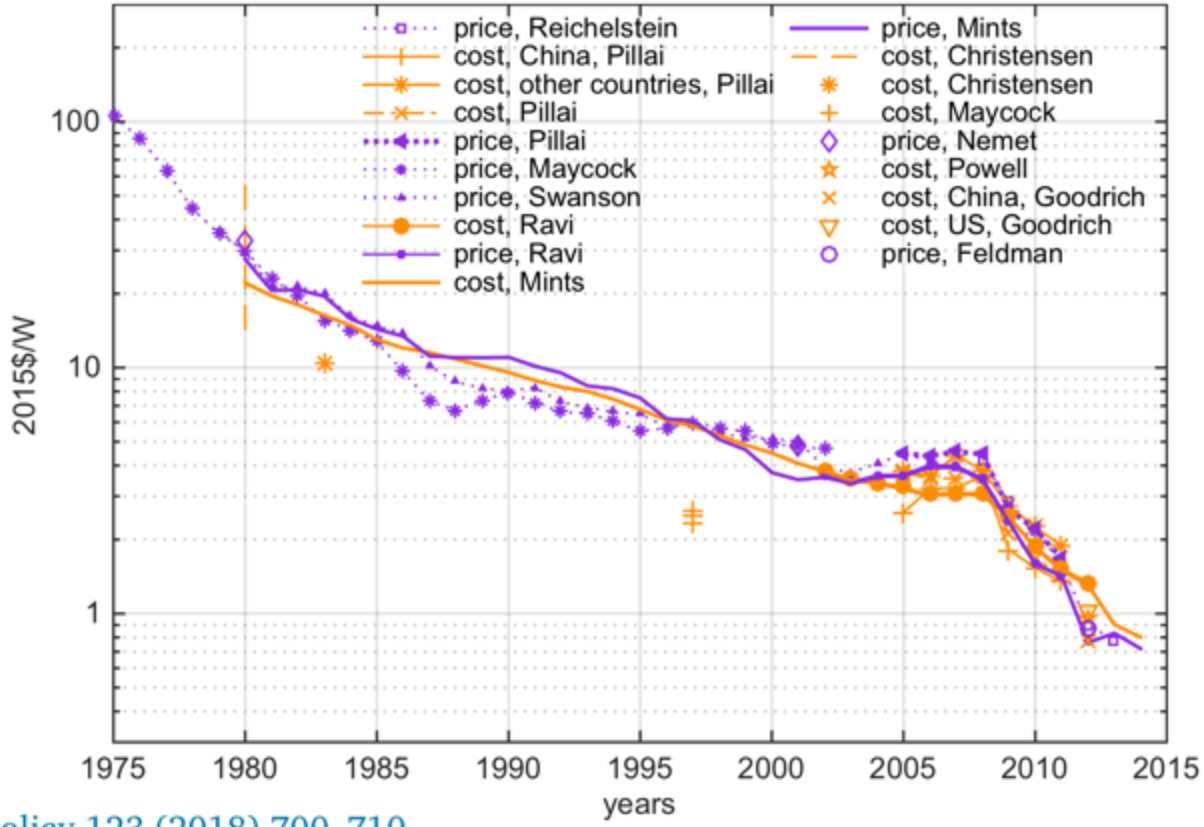
How Cheap Can Solar Photovoltaics Become?

