview-and-Current-Levels-of-Renewable-Energy-Deployment-NERSA.pdf>;  
<http://www.saipppa.org.za/Portals/24/Documents/2016/Coal%20IPP%20factsheet.pdf>; [http://www.ee.co.za/wp-content/uploads/2016/10/New\\_Power\\_Generators\\_RSA-CSIR-14Oct2016.pdf](http://www.ee.co.za/wp-content/uploads/2016/10/New_Power_Generators_RSA-CSIR-14Oct2016.pdf);

StatsSA on CPI; CSIR analysis  
Source: Bischof-Niemz analysis

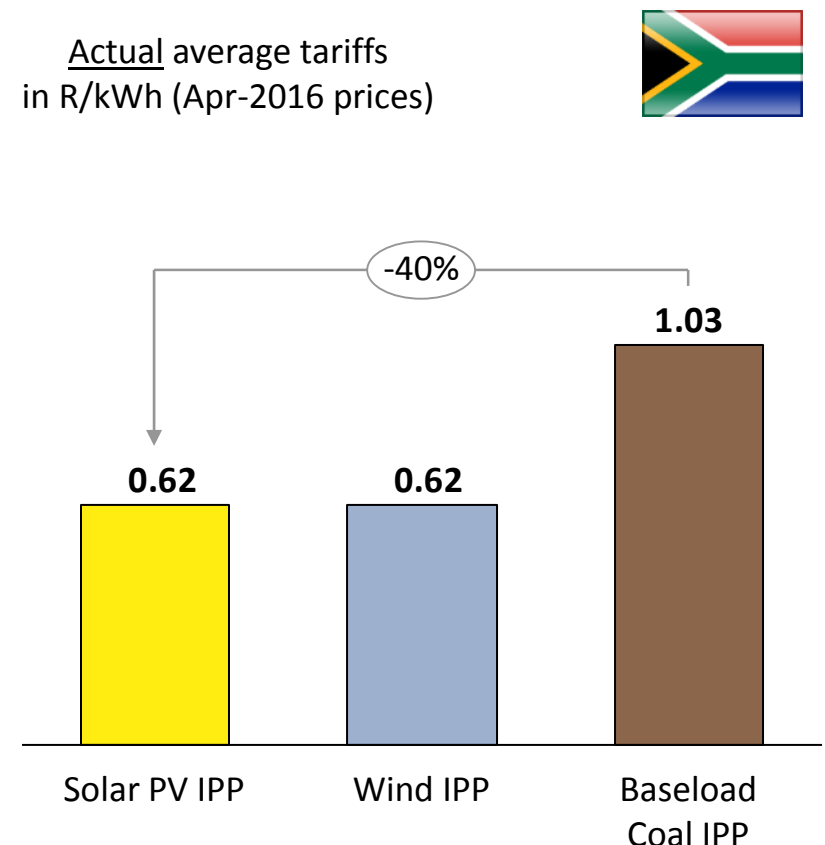
# Actual tariffs: new wind/solar PV 40% cheaper than new coal in RSA

Results of Department of Energy's RE IPP Procurement Programme (REIPPPP) and Coal IPP Proc. Programme

Significant reductions in actual tariffs from the RE IPP Procurement Programme (REIPPPP) ...



... have made new solar PV & wind power 40% cheaper than new coal in South Africa today



Notes: Exchange rate of 14 USD/ZAR assumed Sources: <http://www.energy.gov.za/files/renewable-energy-status-report/Market-Overview-and-Current-Levels-of-Renewable-Energy-Deployment-NERSA.pdf>; <http://www.saippa.org.za/Portals/24/Documents/2016/Coal%20IPP%20factsheet.pdf>; [http://www.ee.co.za/wp-content/uploads/2016/10/New\\_Power\\_Generators\\_RSA-CSIR-14Oct2016.pdf](http://www.ee.co.za/wp-content/uploads/2016/10/New_Power_Generators_RSA-CSIR-14Oct2016.pdf); StatsSA on CPI; CSIR analysis  
Source: Bischof-Niemz analysis

