Financial aspects of the power system expansion

Presentation to Appropriations Committee

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Prof Dr Tobias Bischof-Niemz

Head of CSIR's Integrated Energy Initiative

Professional Experience

- Member of the Ministerial Advisory Council on Energy (MACE)
- Jan 2015 – today: Extraordinary Associate Professor at Stellenbosch University
- Jul 2014 – today: Centre Manager at the CSIR, responsible to lead the establishment of an integrated energy research centre
- 2012 – 2014: PV/Renewables Specialist at Eskom; afterwards 2 months contract work in the Department of Energy's IPP Unit on gas, coal IPP and rooftop PV
- 2007 – 2012: Senior consultant (energy system and renewables expert) at The Boston Consulting Group, Berlin and Frankfurt, Germany

Education

- Master of Public Administration (MPA) on energy and renewables policies in 2009 from Columbia University in New York City, USA
- PhD ("Dr.-Ing.") in 2006 in Automotive Engineering from TU Darmstadt, Germany
- Mechanical Engineering at Technical University of Darmstadt, Germany (Master – "Dipl.-Ing." in 2003) and at UC Berkeley, USA

Agenda

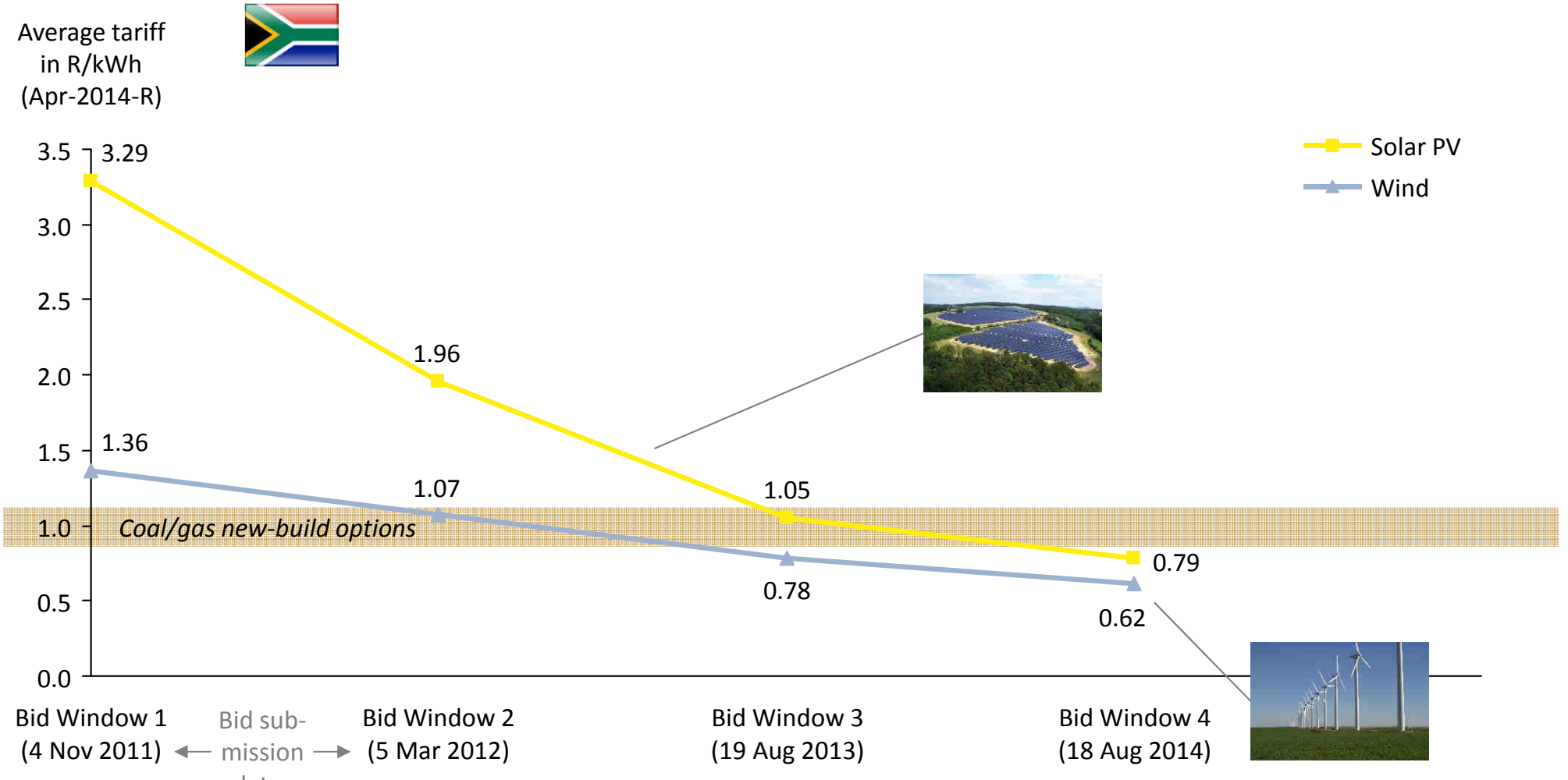
Long-term view on the electricity sector

Electricity tariff and cost of new-builds

Specific Eskom considerations

Actual results: PV and wind in South Africa are cost competitive today

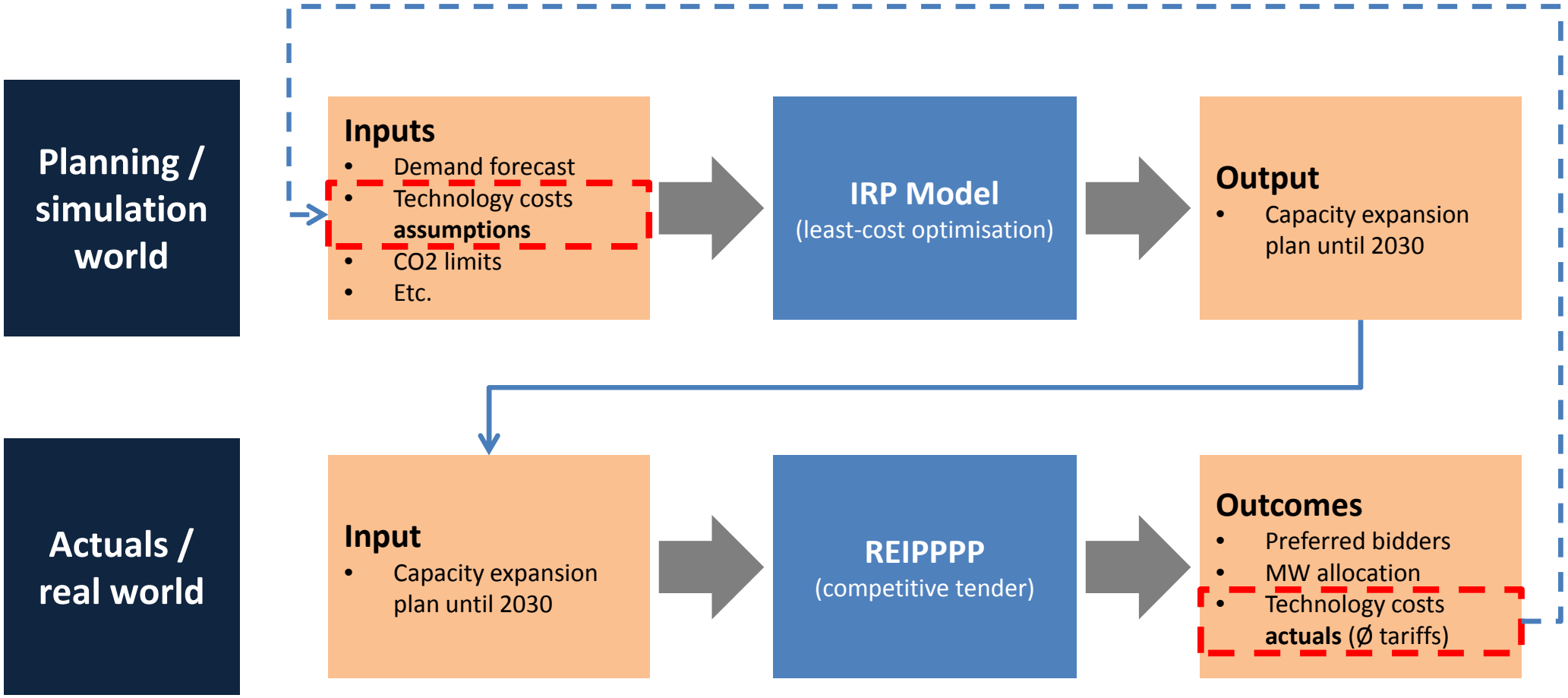
First four bid windows' results of Department of Energy's RE IPP Procurement Programme (REIPPPP)