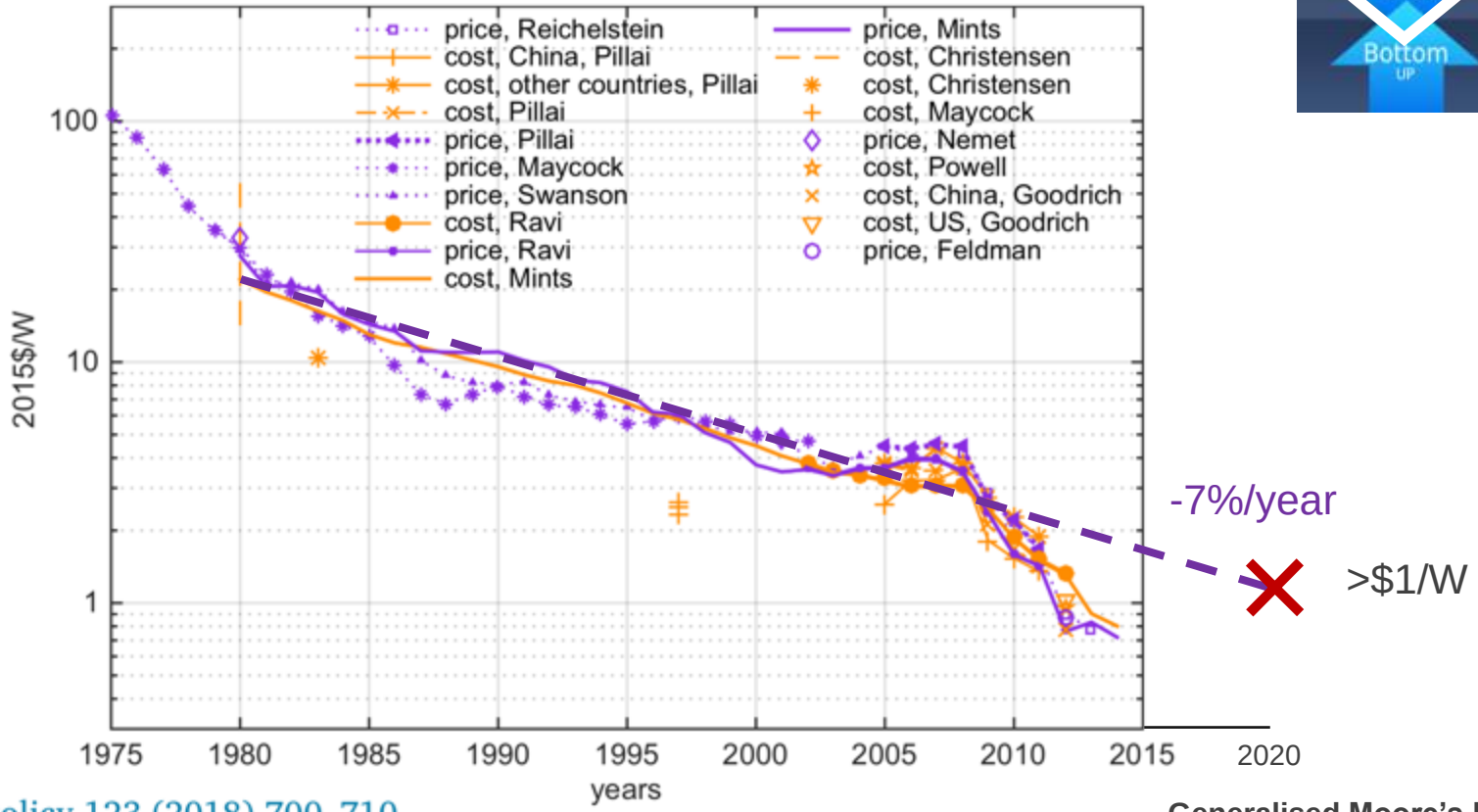
Martin Green, UNSW Sydney

History of PV cost/price reduction



Energy Policy 123 (2018) 700–710

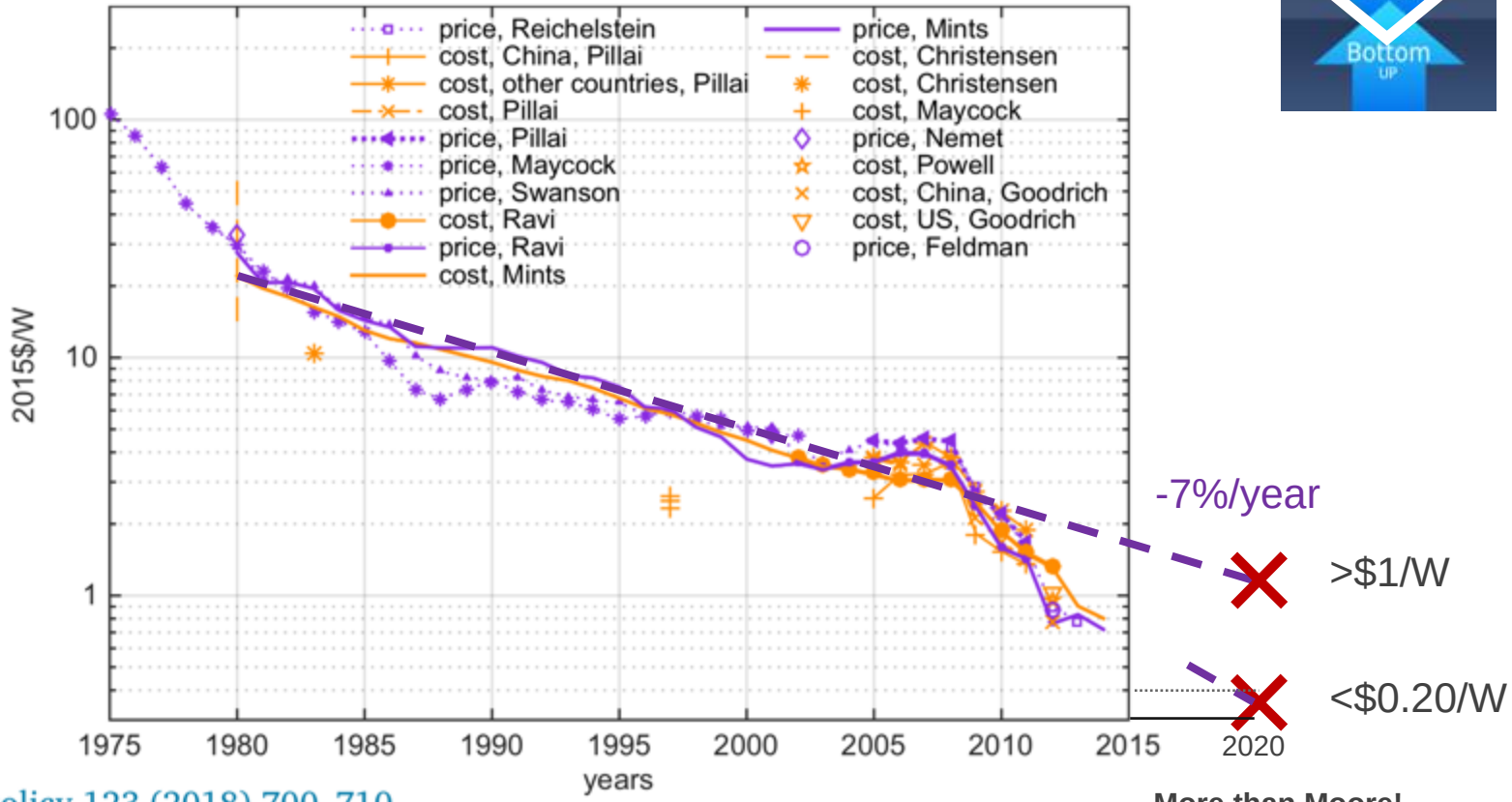
History of PV cost/price reduction



