Is solar PV generated electricity cheap in South Africa?

Presentation at the 2015 South African Institute of Physics Annual Conference

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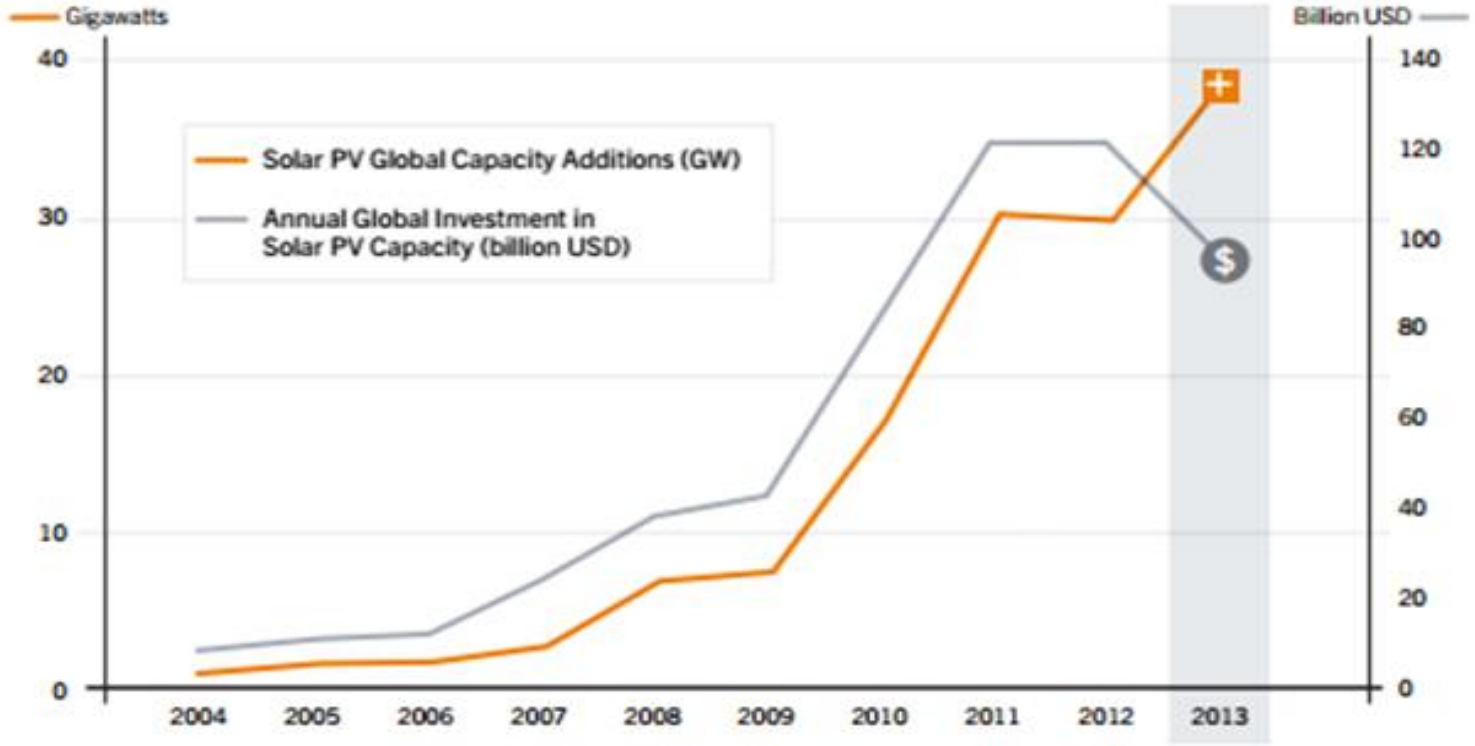
22 % decrease in investment in 2013, despite record capacity additions of more than 32 %

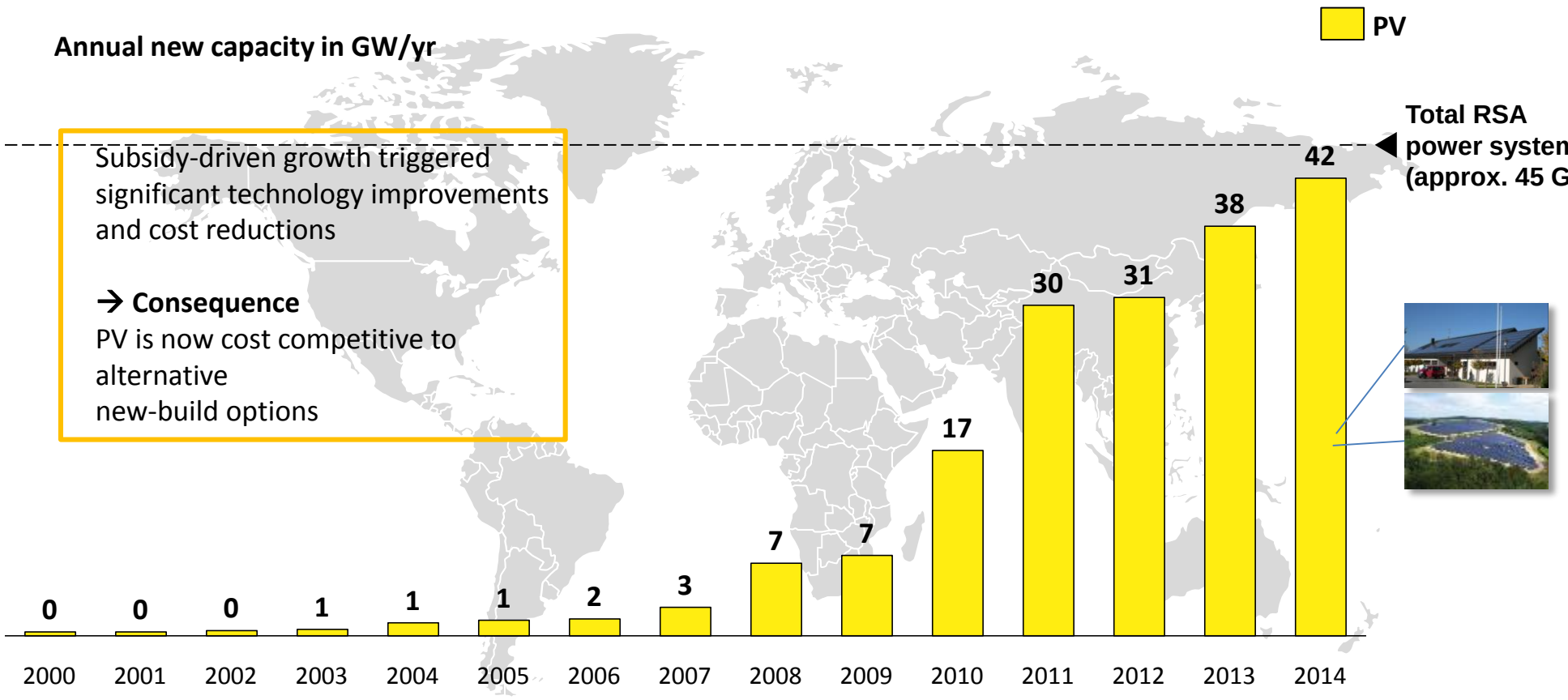
Solar PV Global Capacity Additions & Investment, 2004-2013



Main reason: Module prices are getting lower!