Notes: For CSP Bid Window 3, the weighted average of base and peak tariff is indicated, assuming 50% annual load factor

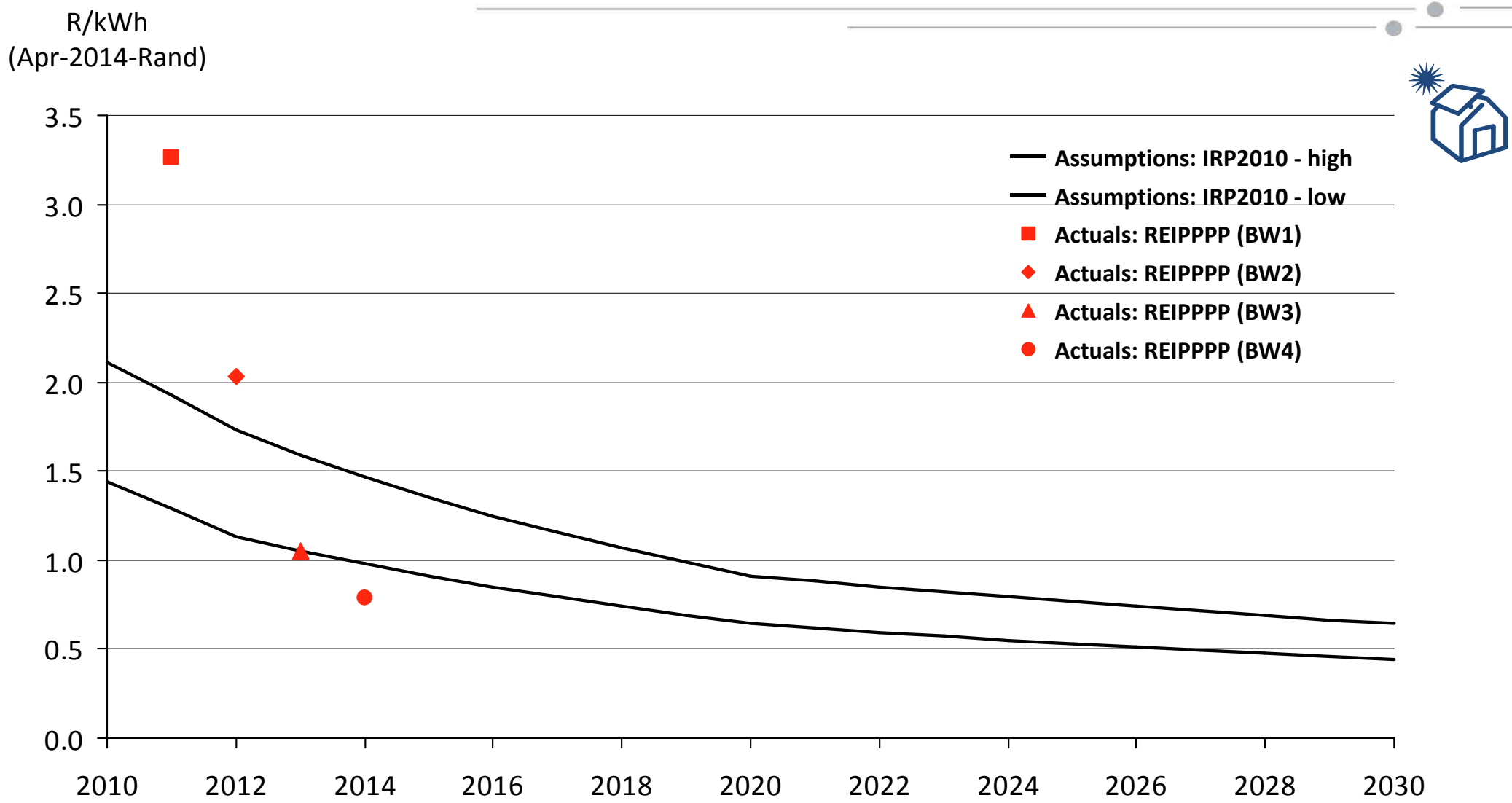
Sources: StatsSA on CPI; Department of Energy's publications on results of first four bid windows http://www.energy.gov.za/IPP/List-of-IPP-Preferred-Bidders-Window-three-04Nov2013.pdf; http://www.energy.gov.za/IPP/Renewables_IPP_ProcurementProgram_WindowTwoAnnouncement_21May2012.pptx; http://www.ipprenewables.co.za/gong/widget/file/download/id/279; CSIR analysis

In-principle process of IRP planning and implementation



Notes: IRP = Integrated Resource Plan; REIPPPP = Renewable Energy Independent Power Producer Procurement Programme
Sources: CSIR analysis