Energy Policy 123 (2018) 700–710

Generalised Moore's law

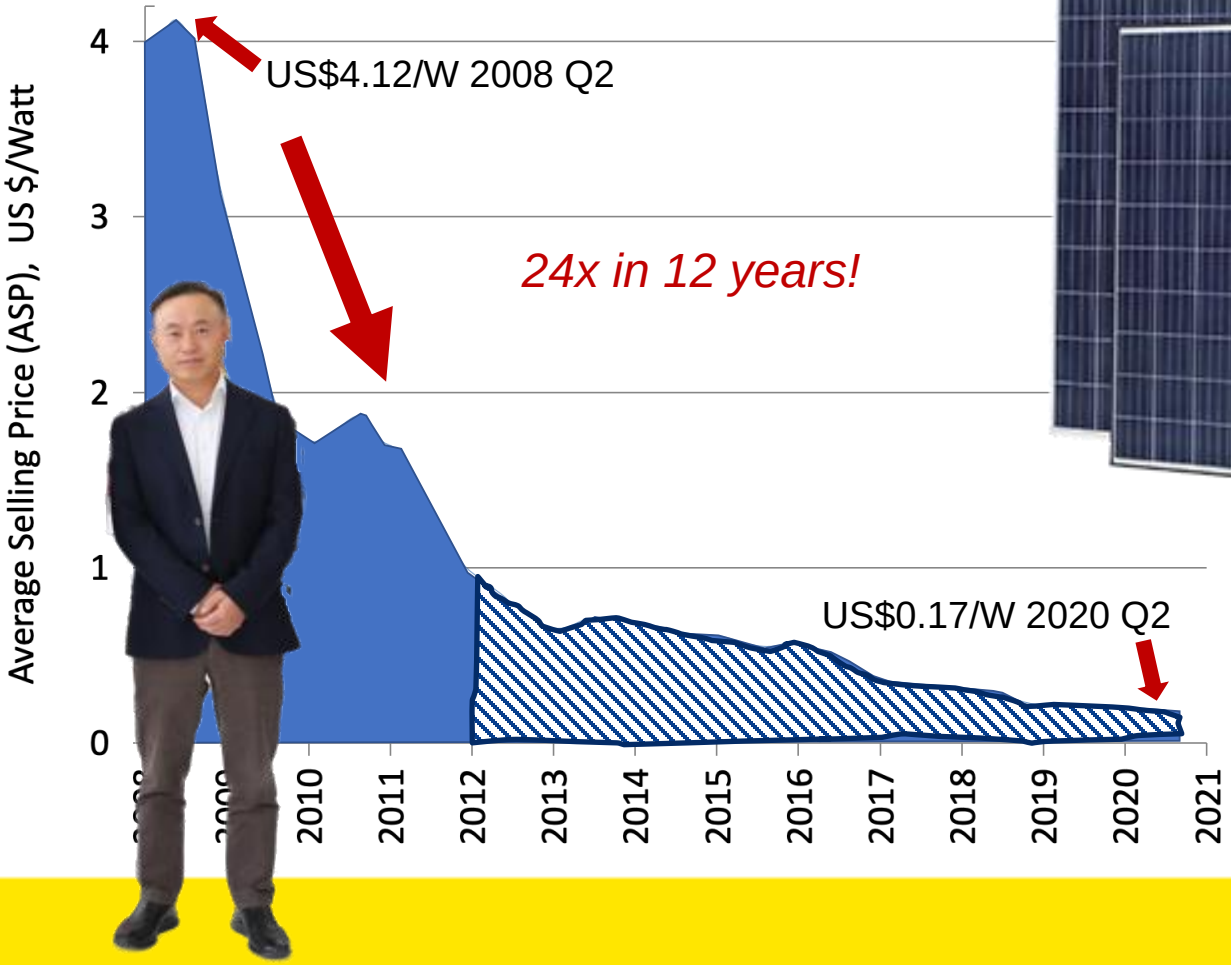
History of PV cost/price reduction



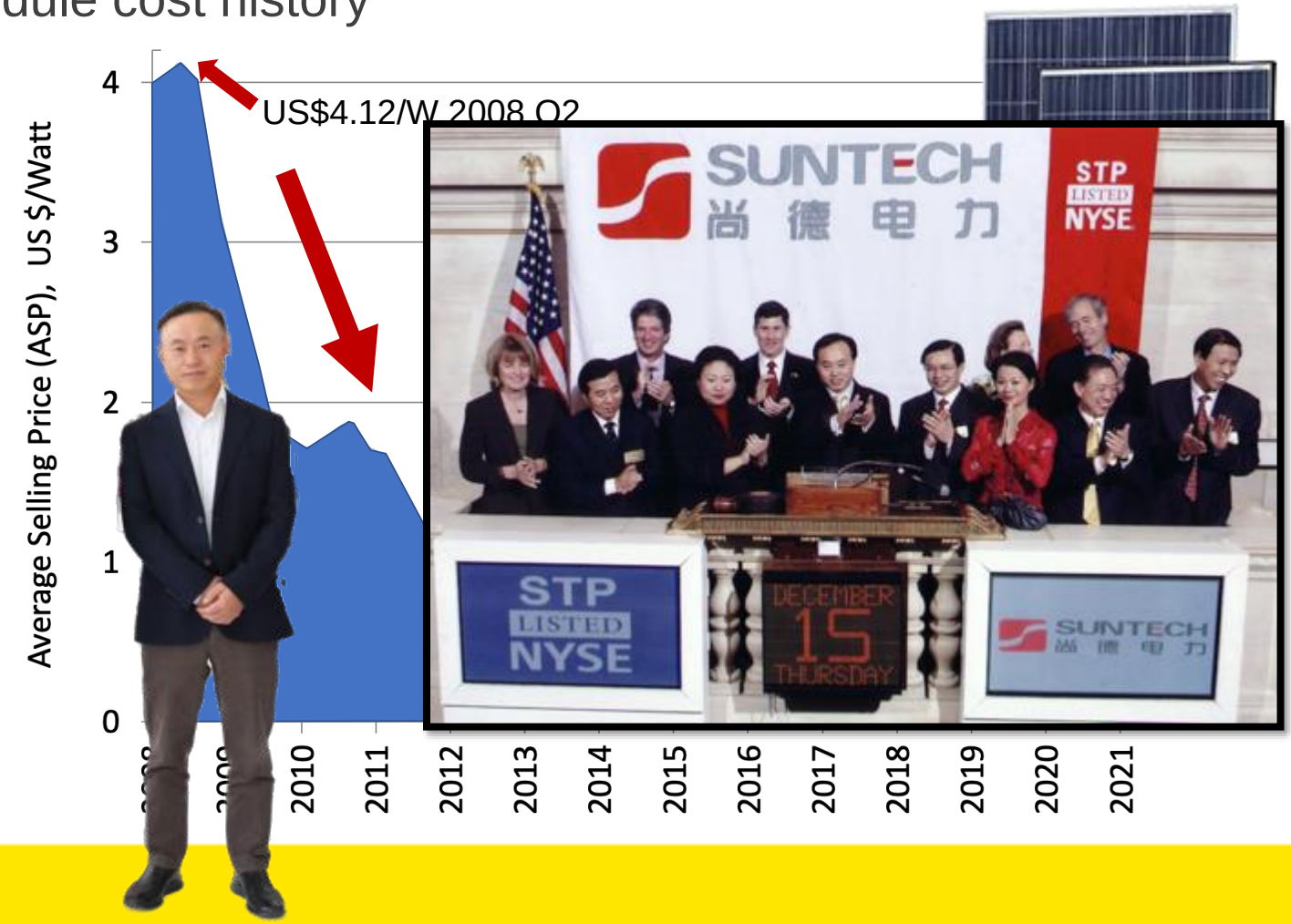
Energy Policy 123 (2018) 700–710

More than Moore!