Sources: REN21 Global Status Report 2014

In 2014, 42 GW of PV were newly installed globally

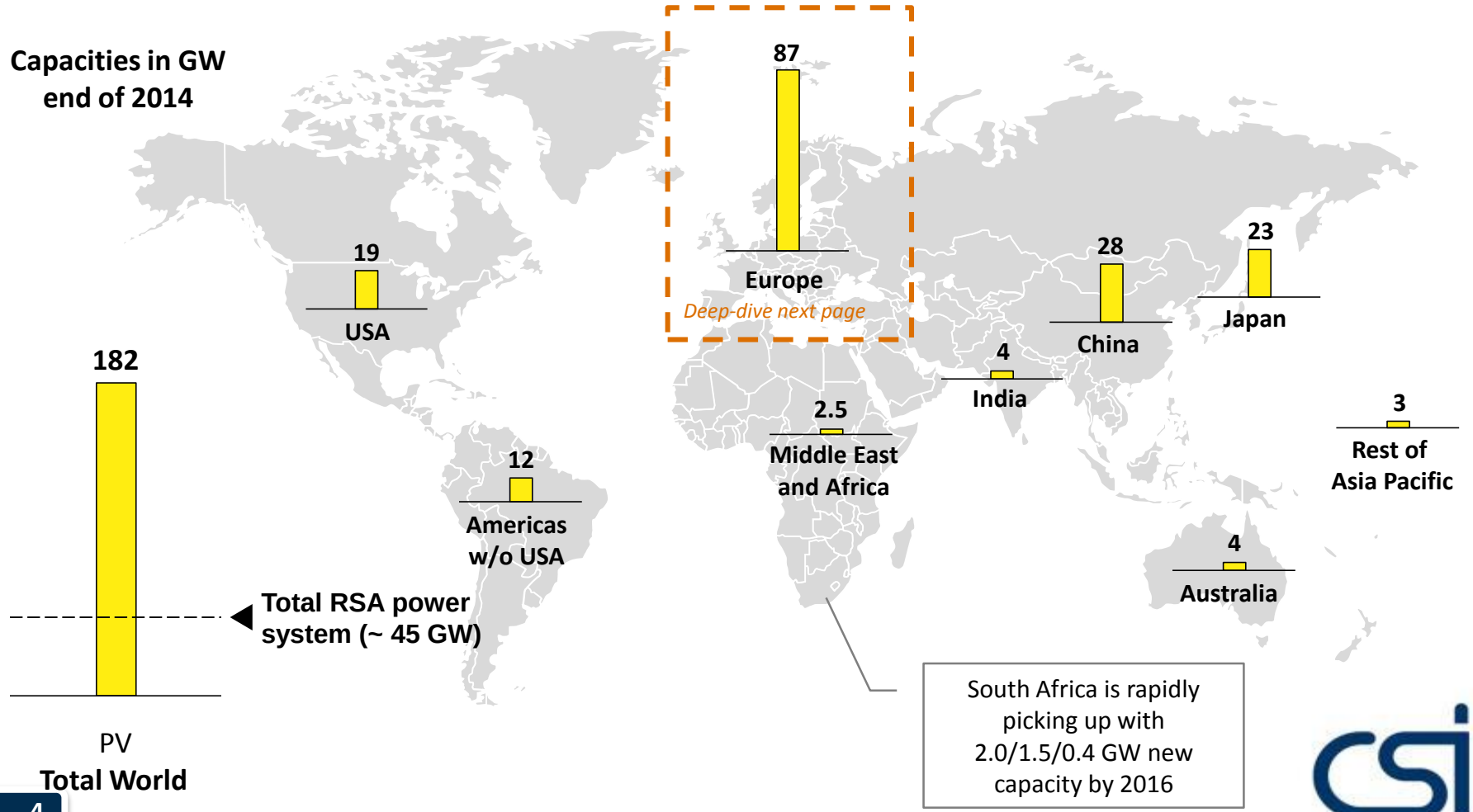


This is all very new: Almost 90% of the globally existing PV capacity was installed during the last five years alone!

Sources: International Energy Outlook of the EIA; SPE; CSIR analysis

PV until today mainly driven by Europe, China, Japan and US

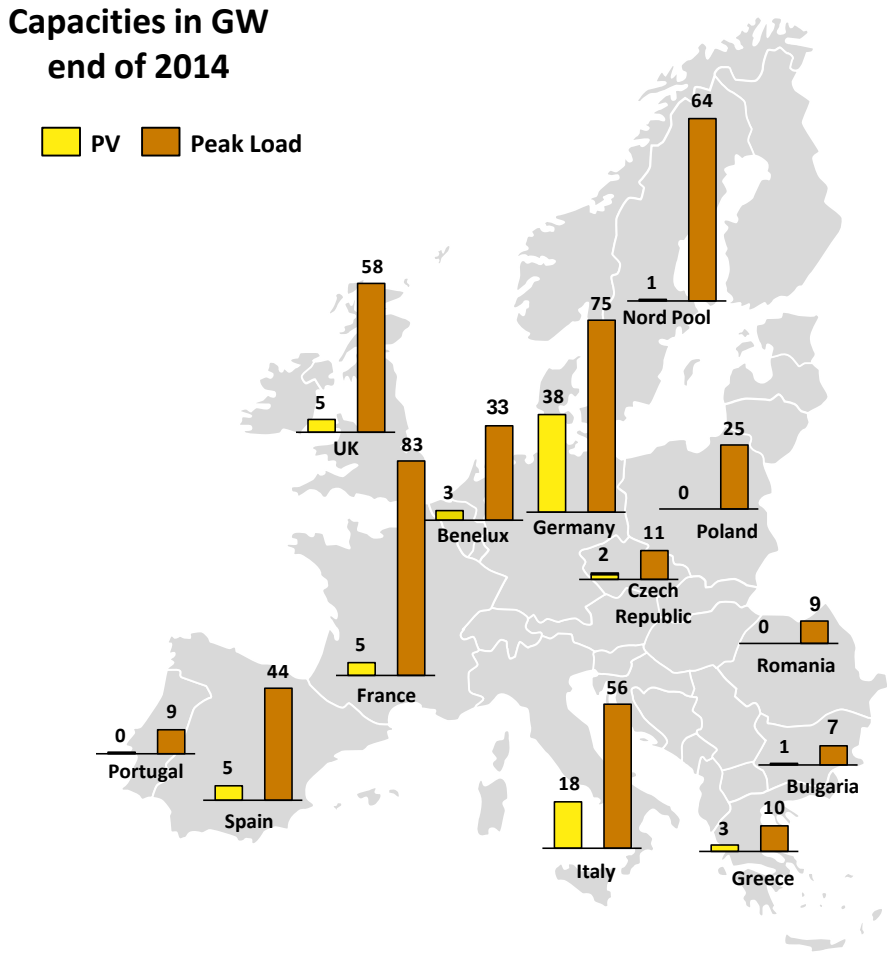
Globally installed capacities for PV end of 2014

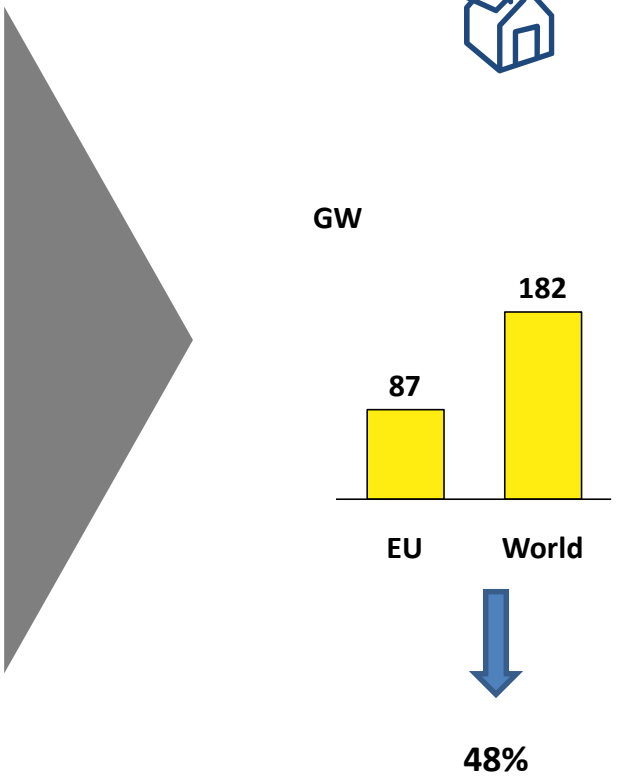


South Africa is rapidly picking up with 2.0/1.5/0.4 GW new capacity by 2016

Sources: SPE; CSIR analysis

End 2014, Europe hosted ~ half of total PV capacities – penetration levels vary widely, very high in some countries





Sources: RED, National Grid, Terna Rete Italia, Nord Pool, EWEA, EPIA, CEER, GWEC, CSIR analysis