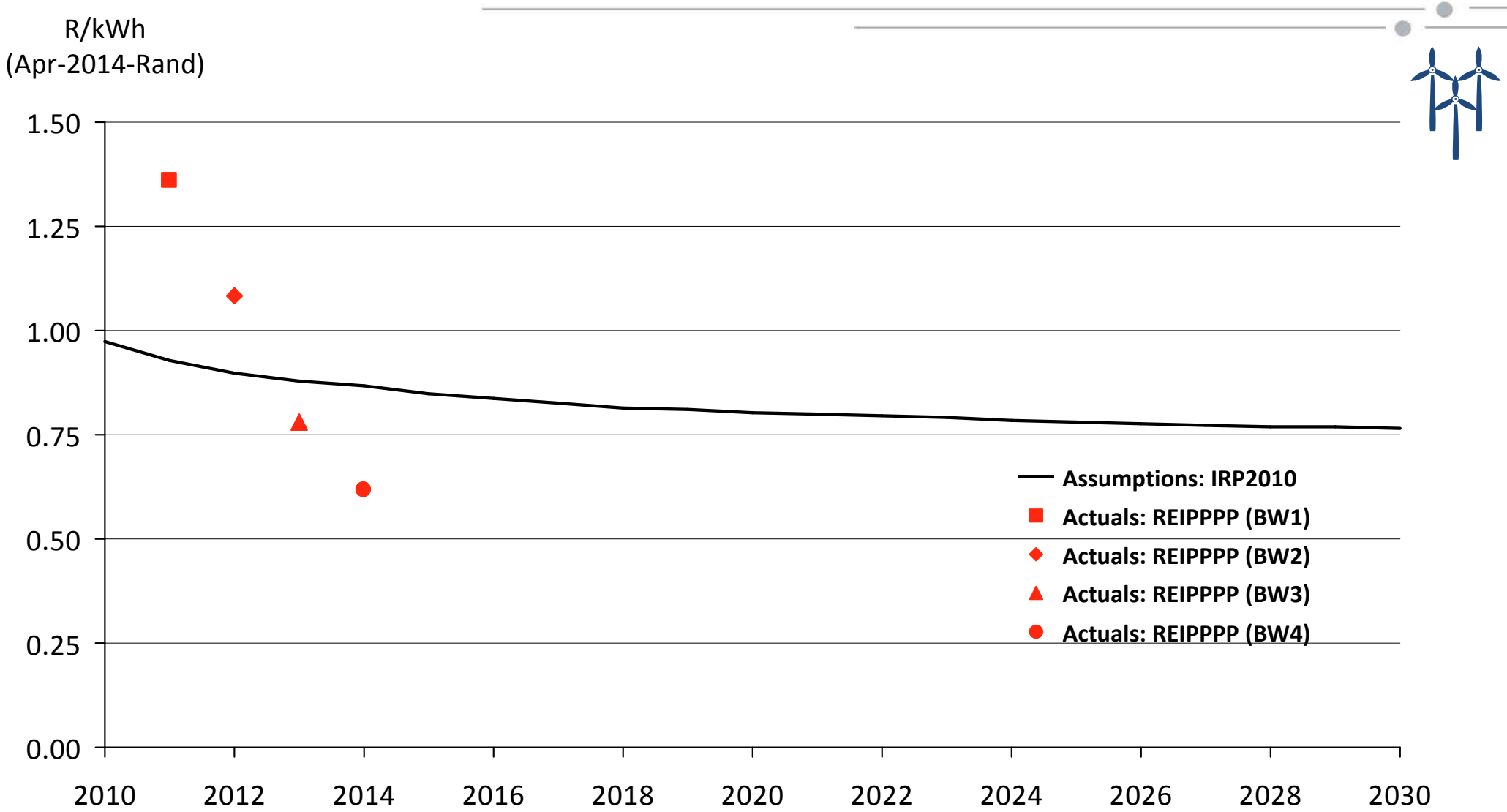
Actual PV tariffs quickly approached IRP cost assumptions in first four bid windows and are now below the lowest cost assumptions of IRP



Sources: IRP 2010; IRP Update; http://www.energy.gov.za/IPP/List-of-IPP-Preferred-Bidders-Window-three-04Nov2013.pdf; CSIR analysis

Assumptions: CPI used for normalisation to Apr-2013 Rand; LCOE calculated for IRP with 8% discount rate (real), 25 yrs lifetime, cost and load factor assumptions as per relevant IRP document; "IRP Tariff" then calculated assuming 80% of total project costs to be EPC costs, i.e. divide the LCOE by 0.8 to derive at the "IRP Tariff"; CSIR analysis

Actual wind tariffs in bid window three were already at the level that was assumed for 2030 in original IRP 2010, BW 4 is significantly below



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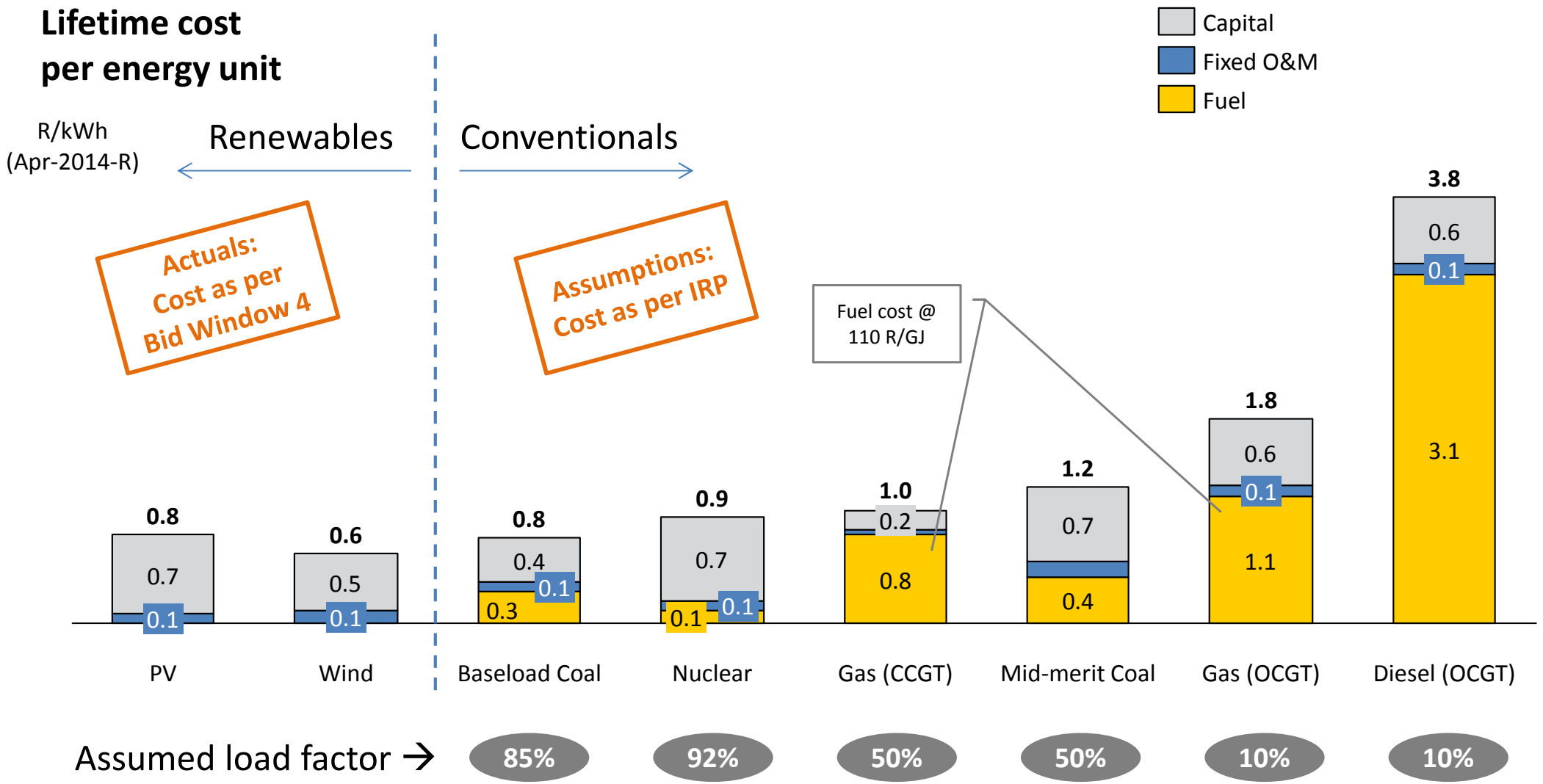
Consequence of renewables' cost reduction: PV and wind are cost-efficient fuel-savers for CCGTs already today



Assumption: Changing full-load hours for conventionals drastically changes the fixed cost components per kWh (lower full-load hours → higher capital costs and fixed O&M costs per MWh); average efficiency for CCGT = 50%, average efficiency for OCGT = 35%; IRP cost from Jan 2012 escalated with CPI to Apr 2014; assumed EPC CAPEX inflated by 10% to convert EPC/LCOE into tariff