Module cost history



Module cost history



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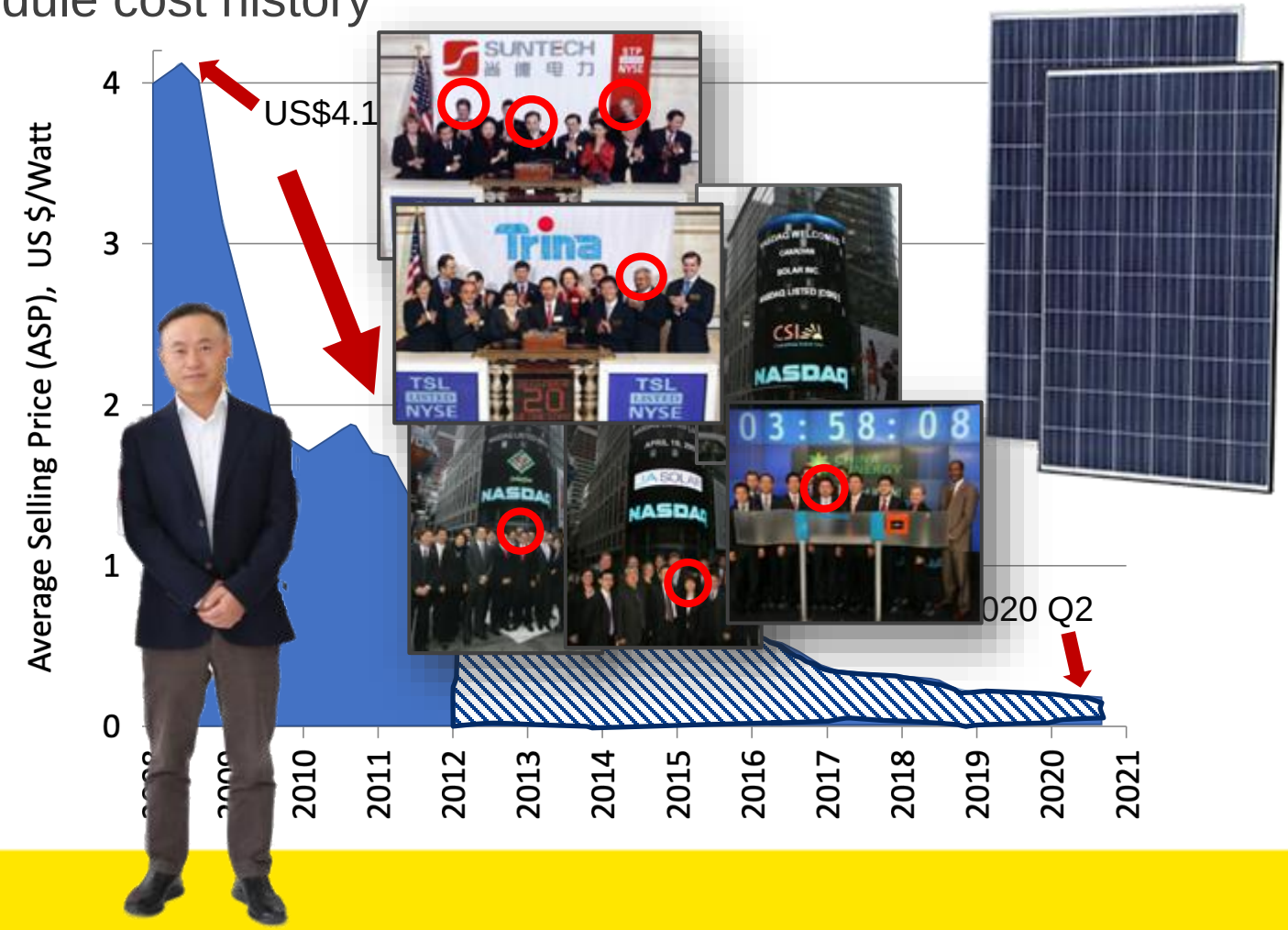
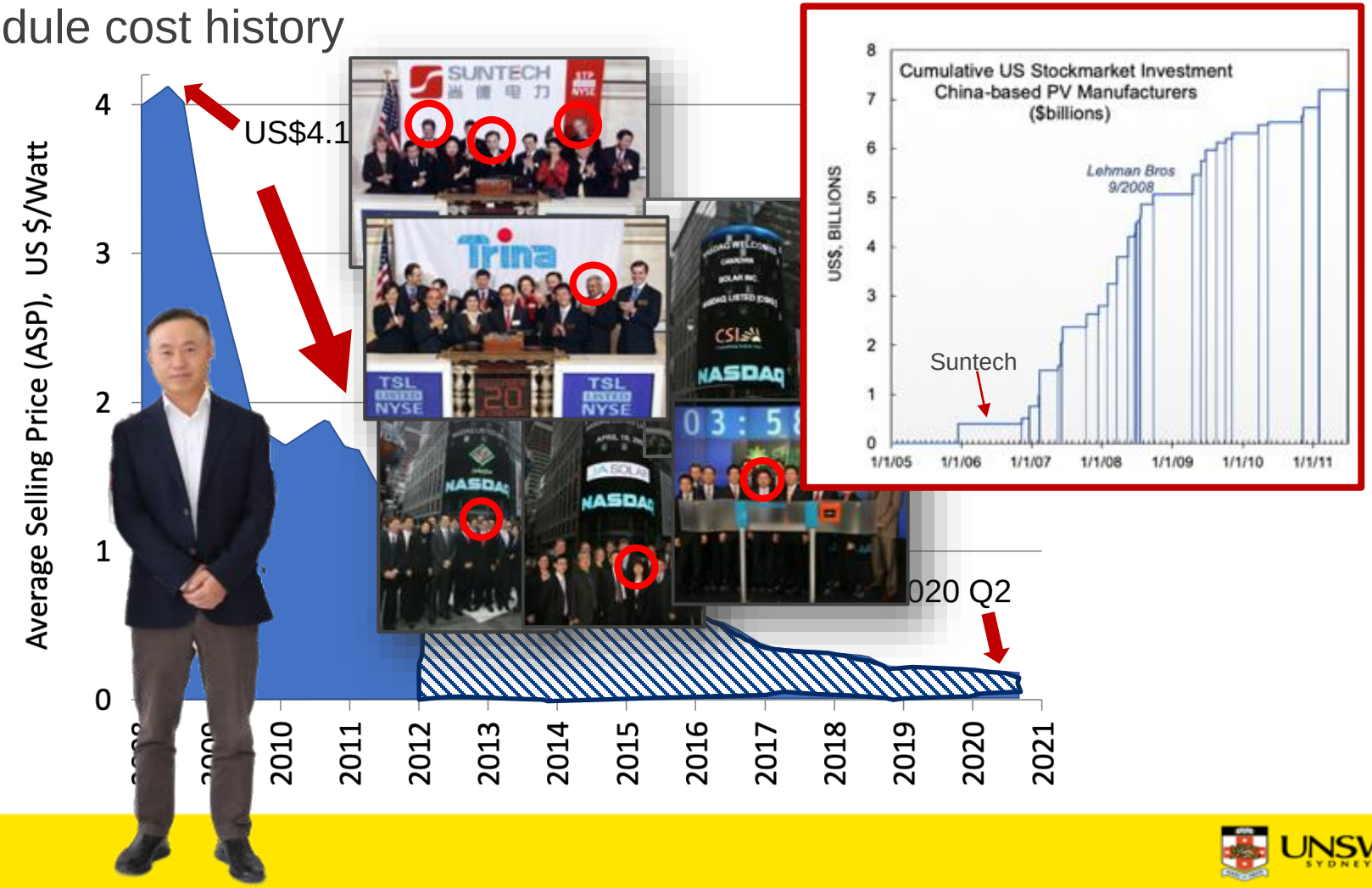
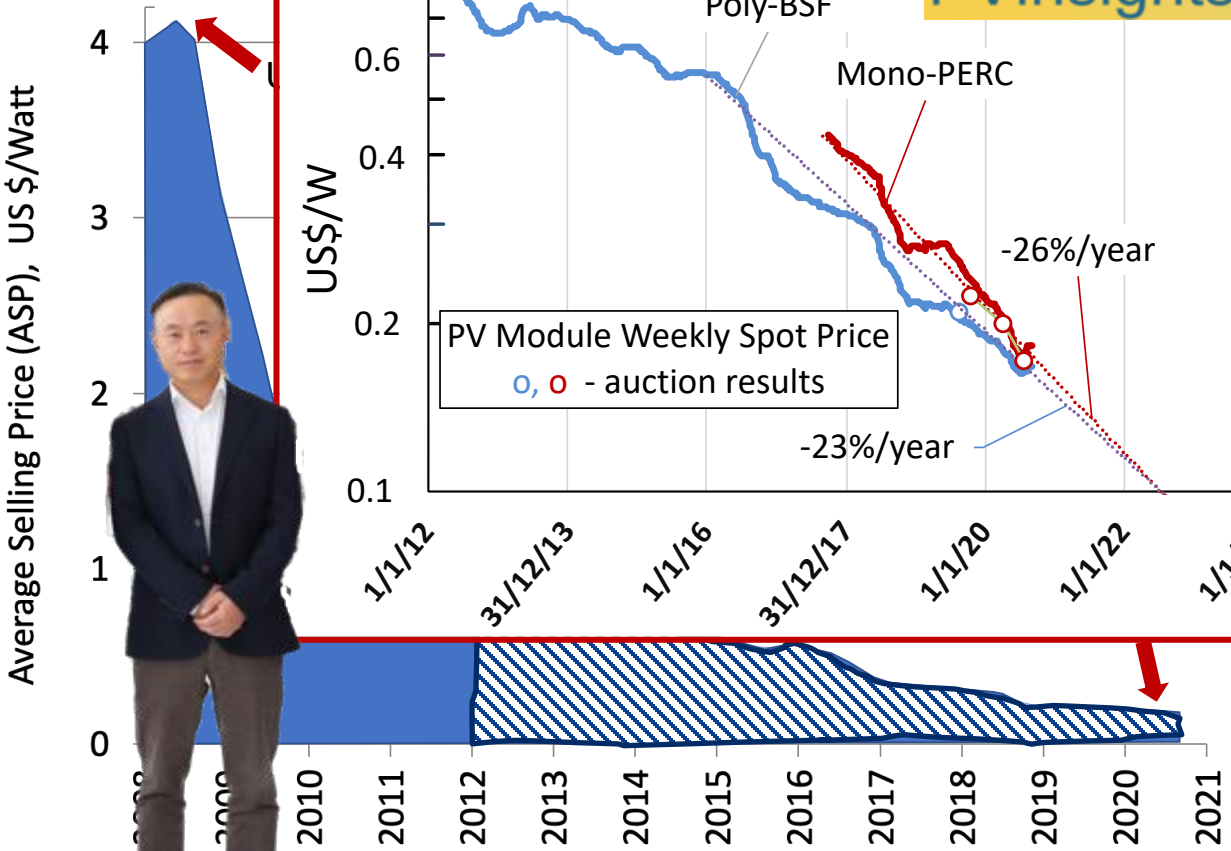