China led PV market in 2014, Germany with the largest installed base

Top 10 countries in 2014: total capacity and newly added capacity

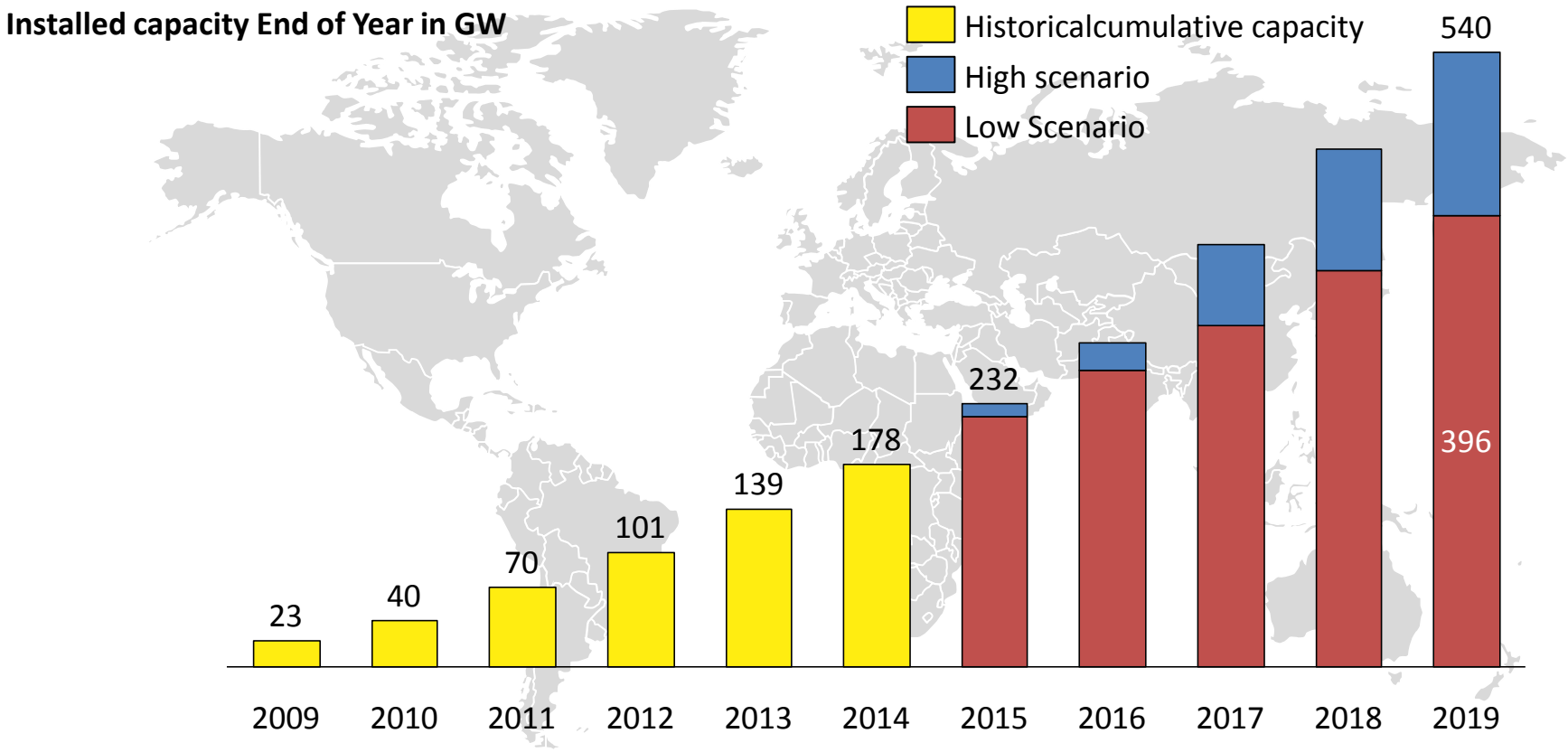
Capacities in MW
end of 2014

Total Capacity		
1.	Germany	38,200
2.	China	28,199
3.	Japan	23,300
4.	Italy	18,460
5.	United States	18,280
6.	France	5,660
7.	Spain	5,358
8.	UK	5,104
9.	Australia	4,136
10.	Belgium	3,074

Added Capacity		
1.	China	10,560
2.	Japan	9,700
3.	United States	6,201
4.	UK	2,273
5.	Germany	1,900
6.	France	927
7.	Australia	910
8.	South Korea	909
9.	South Africa	800
10.	India	616

Source: IEA PVPS

Projection: By 2019, the installed capacity of PV could be tripled



A promising future!

Sources: Solar Power Europe, CSIR analysis

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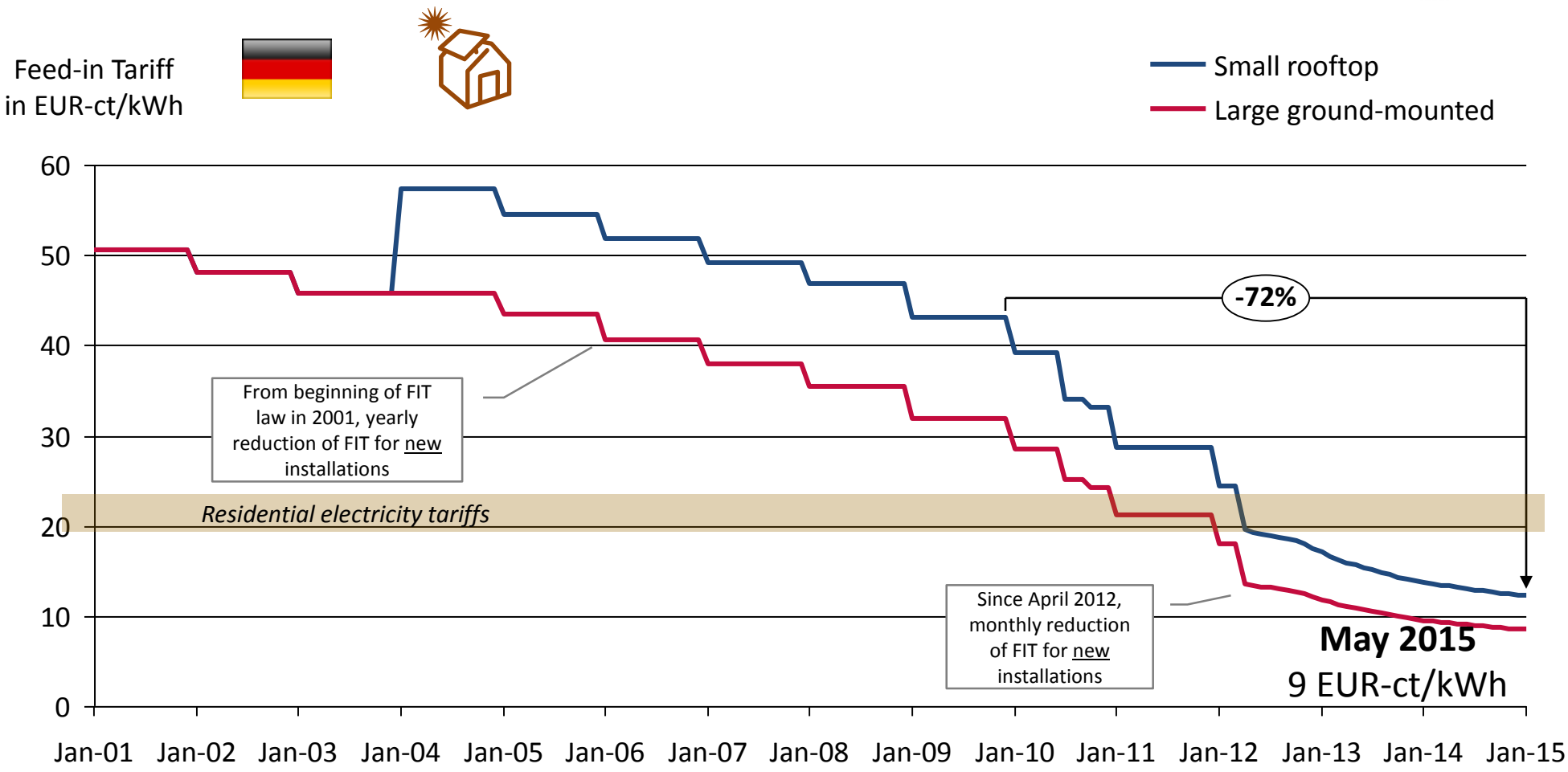
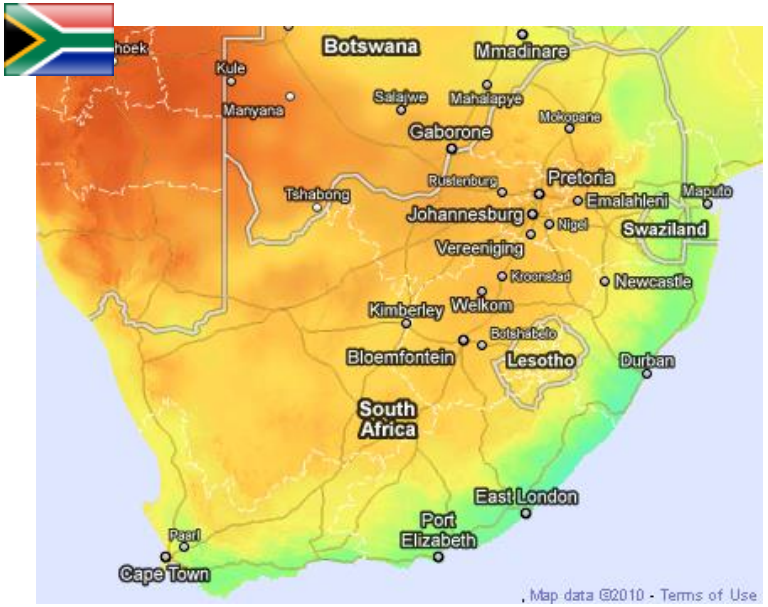
Feed-in Tariff in Germany tracks underlying cost of PV: Tariff was reduced by more than 70% in only five years from 2010-2015