# Agenda

---

Coal: a Global View

New Coal in South Africa: The Cost

**Alternatives to New Coal**

Summary

# Thought experiment: Build a new power system from scratch

**Base load demand (capacity):** 708 MW (*Thabametsi: 557 MW, Khanyisa: 306 MW; total: 863 MW*)

→ **Annual demand (energy):** 708 MW x 8 760 h/a = 6.2 TWh/a (*~50% of Citypower's demand*)

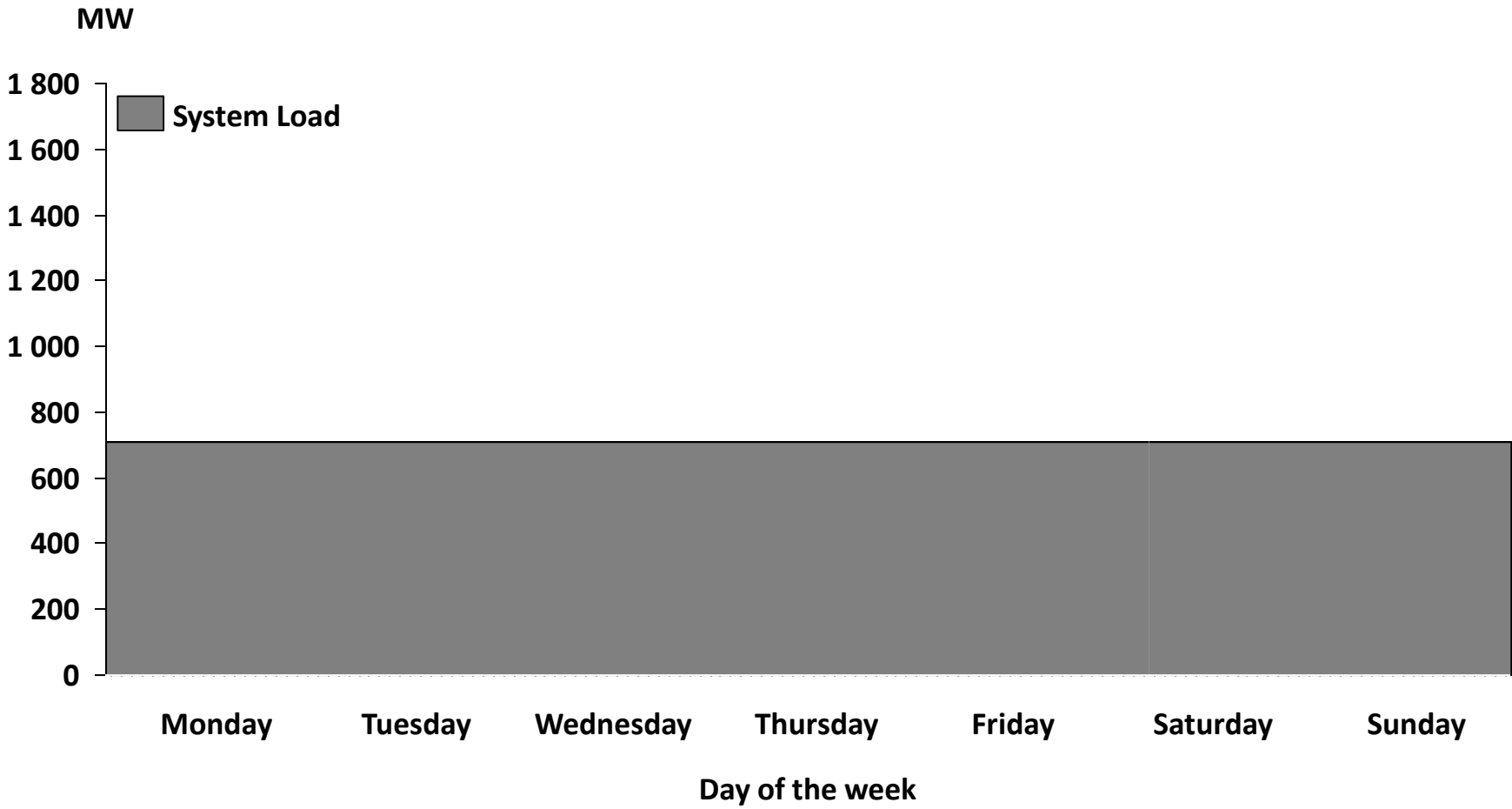
## Questions

- Technical: Can a wind & solar PV blend, mixed with flexible dispatchable power to fill gaps supply this?
- Economical: If yes, at what cost?