Module cost history

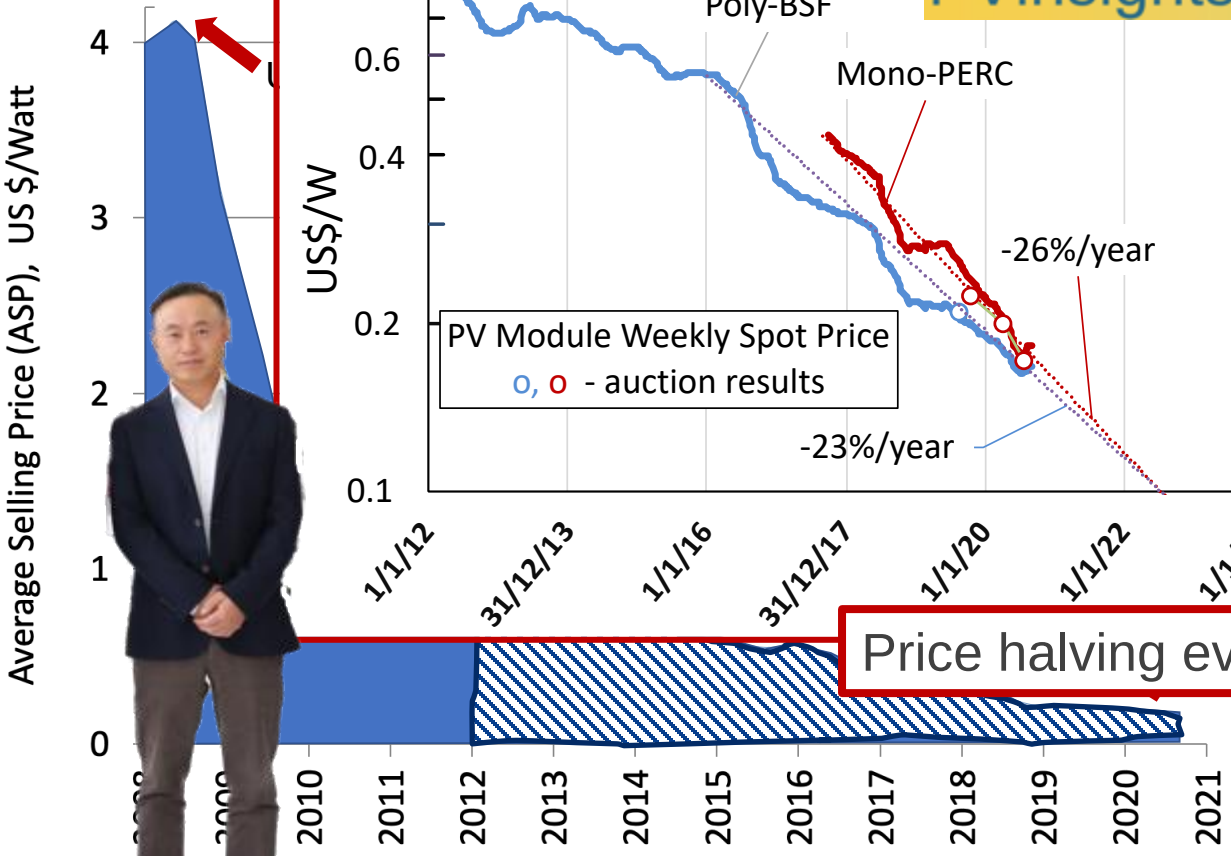


Module cost history

Module cost his



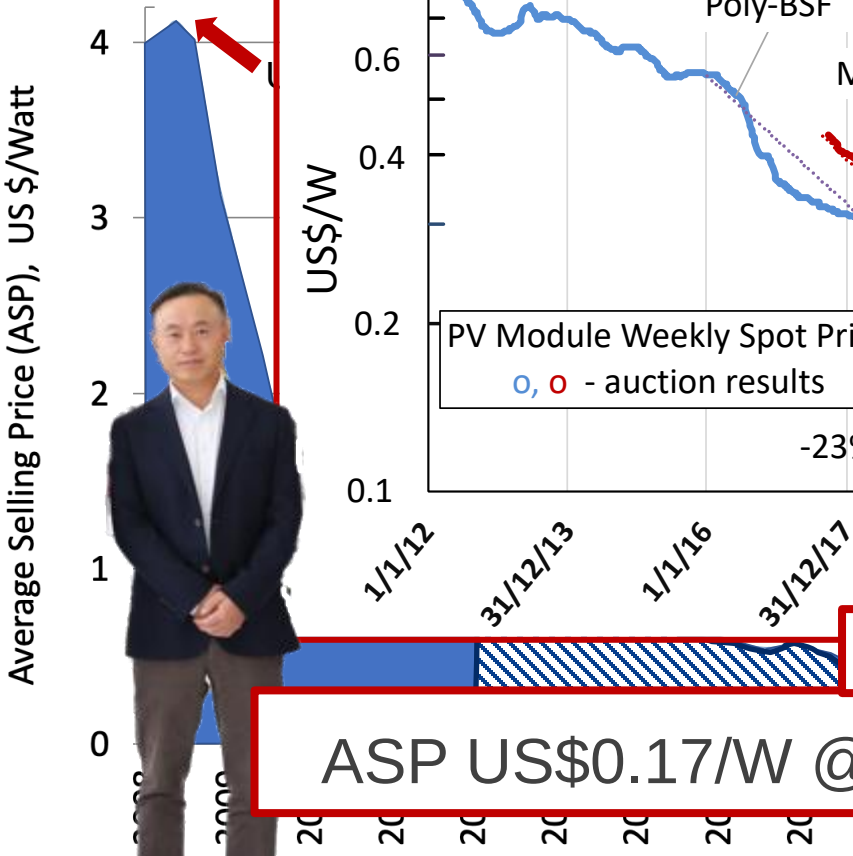
Module cost his

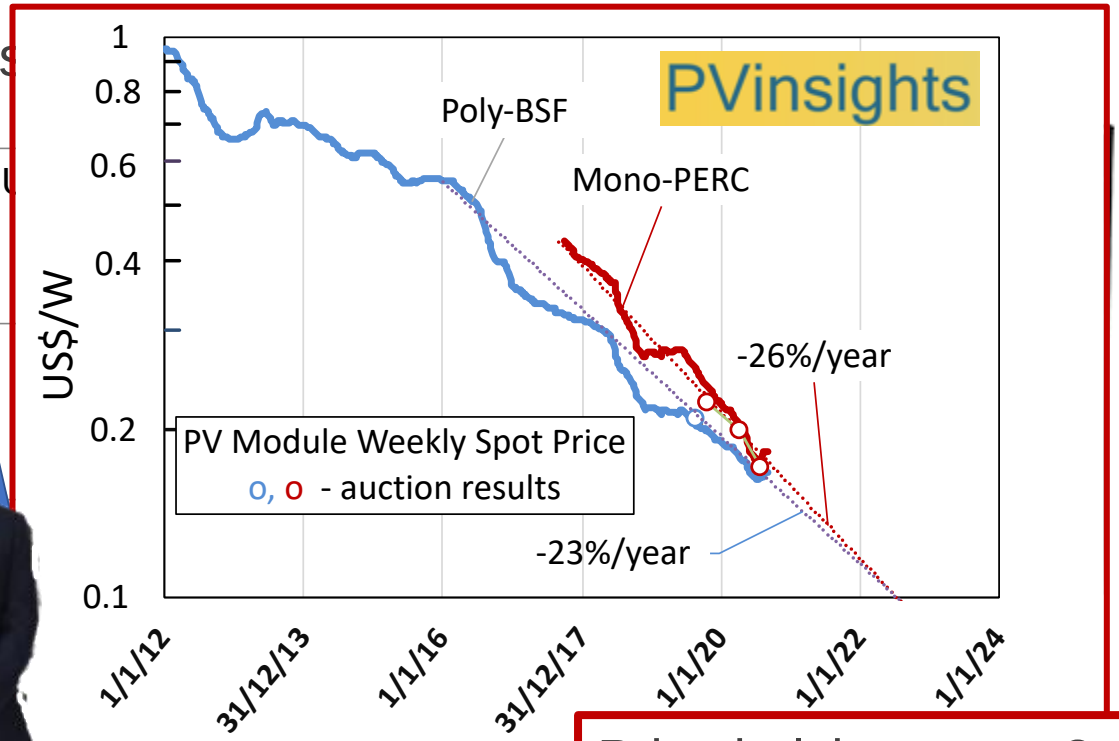


Price halving every 3 years

Generalised Moore's law

Module cost his



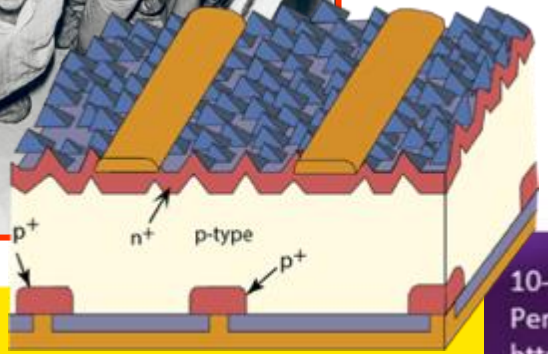


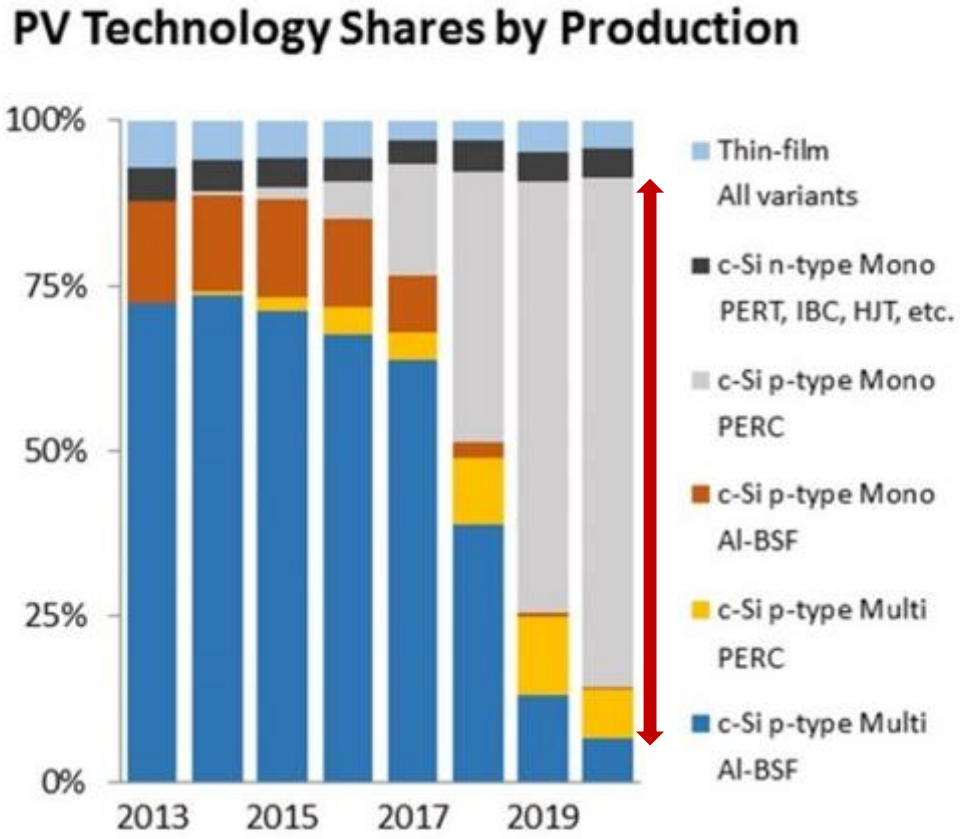
Price halving every 3 years