Sources: German Federal Grid Agency (Bundesnetzagentur), http://www.bundesnetzagentur.de/cln_1431/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/ErneuerbareEnergien/ZahlenDatenInformationen/zahlenunddaten-node.html; CPI by the German Federal Statistics Agency, https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Preise/Verbraucherpreisindizes/Tabellen_/VerbraucherpreiseKategorien.html;jsessionid=F0DAC6D2F53F09E4E7590BC231592E0B.cae2; Bischof-Niemz analysis

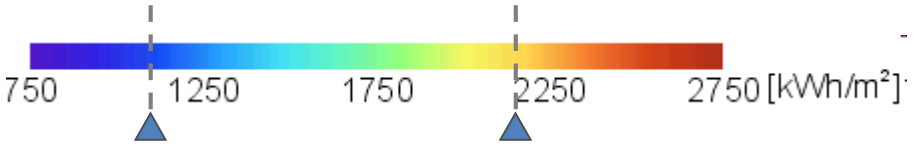
Very high solar irradiation in South Africa is a competitive advantage

Solar irradiation in South Africa ...



... as compared to Germany, where solar PV is now close to cost competitiveness with new coal and gas

Yearly total of global irradiation on horizontal surface



Average for Germany

Average for South Africa (2x)

Source: Joint Research Center of the European Commission, PVGIS, BCG analysis

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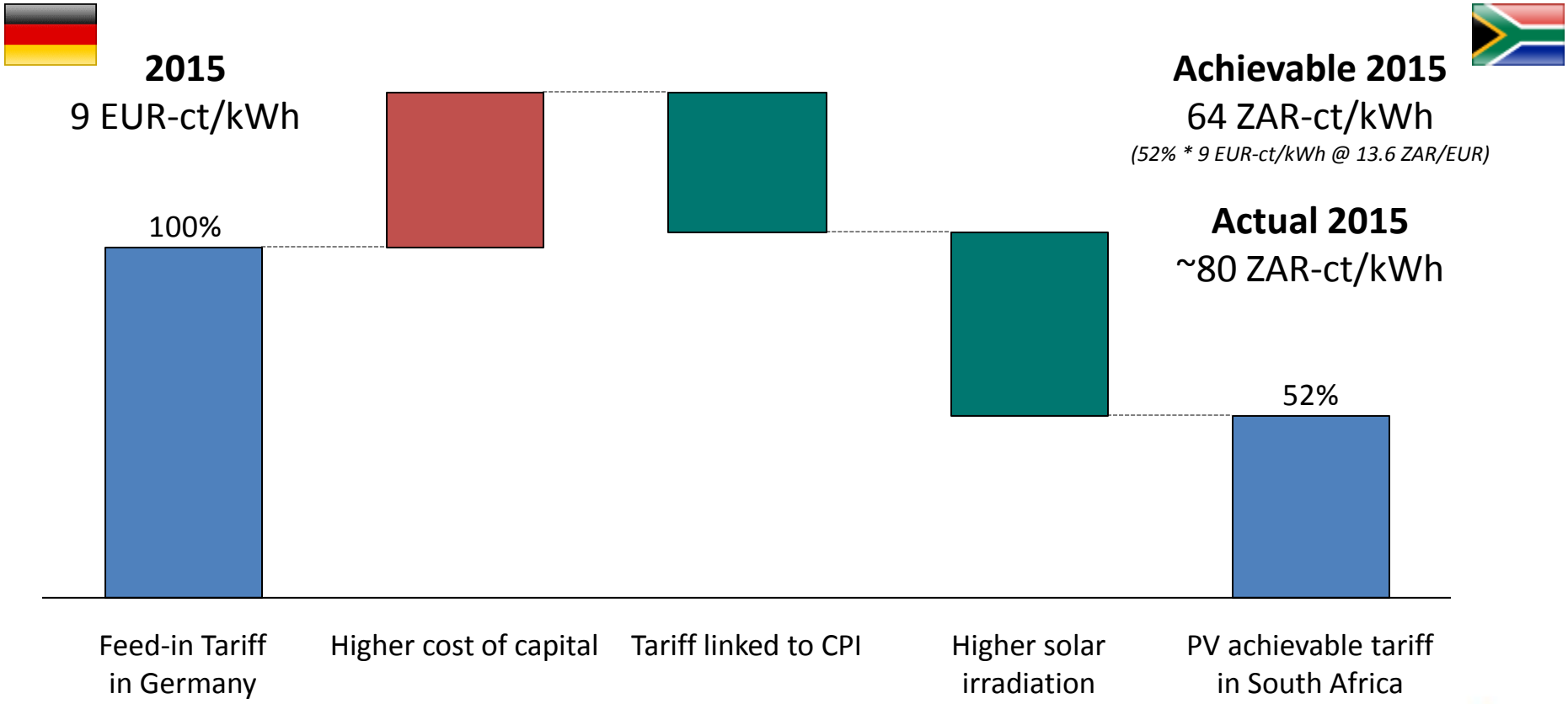
More sun makes PV in RSA almost 50% cheaper than in Germany



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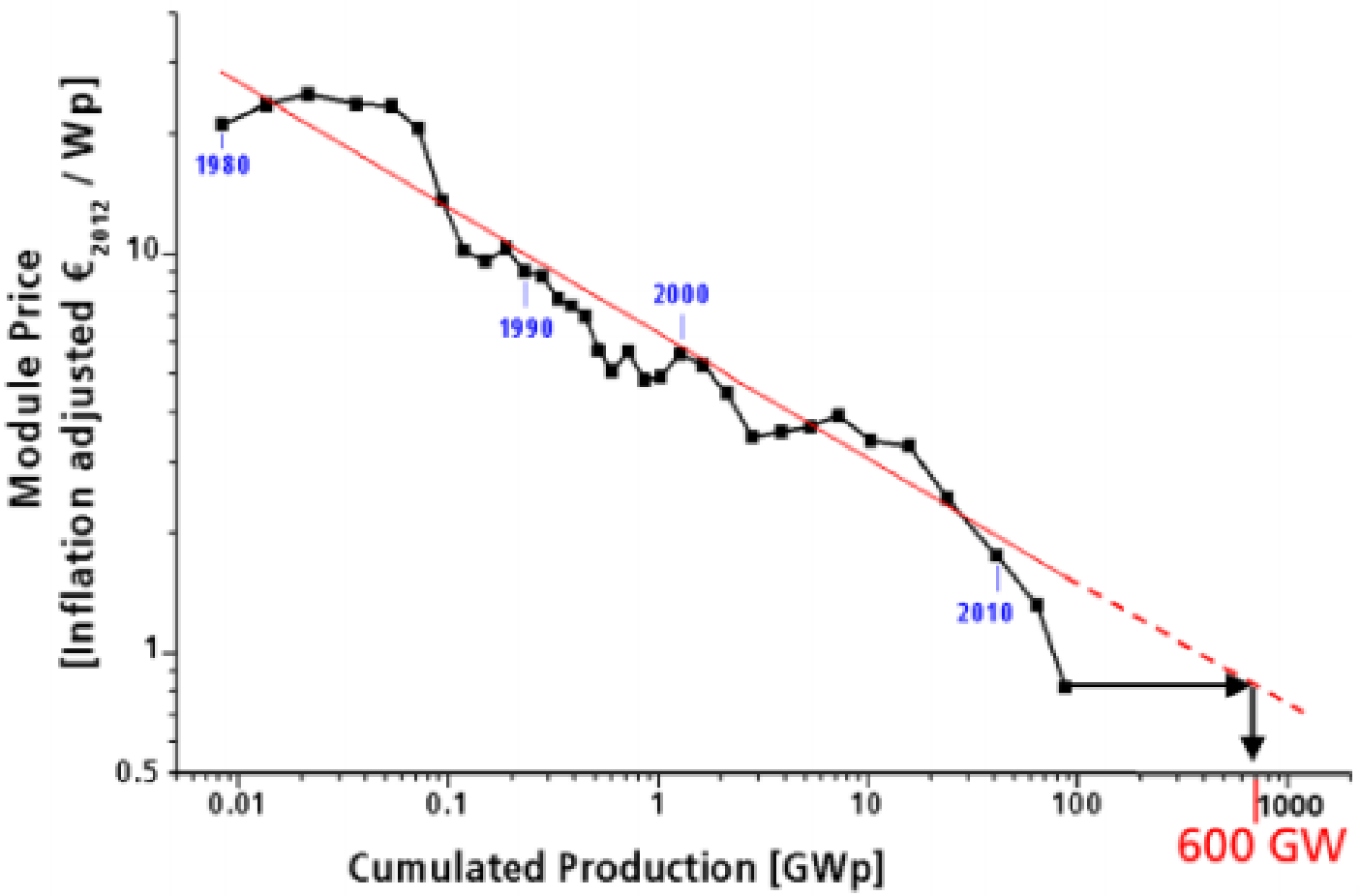
Dramatically falling cost of PV changed the competitive landscape