## Assumptions/approach

- 1 680 MW of wind @ 62 c/kWh (average tariff in South Africa's latest auction from Nov 2015)
- 2 620 MW of solar PV @ 62 c/kWh (average tariff in South Africa's latest auction from Nov 2015)
- 3 863 MW flexible power generator to fill the gaps @ 150 c/kWh (e.g. gas-turbines at Sasol gas prices)
  - 15-minute solar PV and wind data from CSIR resource study, covering the entire country (<https://www.csir.co.za/csir-energy-centre-documents>)
  - 15-minute simulation of supply structure for three consecutive years (2010-2012)

# Thought experiment: assume 708 MW of true baseload (constant load)

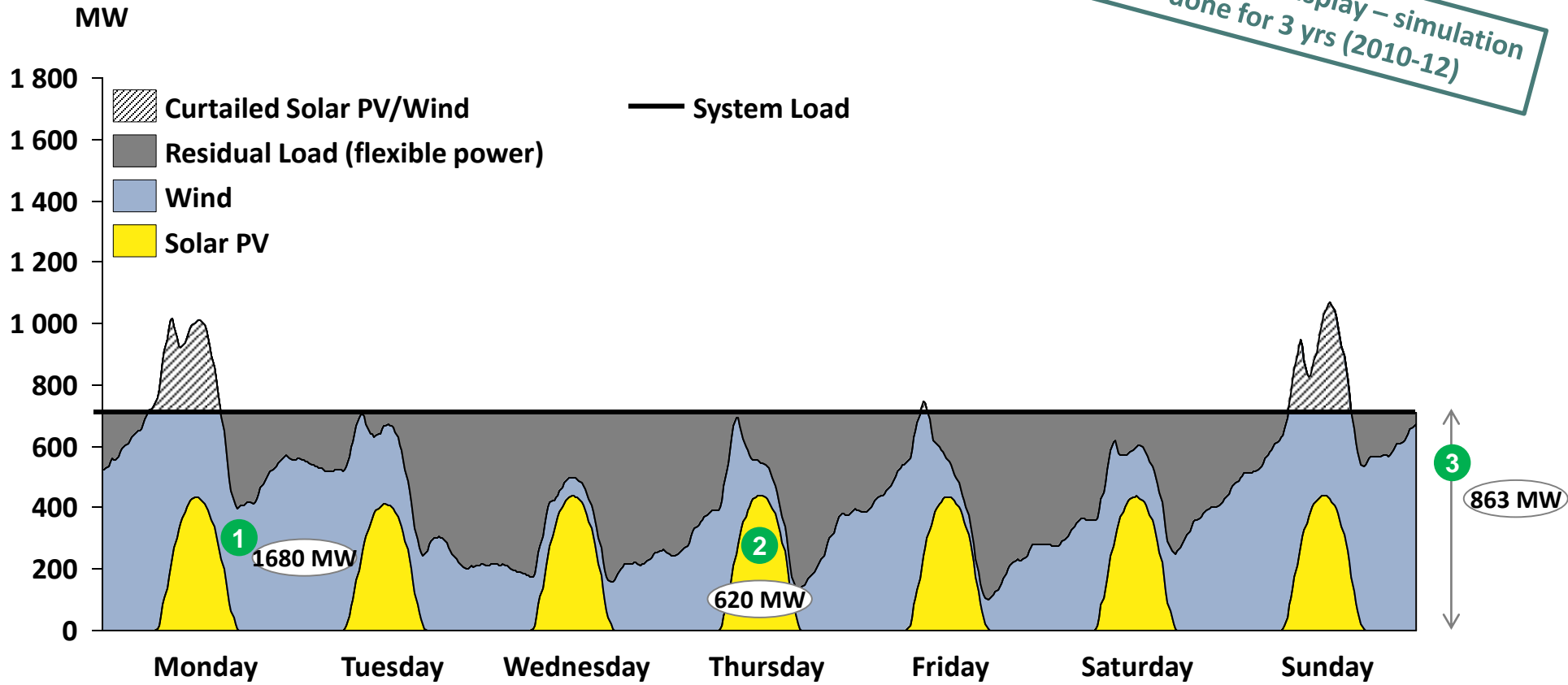


Source: Bischof-Niemz analysis

# In the least-windy week, fuel for flexible generator must be stocked

Simulated 15-minute solar PV and wind power supply for the week from 17-23 May 2010