ASP US$0.17/W @ 200W/m^2 > US$34/m^2

Generalised Moore's law

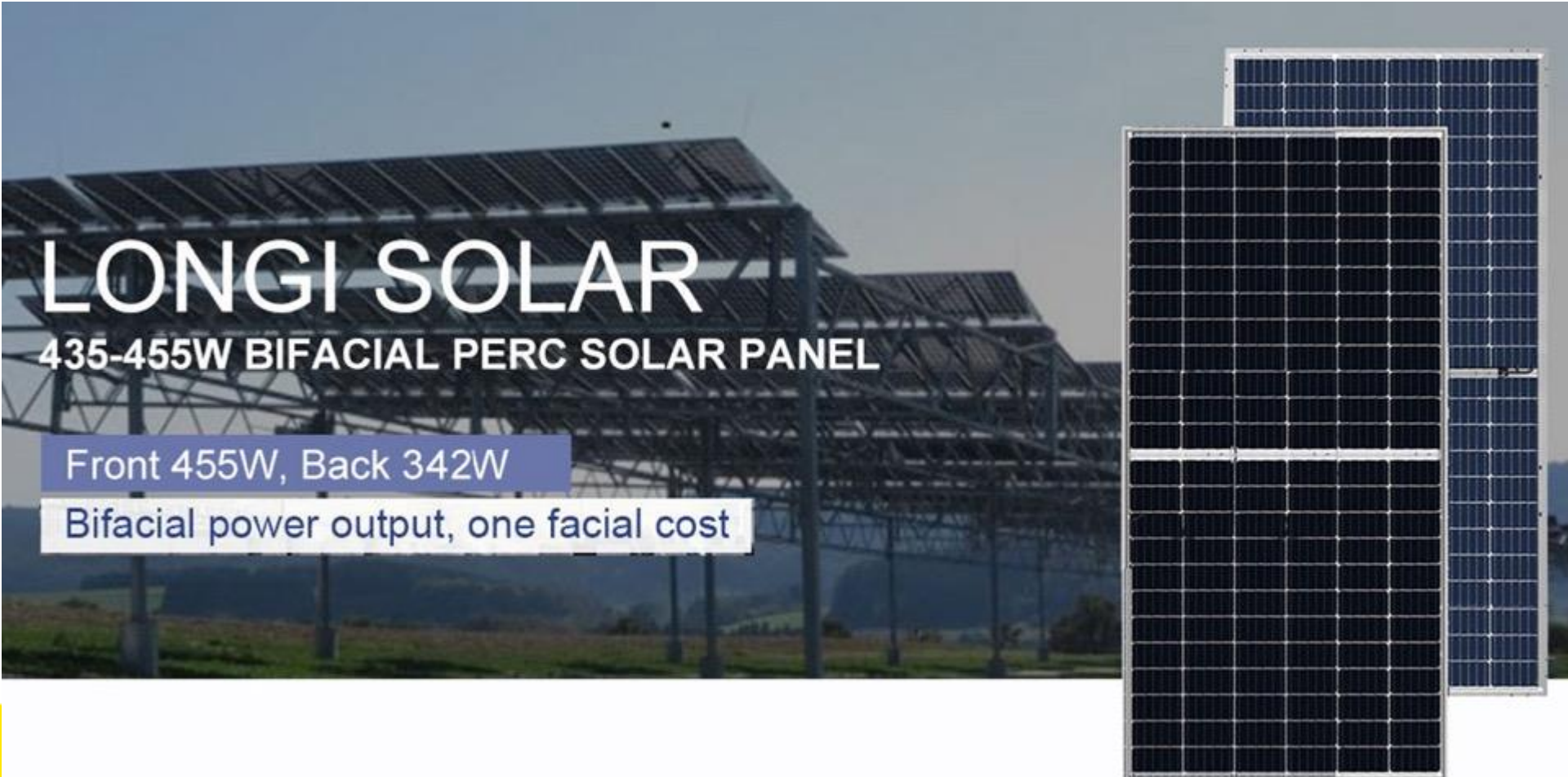
PERC rules!





10-11 March 2020
Penang, Malaysia
https://celltech.solarenergyevents.com
CONFERENCE
PVCELLTECH

PERC functionality: bifacial cells, half-cut cells, shingling/tiling!

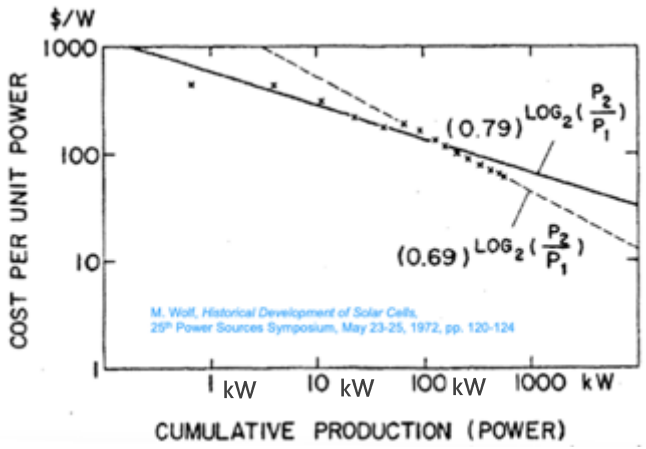


PERC functionality: bifacial cells, half-cut cells, shingling/tiling!