The long term experience curve:
Volume + 100 % → Price -20 %

Source: Navigant / PSE 2013

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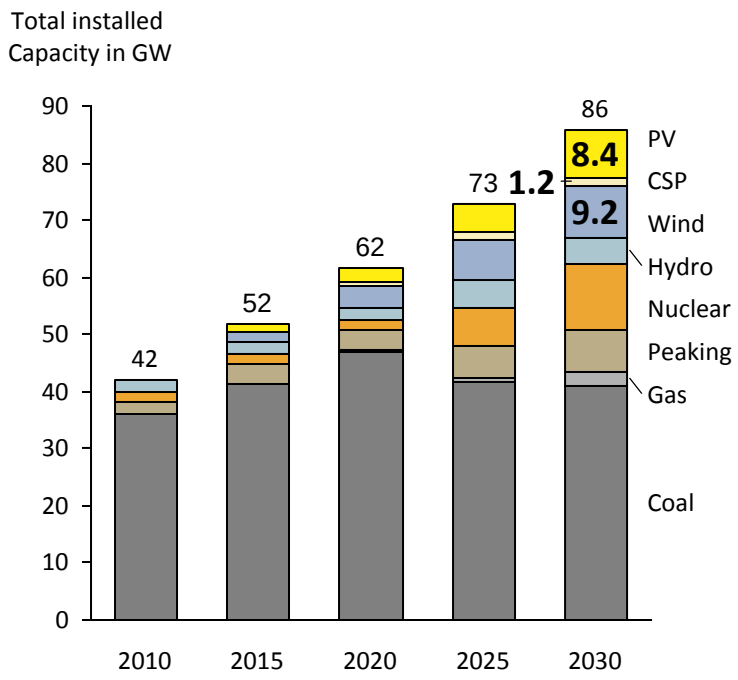
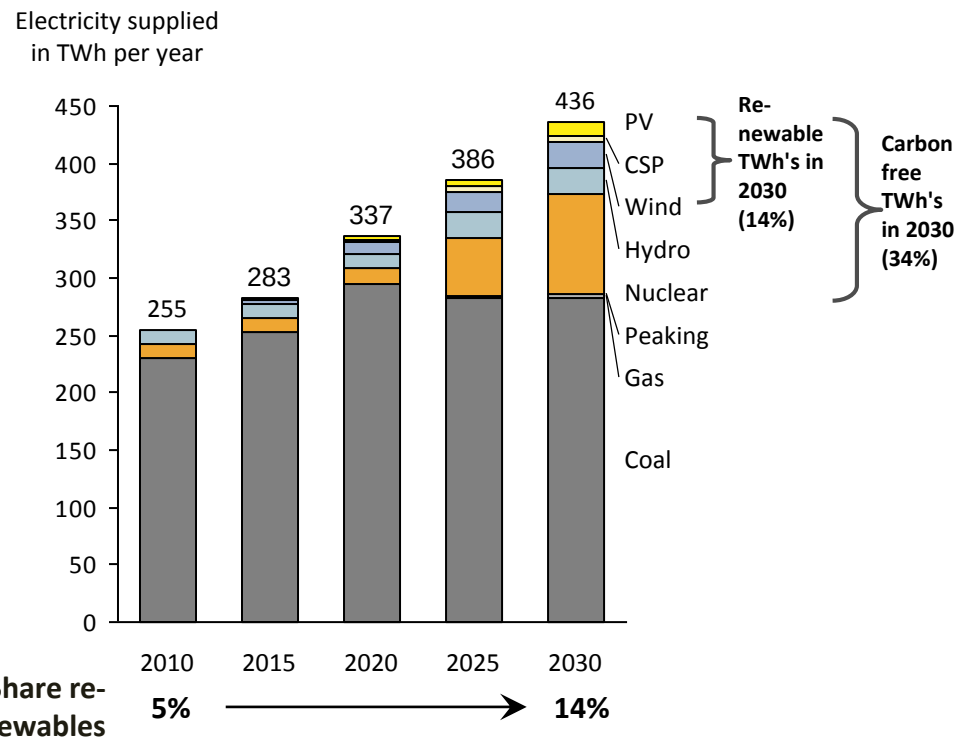
Integrated Resource Plan 2010 (IRP 2010, promulgated version) plans capacity expansion for South Africa until 2030

Installed capacity in GW



Energy mix in TWh



Implementation of the IRP is done by Department of Energy through competitive tenders ("REIPPPP" for renewables)

Source: Integrated Resource Plan 2010, as promulgated in 2011; CSIR analysis

Two PV markets in South Africa

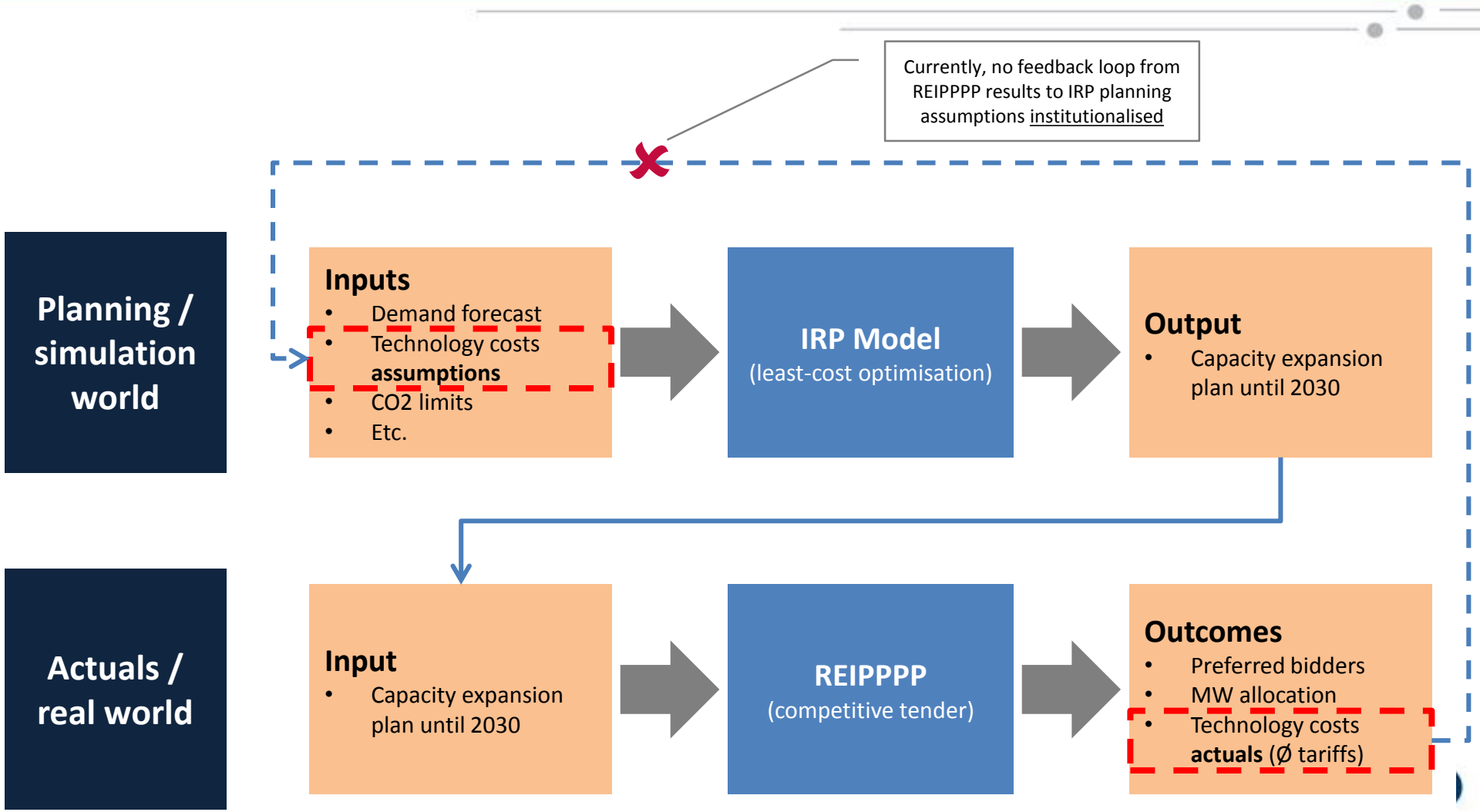
1: Department of Energy's competitive tender space (REIPPPP) → large projects