Source: IRP Update; REIPPPP outcomes; StatsSA for CPI; CSIR analysis

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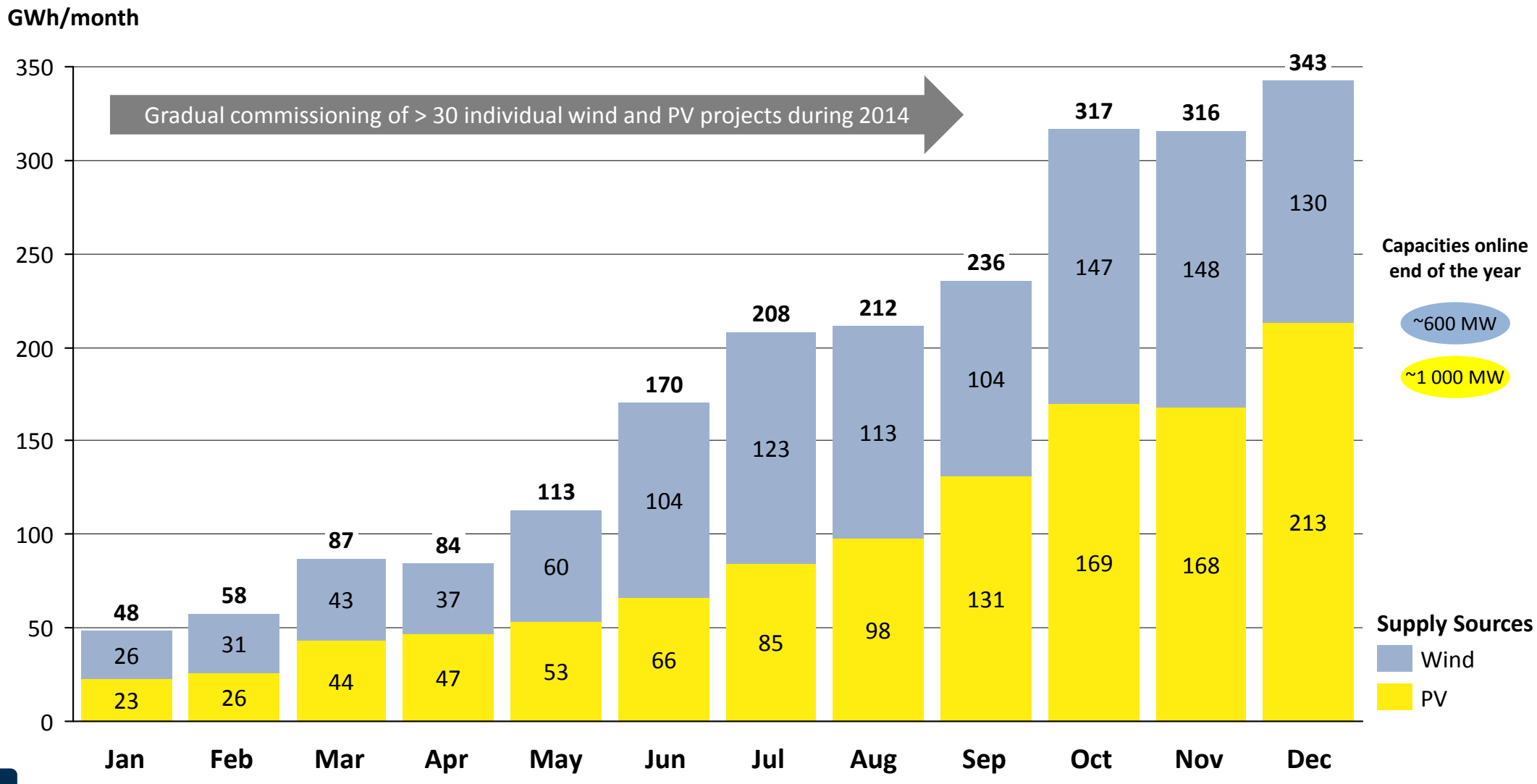
Ramping up of first wind and PV capacities started in 2014

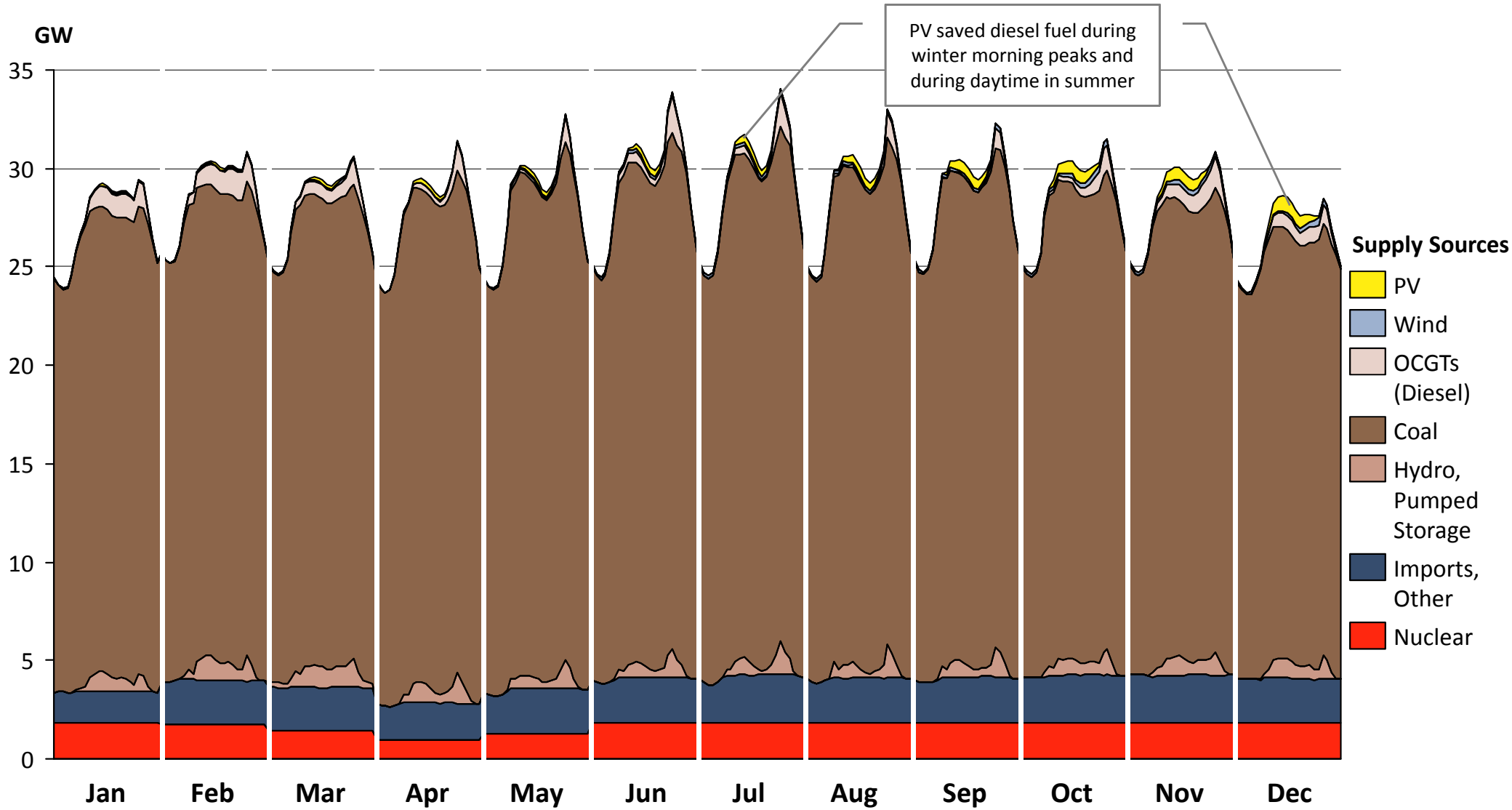
Actual monthly production from large-scale PV and wind plants under the REIPPPP in South Africa in 2014