78 cells (156 HC*)

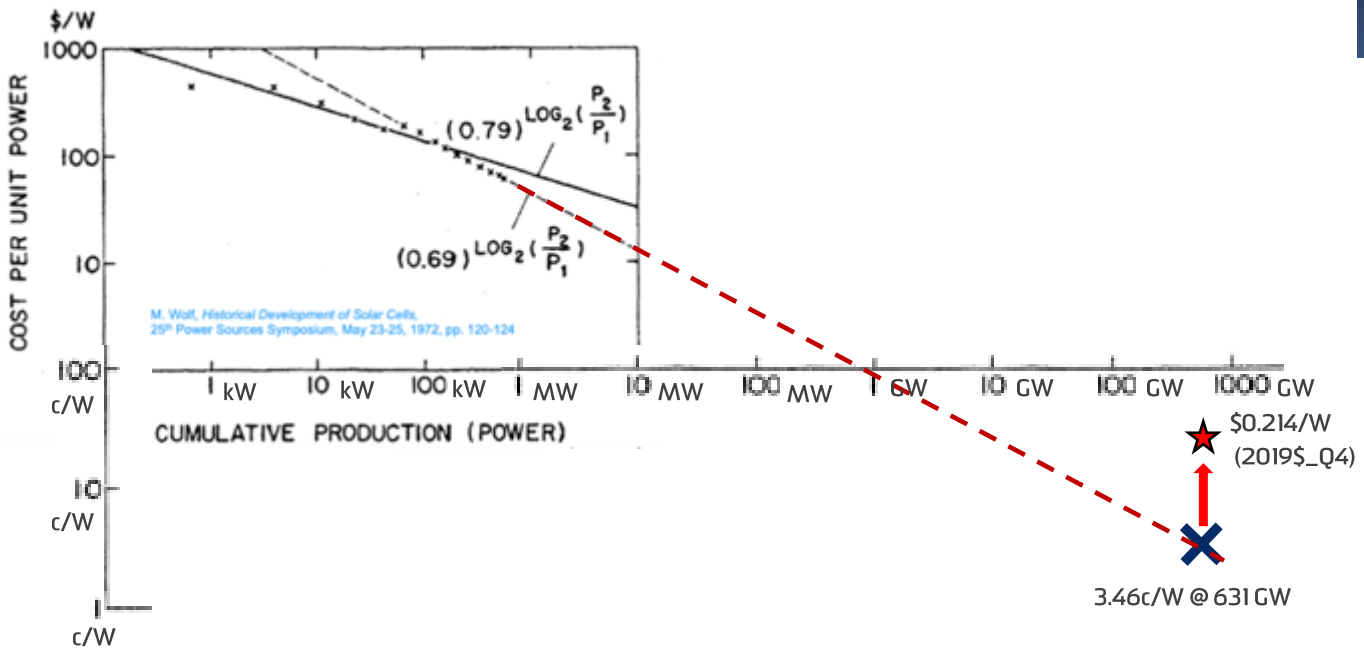
450W - 600W+

Learning curve (Martin Wolf 1972)



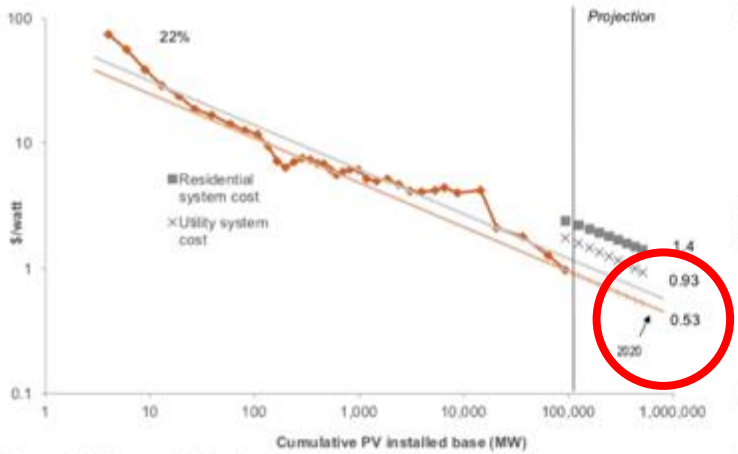
Wright's law

Learning curve (Martin Wolf 1972)



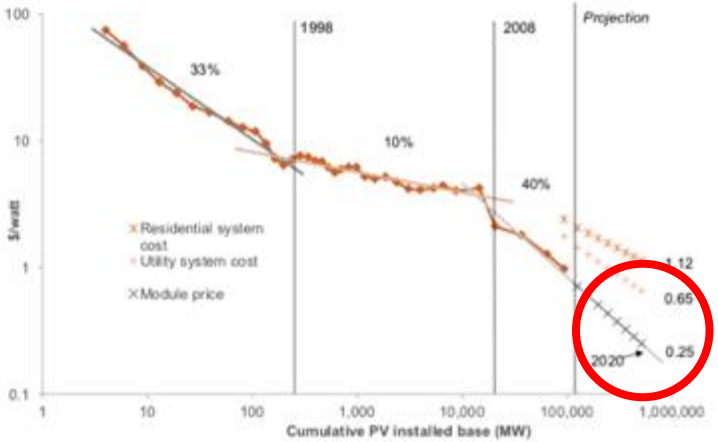
Learning curve update

Figure 63. Solar module price declines from 1972 show an overall learning rate of 22%...