2: Self-generation, embedded generators → small projects

IRP does not specifically plan for embedded PV, but mentions it as a mean to achieve the planned capacity

Source: CSIR analysis

In-principle process of IRP planning and implementation



Sources: CSIR analysis

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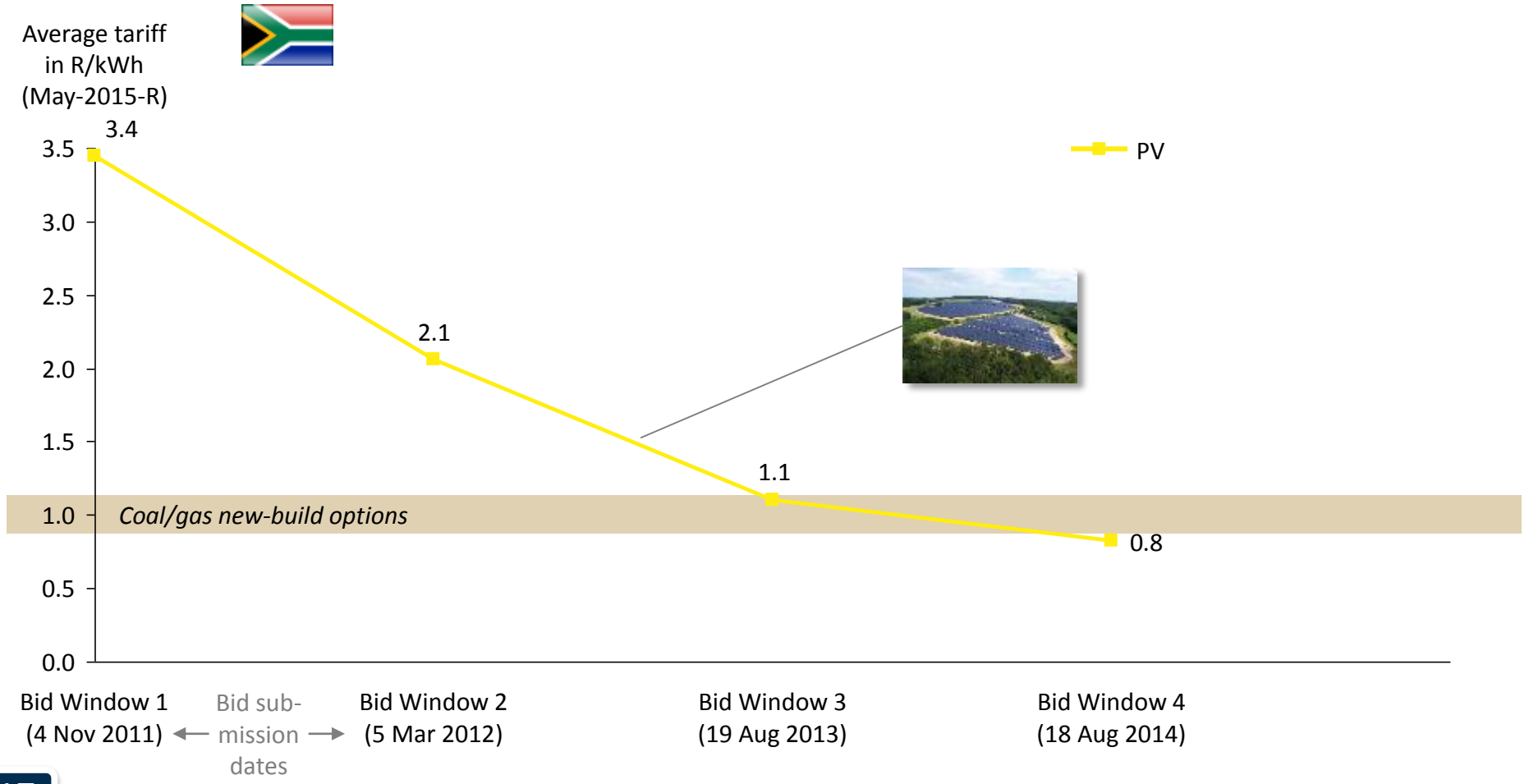
Actual results: PV and wind in South Africa are cost competitive today

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

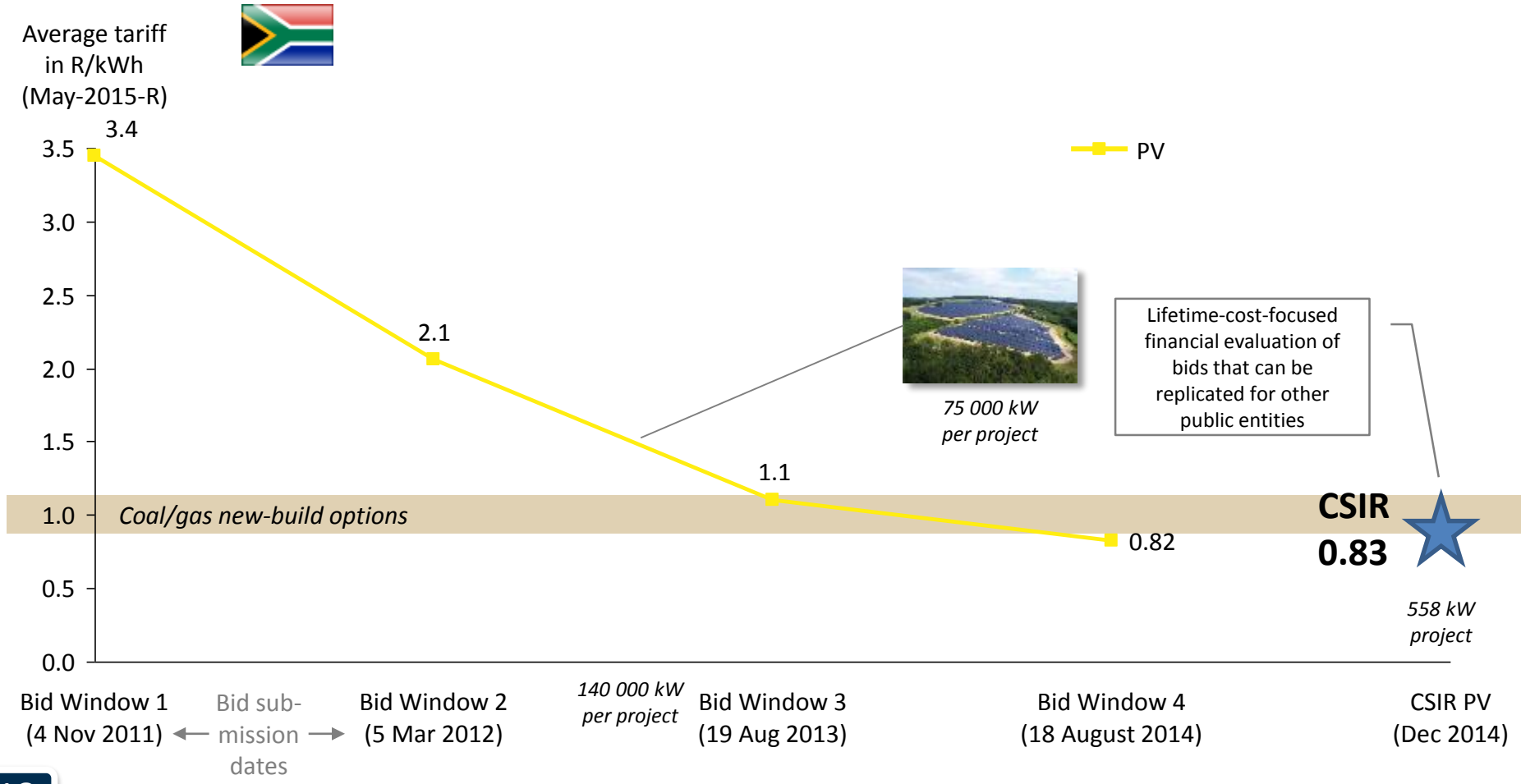


Note: For CSP Bid Window 3, the weighted average of base and peak tariff is indicated, assuming 50% annual load factor