Sources: Eskom; CSIR Energy Centre analysis

In 2014, OCGTs were used daytime in summer and for winter peaks

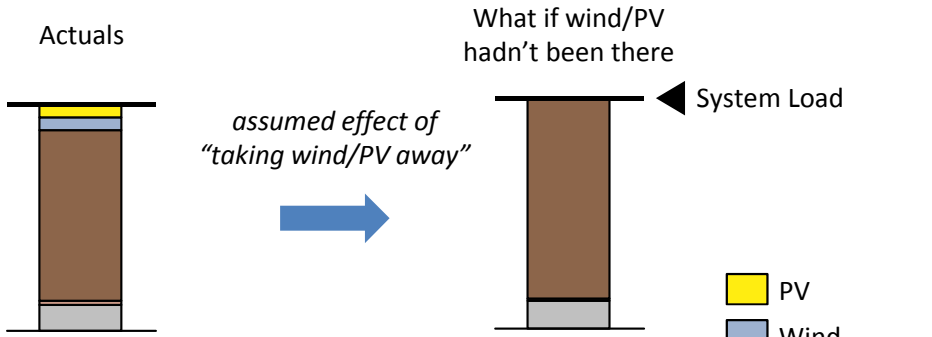
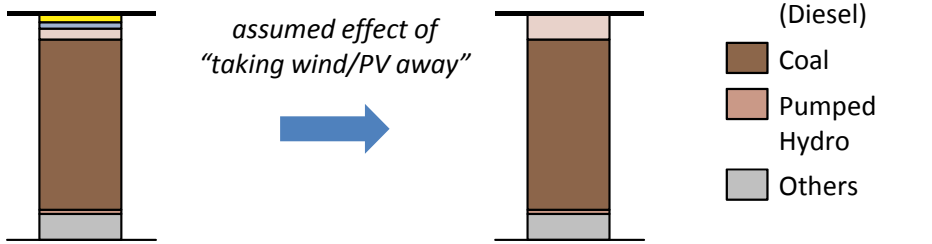
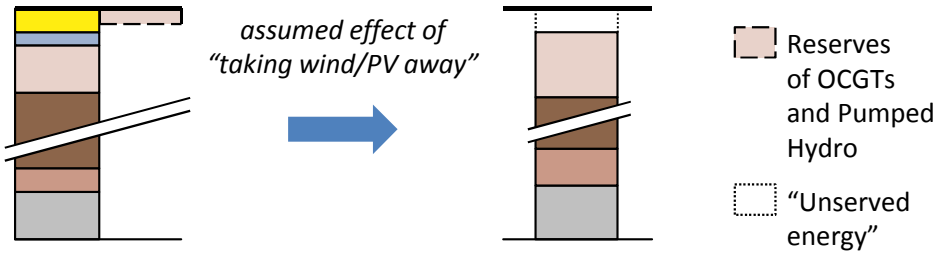
Actual monthly average diurnal courses of the total power supply in South Africa for the year 2014



Note: Design as per Fraunhofer ISE

Sources: Eskom; CSIR Energy Centre analysis

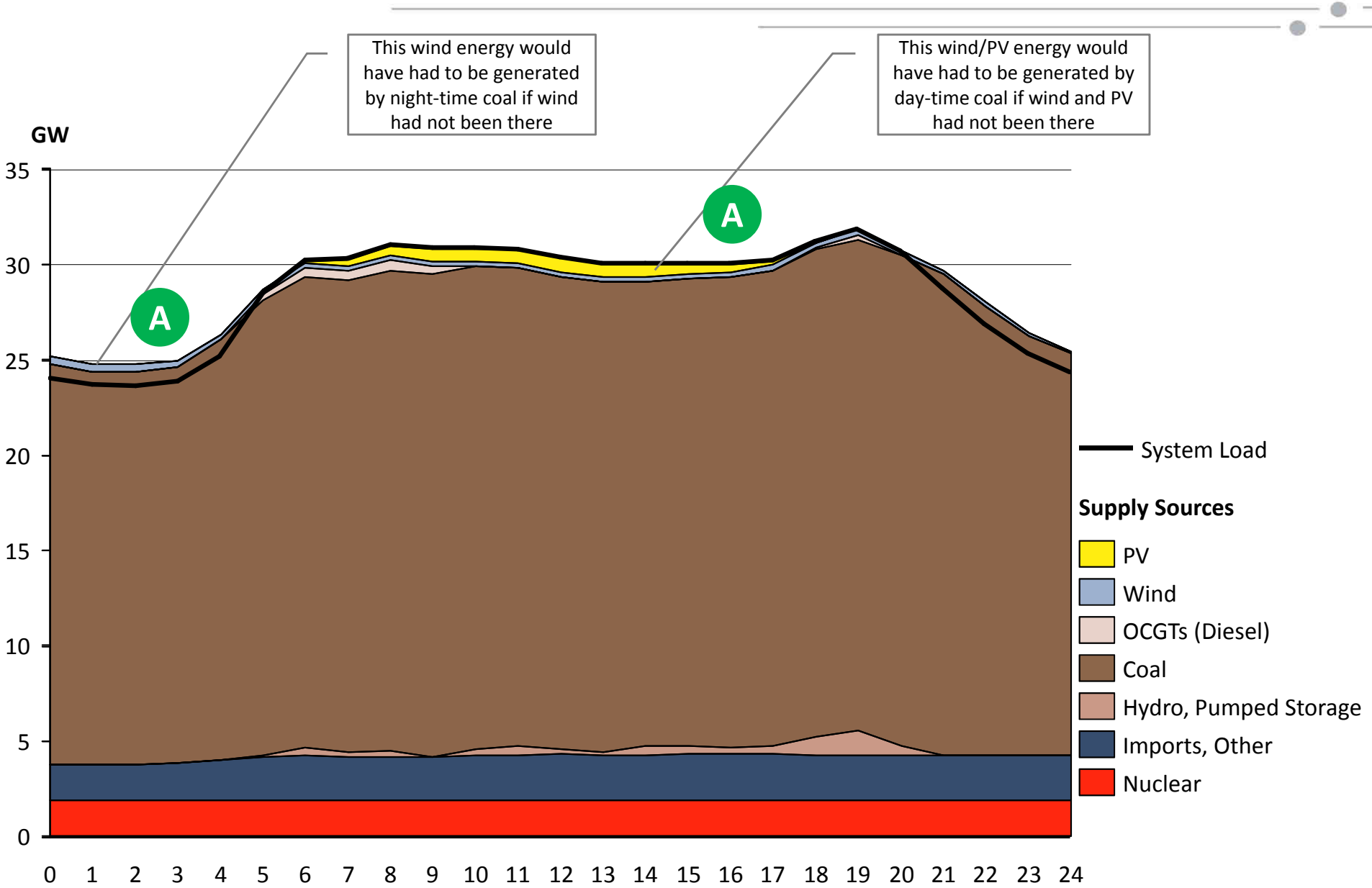
CSIR-defined methodology:
In any hour, wind/PV can have one out of three effects on the system