One week in display – simulation done for 3 yrs (2010-12)



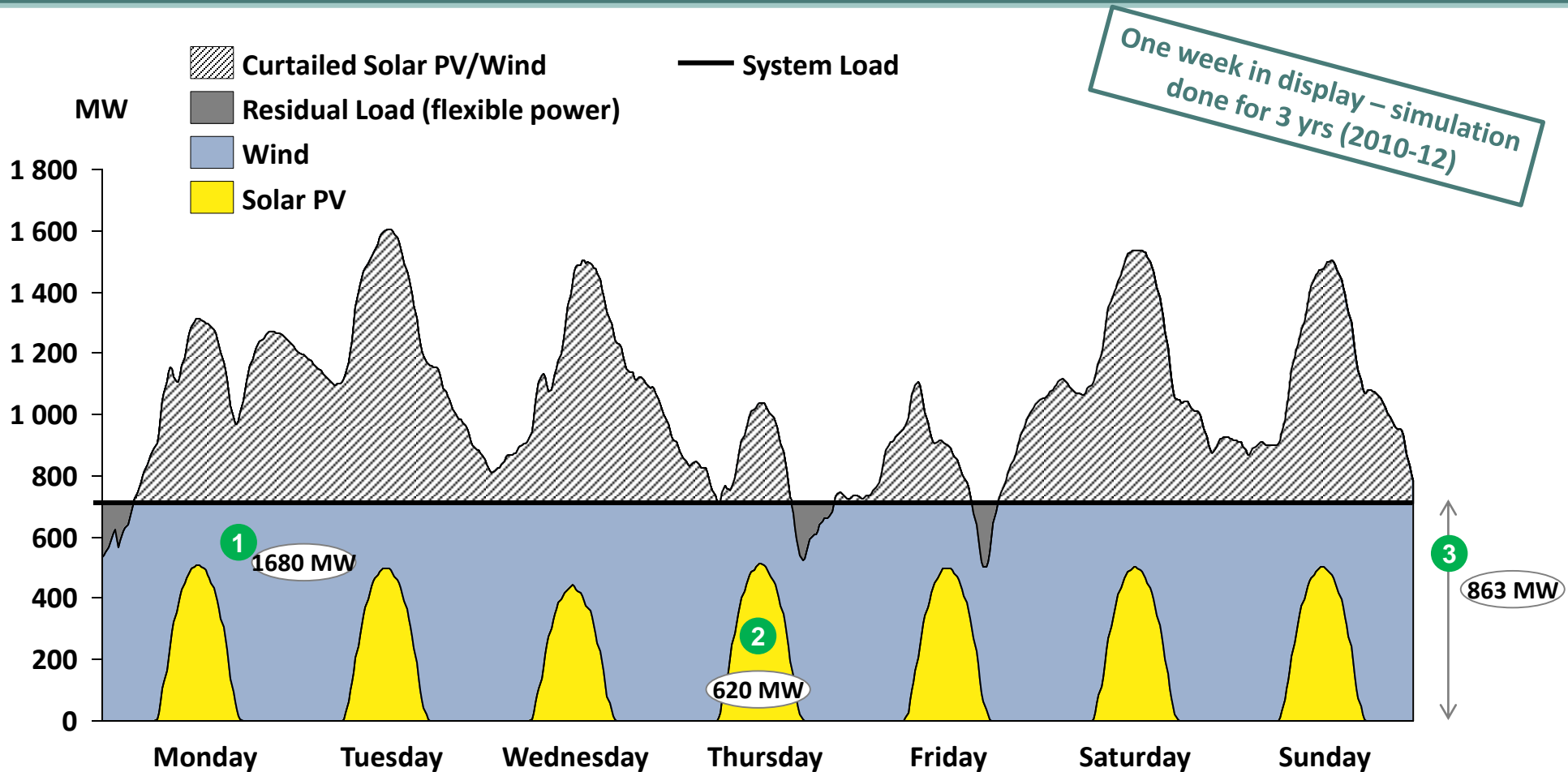
## Energy Mix in this week

Flexible power generator:	36%	of total primary electricity
Wind and solar PV:	64%	of total primary electricity
Curtailment:	4%	of all wind/solar energy is curtailed