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

PV makes sense across South Africa: CSIR's first 560 kW PV system in Pretoria can compete with 75 000 kW PV systems in the Northern Cape

Four bid windows' results of Department of Energy's IPP Procurement Programme and CSIR's first own PV



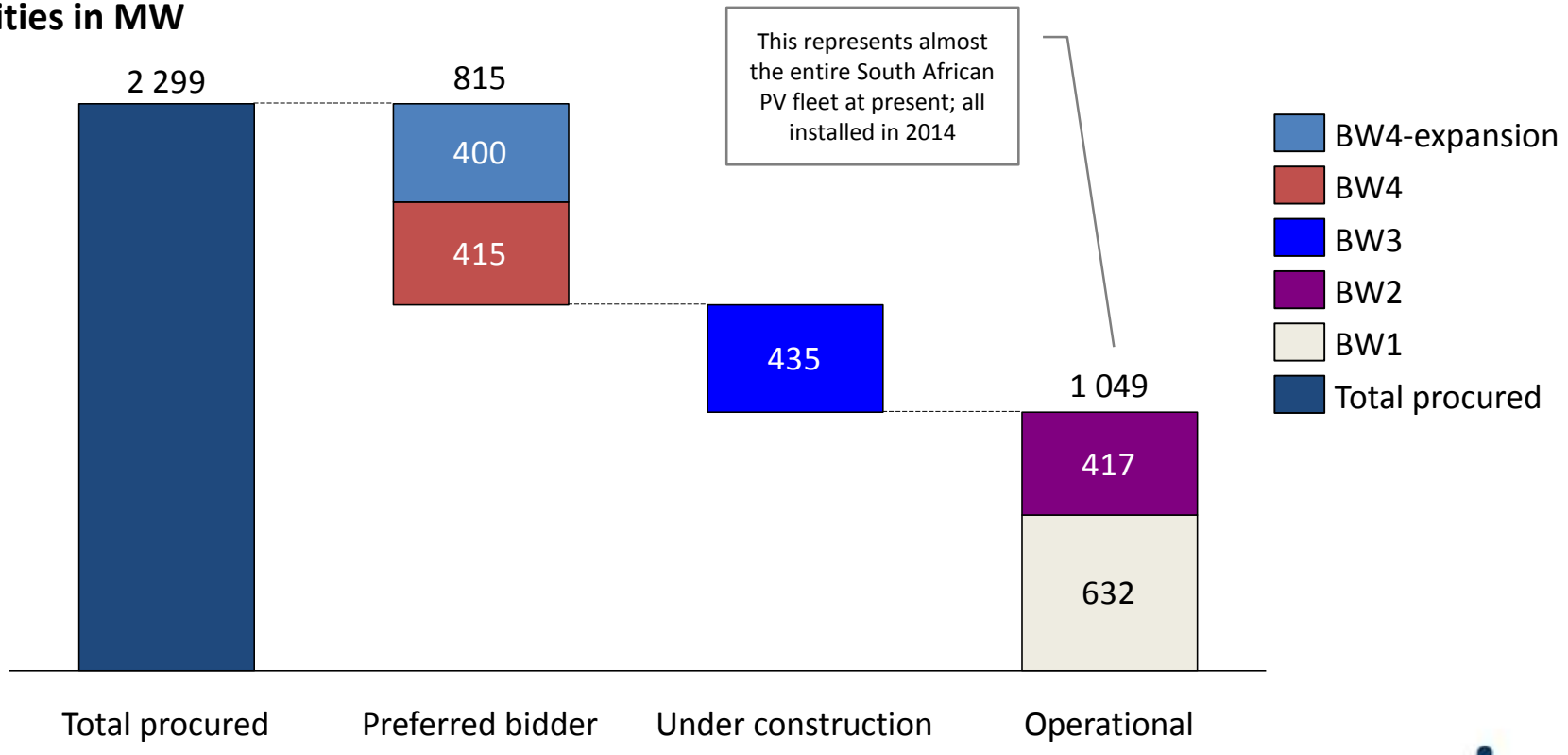
Notes: For CSP Bid Window 3, the weighted average of base and peak tariff is indicated, assuming 50% annual load factor

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

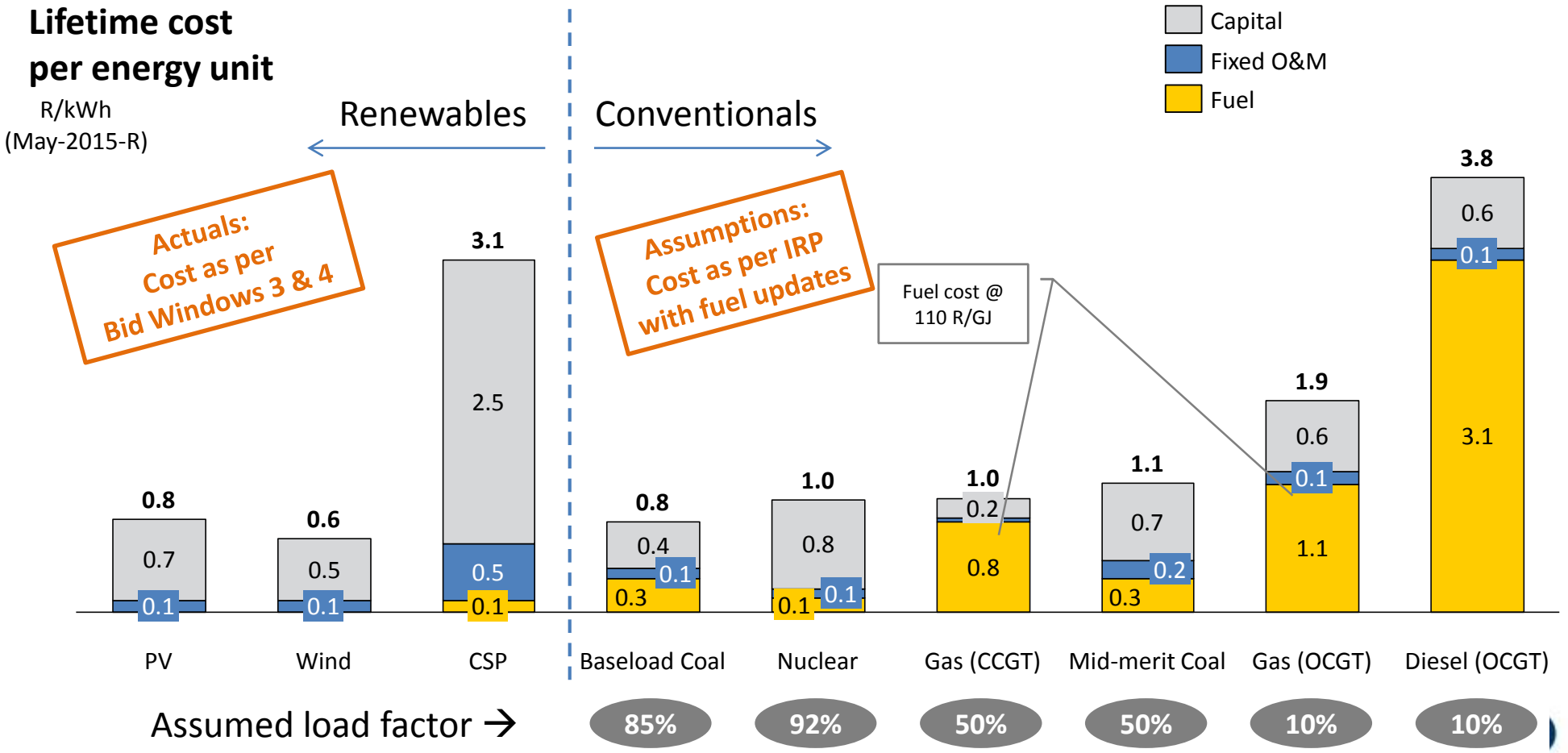
At present, more than 1 000 MW of PV are operational in South Africa