		Applicable if …	Snapshot of supply structure in a particular hour
A	Saving coal fuel	… output from OCGTs = 0 MWh	
B	Saving diesel fuel	… output from OCGTs > 0 MWh	
C	Avoiding "unserved energy"	… output from OCGTs > 0 MWh and (reserves of OCGTs and Pumped Hydro) < (wind and PV)	

Note: Only applicable in the short run to assess effect of wind/PV on the existing fleet. Not applicable to assess additional value of renewables in new-build scenarios; Sources: CSIR Energy Centre analysis

On an unconstrained day, wind and PV replace mainly coal fuel

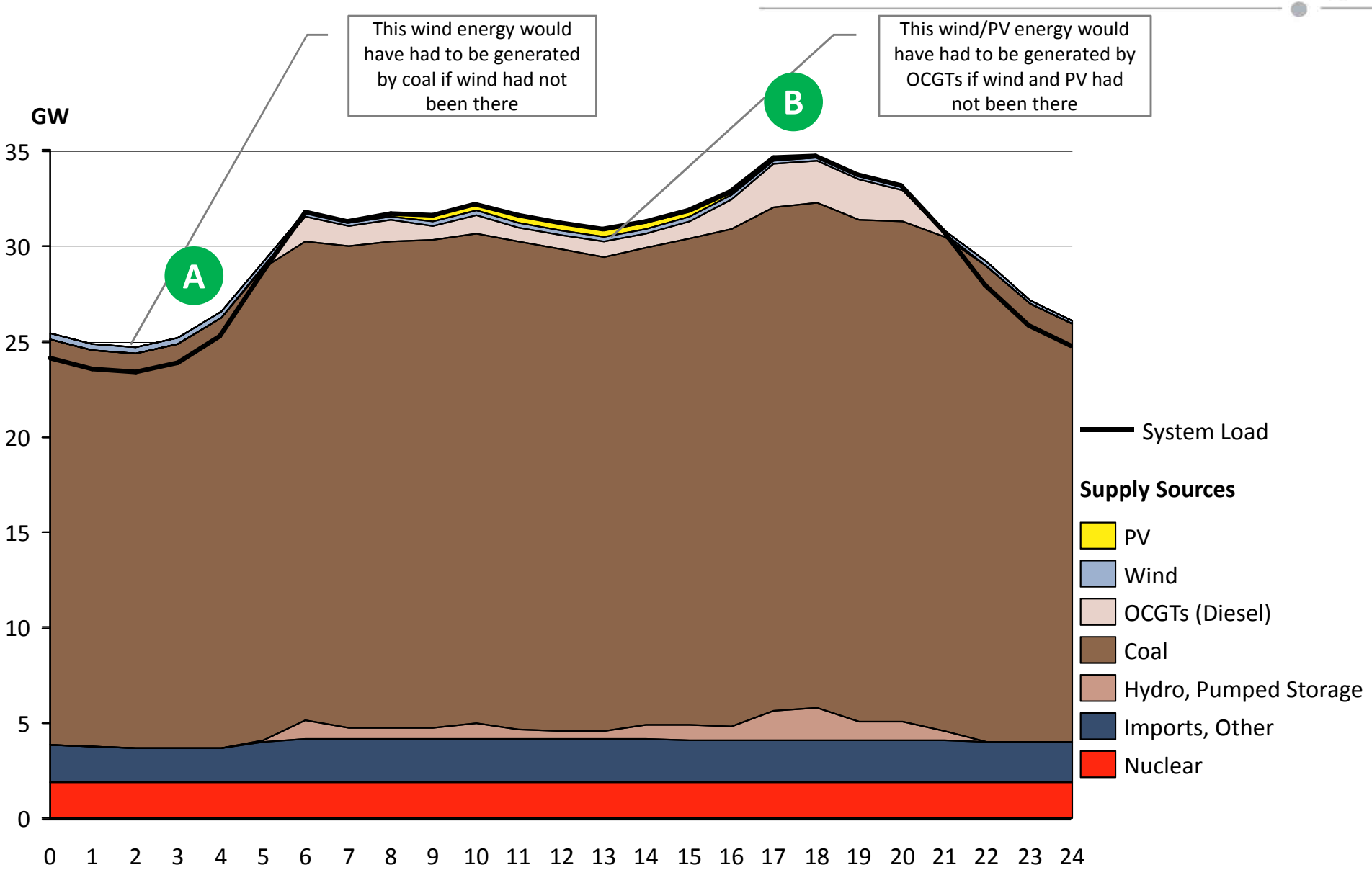
Actual South African supply structure for a spring day, the 17 October 2014



Sources: Eskom; CSIR Energy Centre analysis

On a constrained day, both wind and PV replace mainly diesel fuel

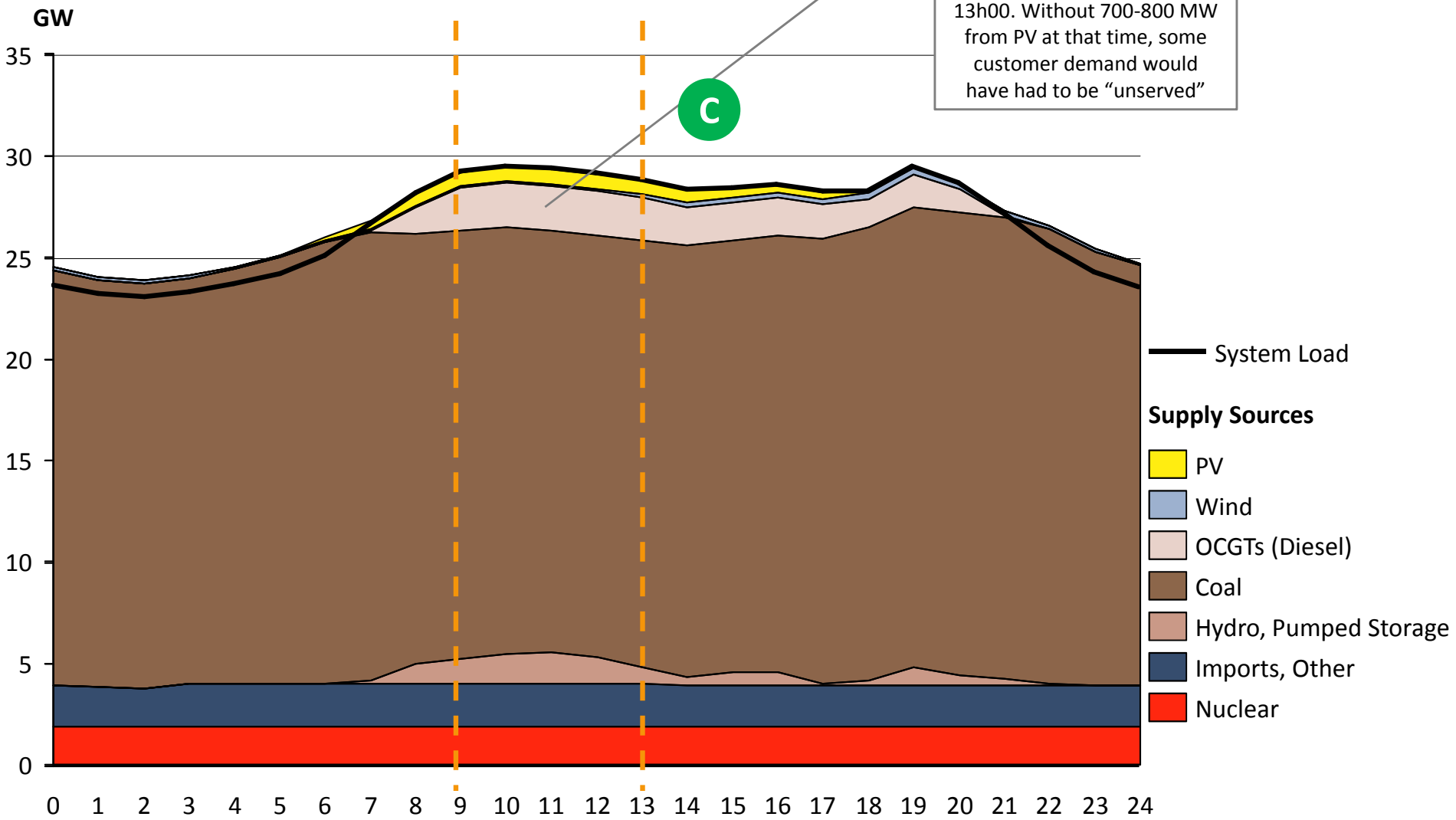
Actual South African supply structure for a winter day, the 19 June 2014