## Day of the week

# Windiest week: residual load very small & lots of curtailed wind energy

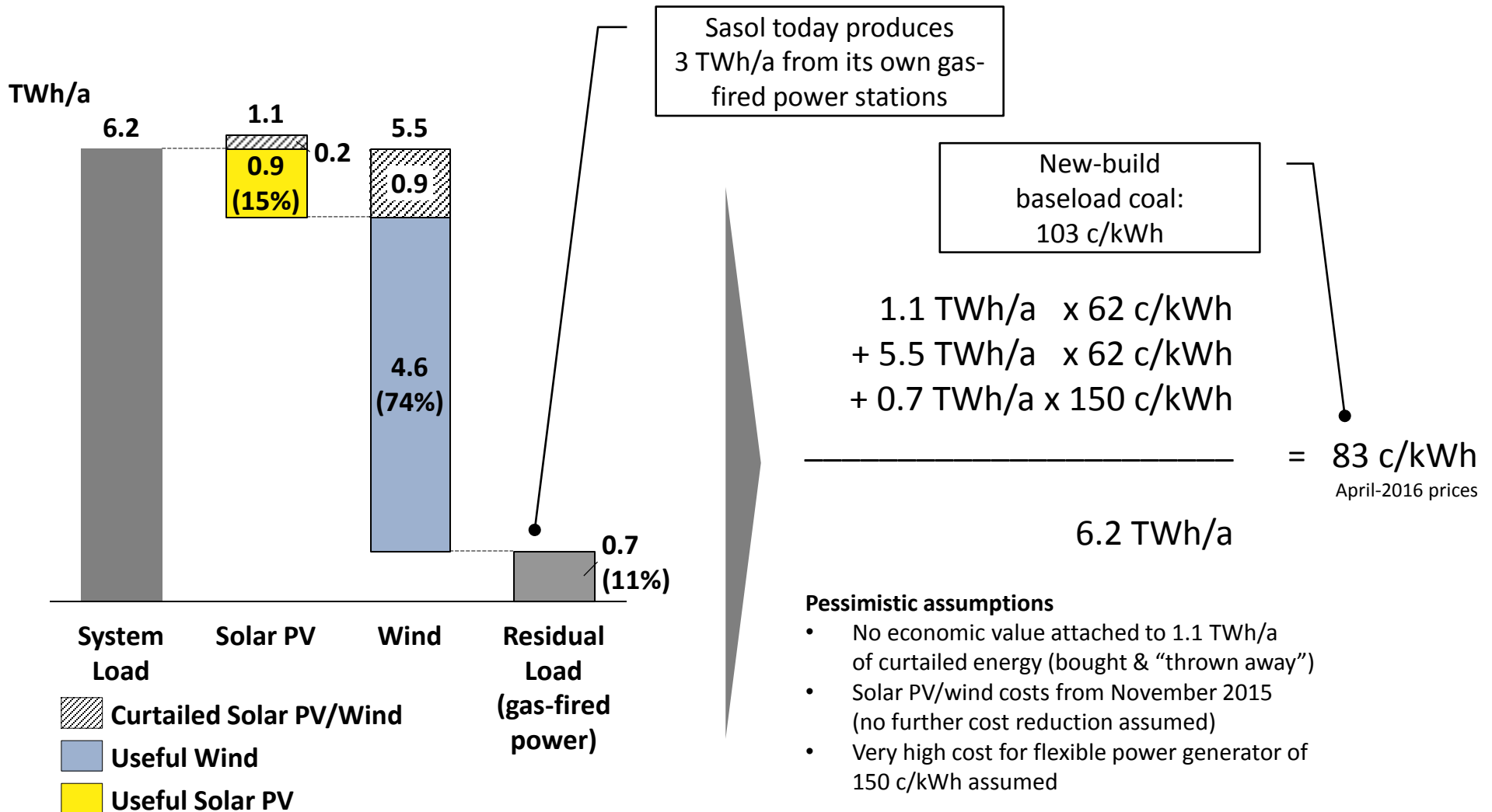
Simulated 15-minute solar PV and wind power supply for the week from 13-19 August 2012