Pipeline of PV projects in the REIPPPP for large, utility-scale PV

PV capacities in MW



Consequence of cost reduction:
PV is cost-efficient fuel-savers for CCGTs already today



Note: 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);
Assumptions: average efficiency for CCGT = 50%, OCGT = 35%; coal = 37%; nuclear = 33%; IRP cost from Jan 2012 escalated with CPI to May 2015; assumed EPC CAPEX inflated by 10% to convert EPC/LCOE into tariff; CSP: 50% annual load factor and full utilisation of the five peak-tariff hours per day assumed to calculate weighted average tariff from base and peak tariff
Sources: IRP Update; REIPPPP outcomes; StatsSA for CPI; Eskom financial reports on coal/diesel fuel cost; CSIR analysis

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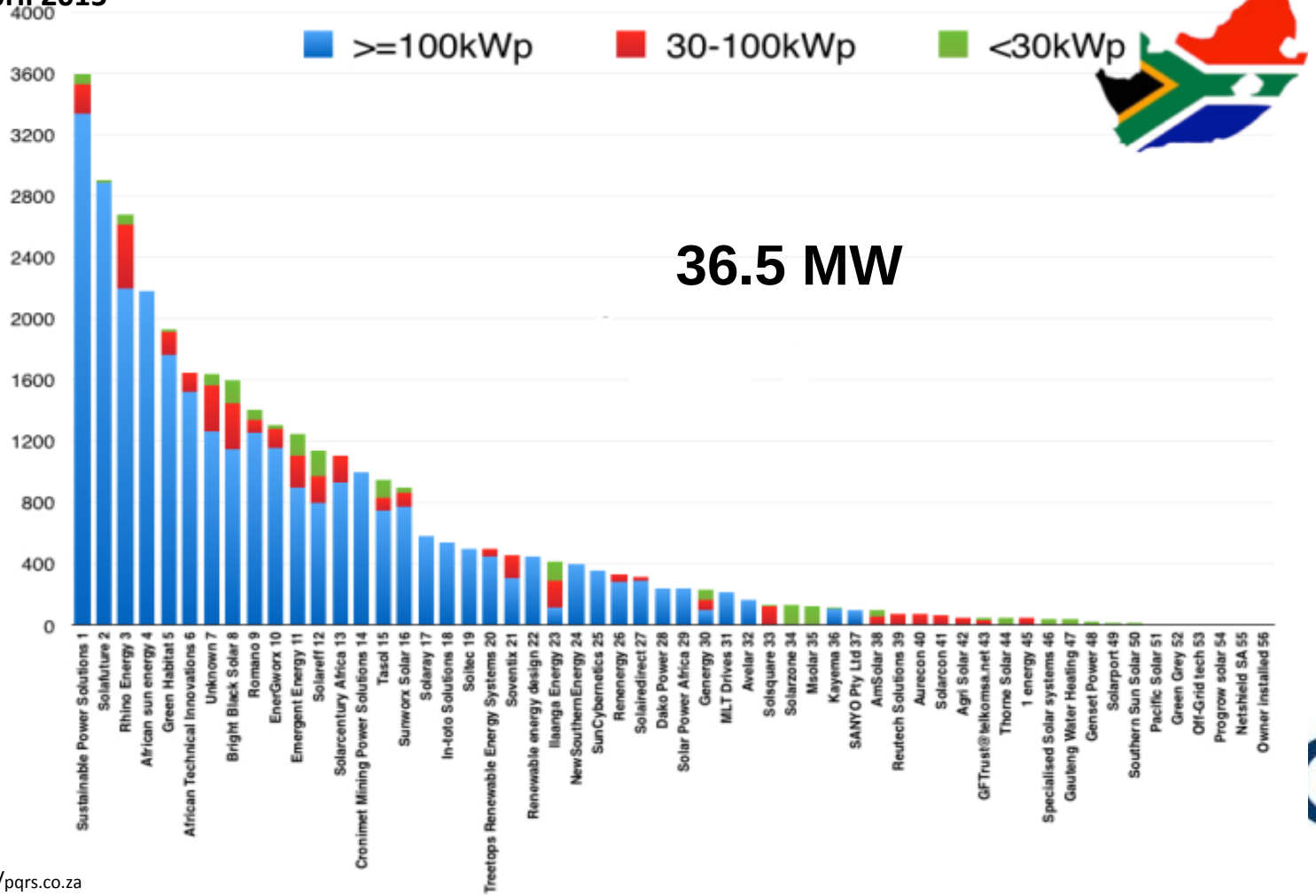
The development of small scale projects is impressive

The most extensive list of privately owned installed and commissioned PV systems in SA

Capacities in MW up to April 2015



36.5 MW

Source: http://pqrs.co.za

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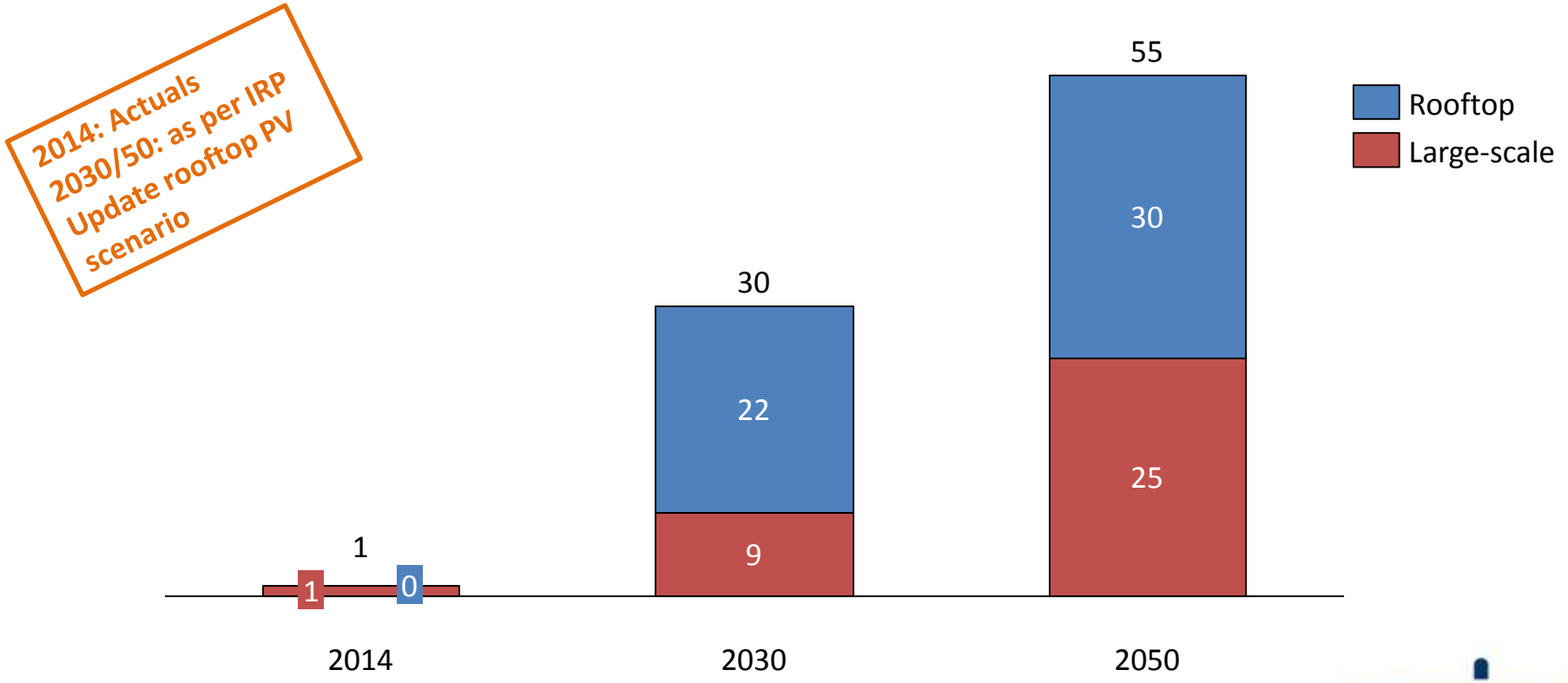
It is expected that Rooftop PV will grow significantly in South Africa

PV capacities end of year in GW



Source: Integrated resource plan for electricity (IRP) 2010-2030, update report

Thank you

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