Sources: Eskom; CSIR Energy Centre analysis

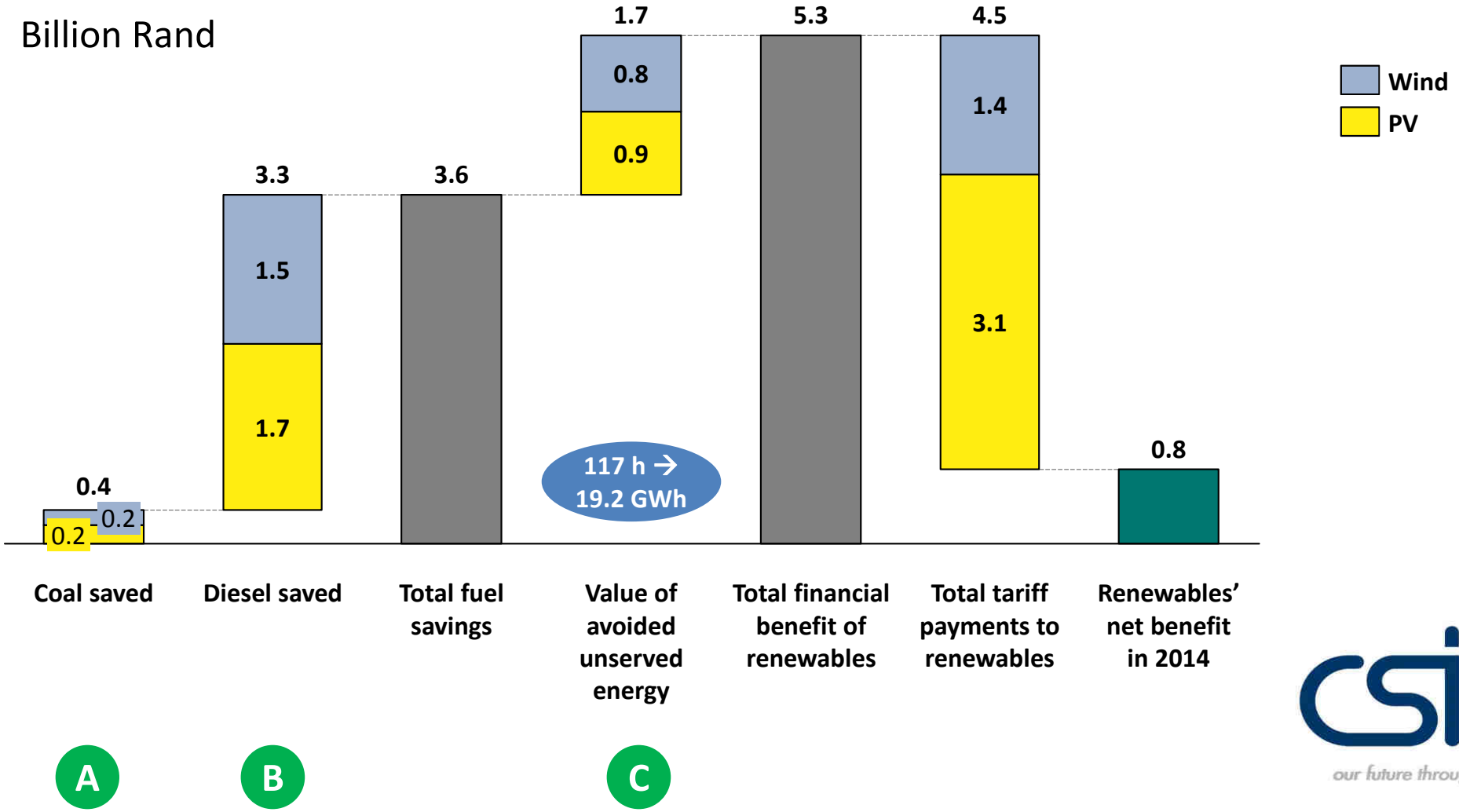
On that day, PV even prevented unserved energy between 9h00-13h00

Actual South African supply structure for a summer day, the 16 December 2014



Sources: Eskom; CSIR Energy Centre analysis

In summary:
Renewables in 2014 generated R0.8 billion net benefit to the economy



Sources: CSIR Energy Centre analysis

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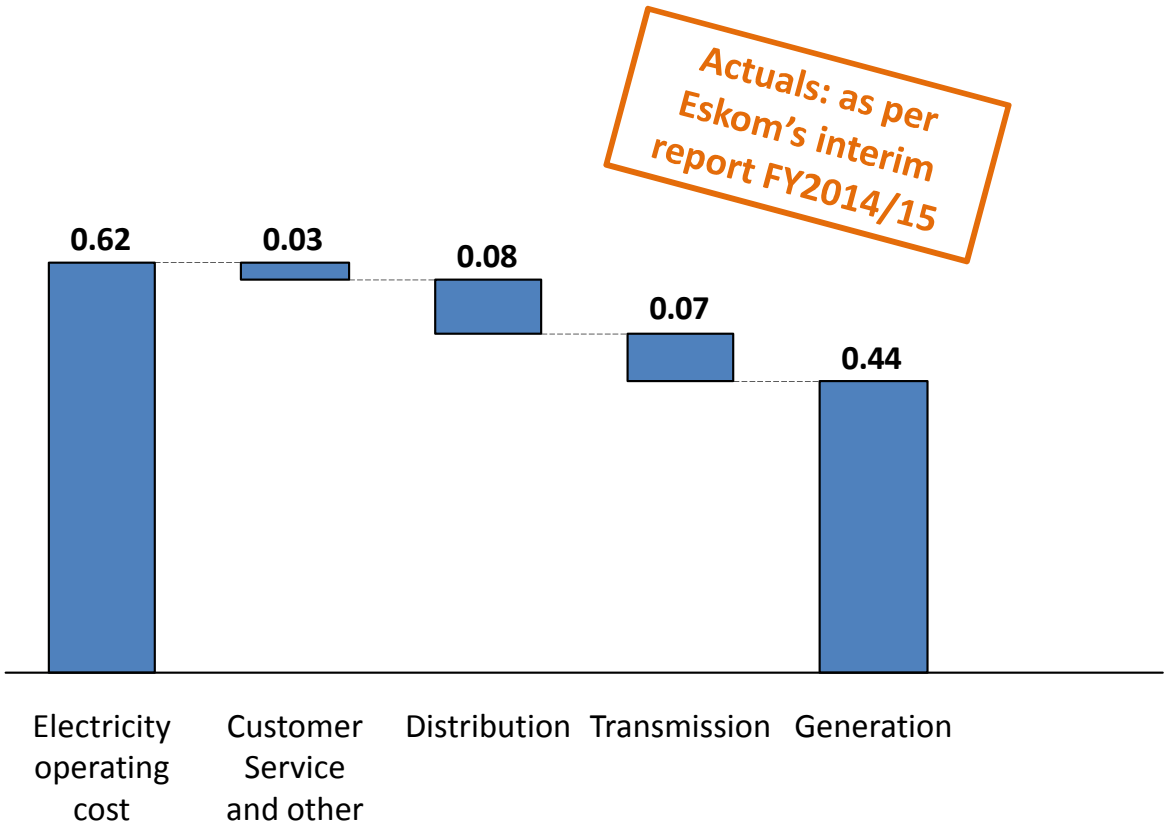
Electricity tariff and cost of new-builds