Source: Citi Research, BloombergNew Energy Finance

Figure 64. ...though in recent years that learning rate has increased to 40%

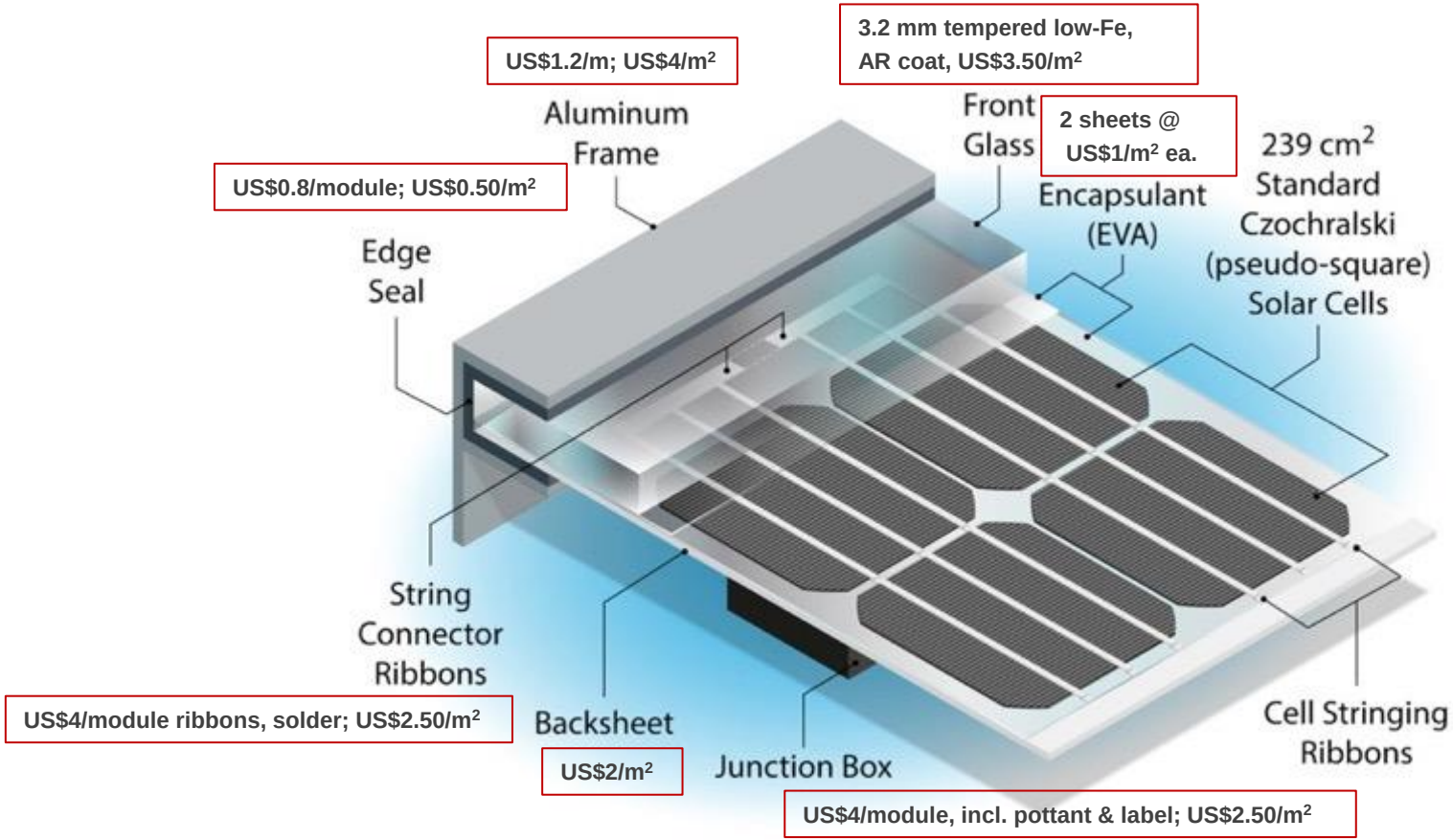


Source: Citi Research, Bloomberg New Energy Finance

Citi GPS: Global Perspectives & Solutions

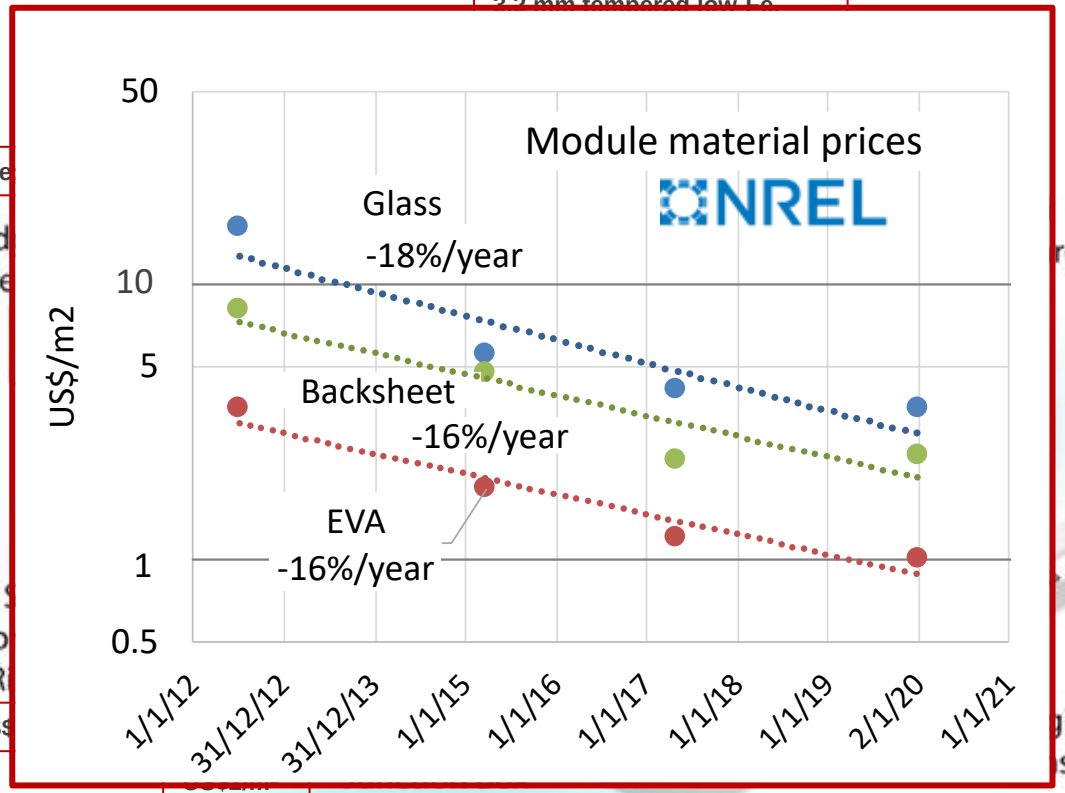
October 2013

Standard Module Assembly (> US$17/m^2)



Source of figure & data: NREL

Standard Module Assembly (> US$17/m²)



US$0.8/module

US$4/module ribbons, solder; US$

US$4/module, incl. pottant & label; US$2.50/m²

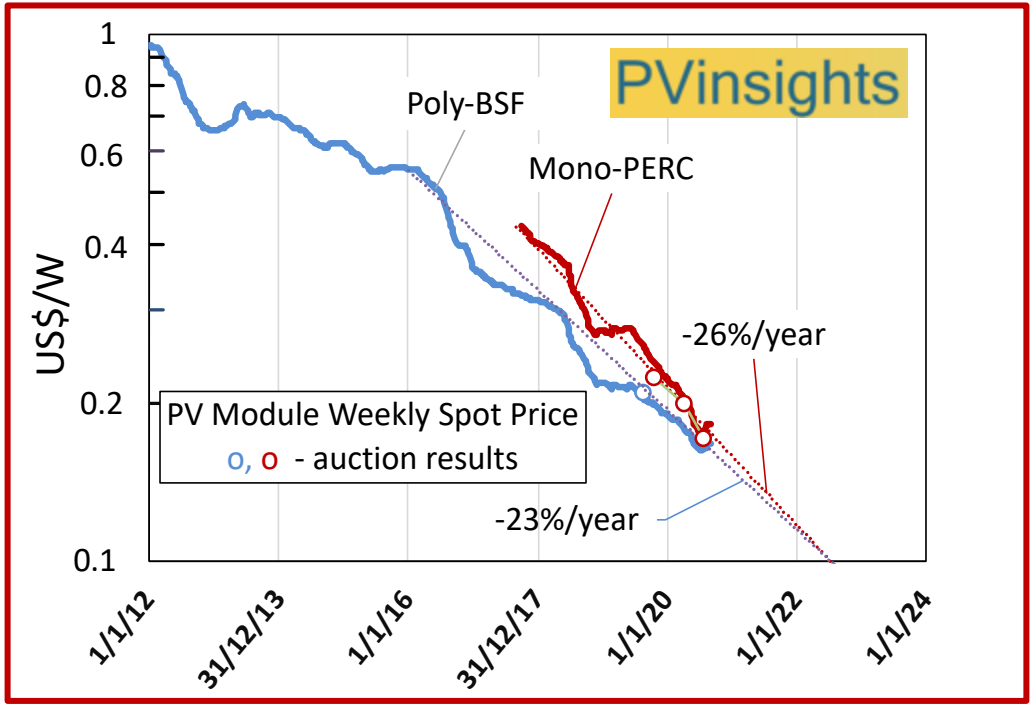
Source of figure & data: NREL

How Cheap Can Solar Photovoltaics Become?

. *Insanely cheap!*
(Ramez Naam)

. *PERC has accelerated pace of change*

. *10c/Watt (US$) modules within next few years!*



ARENA
Australian Government
Australian Renewable Energy Agency
ACAP