## Energy Mix in this week

	Day of the week
Flexible power generator:	1% of total primary electricity
Wind and solar PV:	99% of total primary electricity
Curtailment:	33% of all wind/solar energy is curtailed

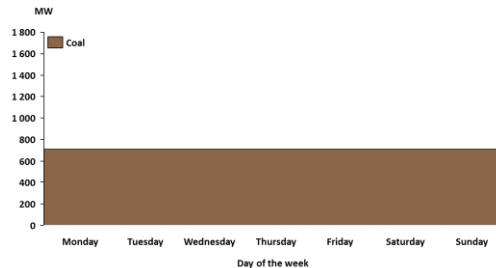
# Mix of solar PV, wind and expensive flexible power costs 83 c/kWh at the maximum – 20 c/kWh or 20% cheaper than new baseload coal





# Two options for new reliable 863 MW that produces 6.2 TWh/a

## Option 1: New baseload coal

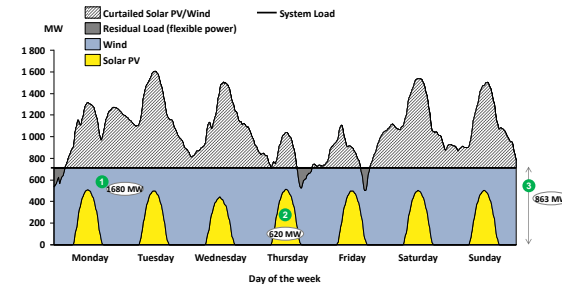


6.2 TWh per year @ 1.03 R/kWh

- 1) Total cost: R6.4 billion per year (R7.0 billion with CO<sub>2</sub>)
- 2) CO<sub>2</sub> emissions: 5.3 million t/a
- 3) Jobs: 4-5 000 jobs during 5 years of construction, 480 permanent jobs during operations

Investment in sunset industry and 30-year lock in  
 → Very high risk of stranded assets

## Option 2: Mix of solar PV, wind & flexibility



6.2 TWh per year @ blended 0.83 R/kWh

Additionally: 1.1 TWh/a renewable energy for free

- 1) Total cost: R5.1 billion per year (-R1.3 billion or -20%)
- 2) CO<sub>2</sub> emissions: 0.4 million t/a (-92%)
- 3) Jobs: 4-5 000 job-years during 4 years of construction, 800 permanent jobs during operations (+67%)

Investment in sunrise industry, plus only 20-year lock in  
 → Opportunity to replace gas component with batteries at any time and wind/PV with new wind/PV after 20 years

# Agenda

---

Coal: a Global View

New Coal in South Africa: The Cost

Alternatives to New Coal

**Summary**

## Summary:

# There is no trade-off anymore between cleanest, cheapest & most jobs

---

**The World is moving away from coal-fired power generation – with increasing speed. The question today is less „should we build new coal“, but rather „how do we phase out existing coal in an optimal manner?“**

**Already today, new solar PV and wind is 40% cheaper than new coal-fired power in South Africa**

**Very soon new PV & wind will be cheaper than existing coal, lowering capacity factors of existing assets**

- The two coal IPPs with 863 MW will be procured with a minimum guaranteed capacity factor of ~80% – congests the grid & is the opposite of what is needed to complement new workhorses variable PV/wind
- This means that South Africa will foreseeably create stranded assets by procuring new baseload coal power stations on long-term (30 year) take-or-pay contracts

**New solar PV and wind, blended with energy from flexible, but more expensive gas-fired power generators, is at least 20% cheaper than new baseload coal**

**As a consequence, if South Africa builds new coal-fired power stations at 1.03 R/kWh, it will pay at least R1.3 billion per year too much for electricity (R1.9 with CO<sub>2</sub>), for 30 years – essentially a subsidy for coal**

- This premium could be better spent to manage a just transition away from coal towards new industries
- For example: The coal subsidy is the same as the salary bill of 3 000 to 4 000 semi-skills permanent jobs

**Ha Khensa**

**Re a leboha**

**Siyathokoza**

**Enkosi**

**Thank you**

**Re a leboga**

**Ro livhuha**

**Siyabonga**

**Dankie**