Specific Eskom considerations

Any new power generator is more costly than the current cost of generation and will therefore increase the average tariff

R/kWh



Total sales in reporting period (Apr-Sep 2014)

109 168 GWh

Sources: Eskom interim integrated report 2014; CSIR analysis

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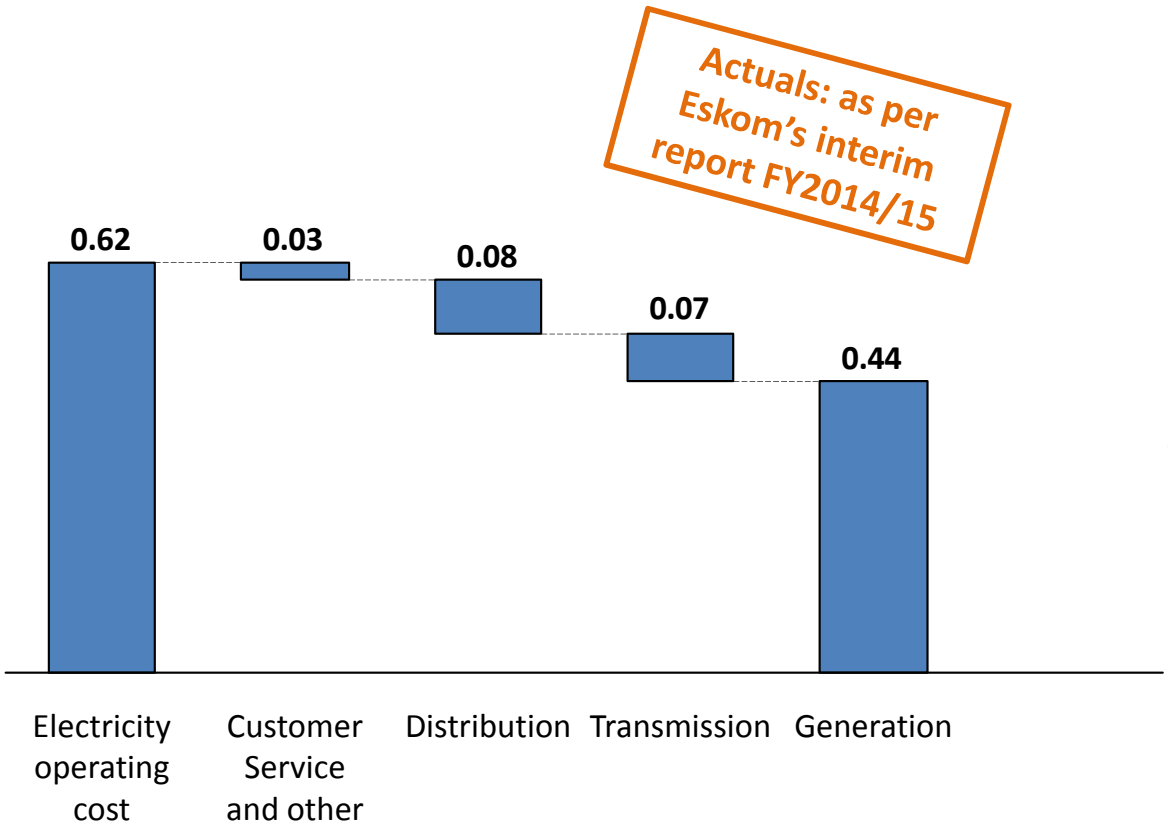

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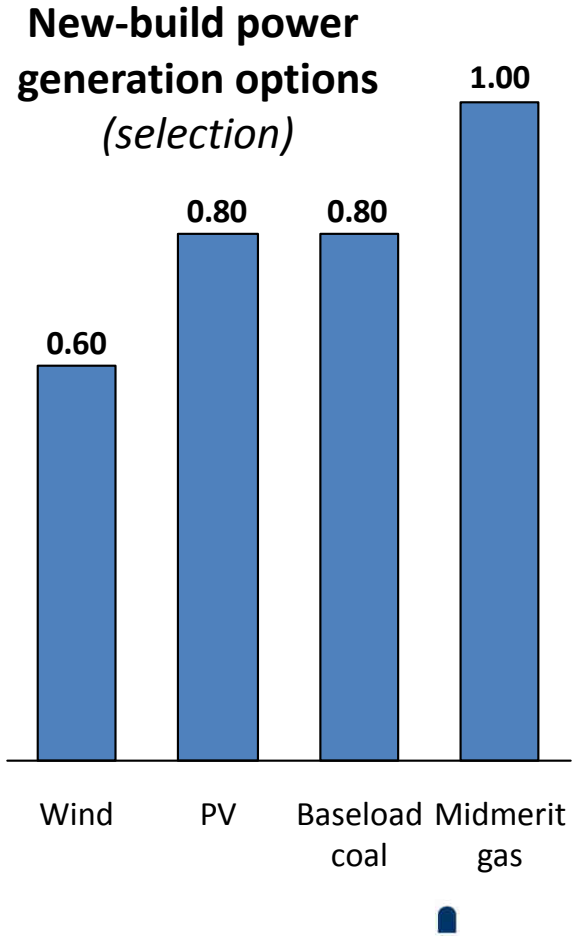

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Appropriations will release constrain on Eskom's liquidity position

New IPP purchases are not funded under MYPD3 yet

- Bid Windows 3.5 and 4 of renewables not funded yet under MYPD3
- Cogen, STPPP, extension to Bid Window 4 and additional 1 800 MWs from expedited programmes are also not funded under MYPD3

Although these costs are all approved and Eskom will be able to recover them in next MYPD rounds, they pose a challenge from a liquidity perspective

The proposed appropriations will release constrain in terms of liquidity from Eskom and will allow the tariff increase to be slower than otherwise necessary

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Balanced spending between new-build and grid is important

Compared to generation new-build, cost of transmission is small in absolute terms

Spending in transmission infrastructure however is a key enabler for

- Grid connections for IPPs
- Customer connections
- Overall security of the network

Without appropriate spending on the grid infrastructure, total costs of the power system will increase

As important as the new-build programme is, spending in grid infrastructure must not be de-prioritised

Otherwise the long-term effects will be

- Non-availability of inexpensive additional power in time (mainly wind power)
- Suppressed sales due to fewer / less loaded customer connections

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Thank you!