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“Photovoltaic state of the art and perspectives”

Martin Green, UNSW Sydney

ipcc

INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2022

Mitigation of Climate Change

4 April 2022

WGIII

Working Group III contribution to the
Sixth Assessment Report of the
Intergovernmental Panel on Climate Change

WMO UNEP

Accelerated climate action is critical to sustainable development

UNSW SYDNEY

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critical

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Figure SPM.7: Overview of mitigation options and their estimated ranges of costs and potentials in 2030.

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INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2022

Mitigation of Climate Change

4 April 2022

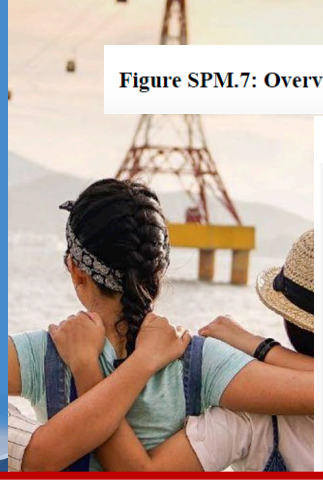
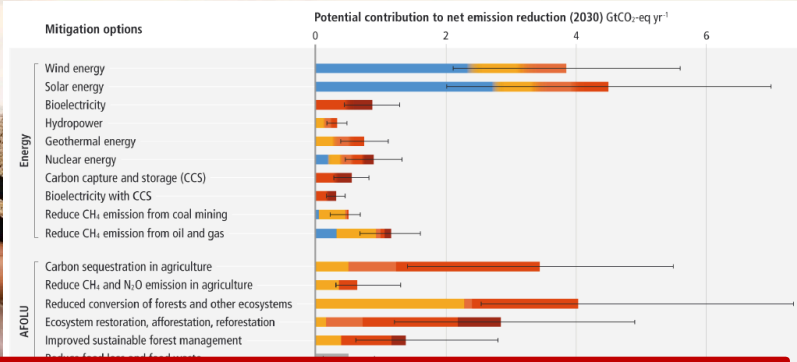
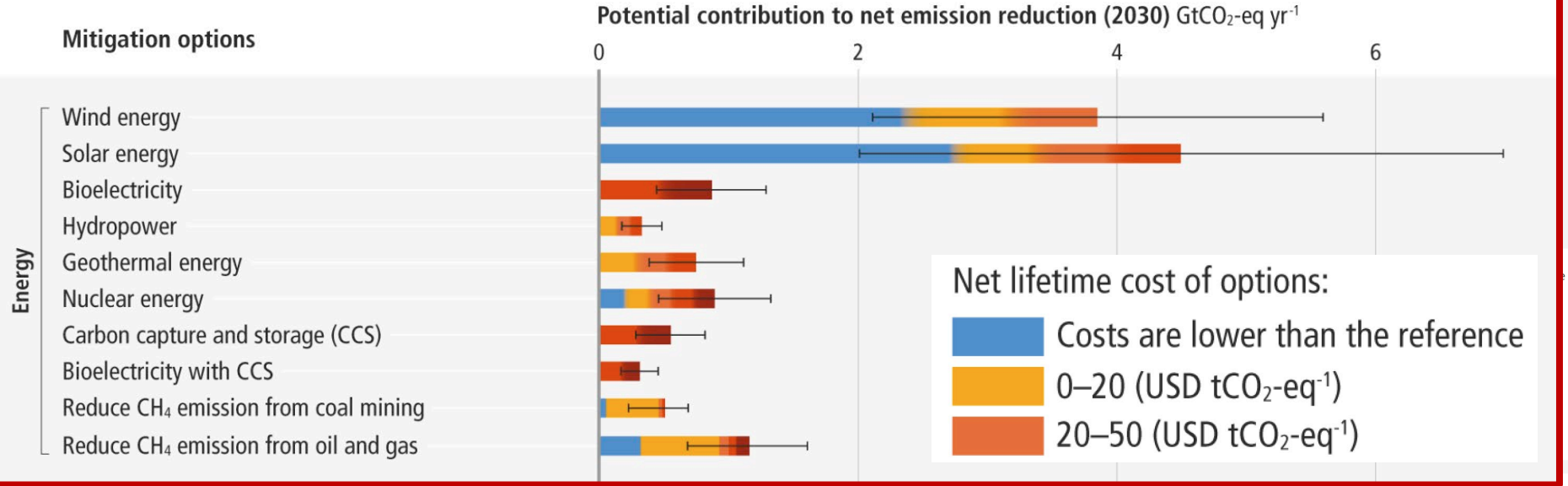
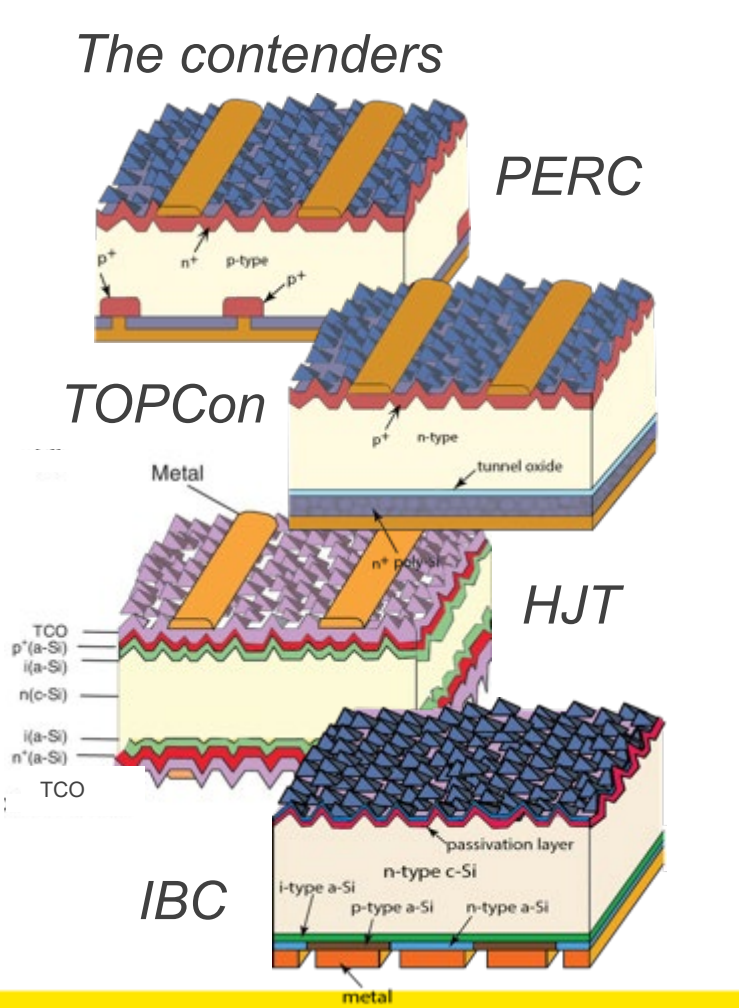
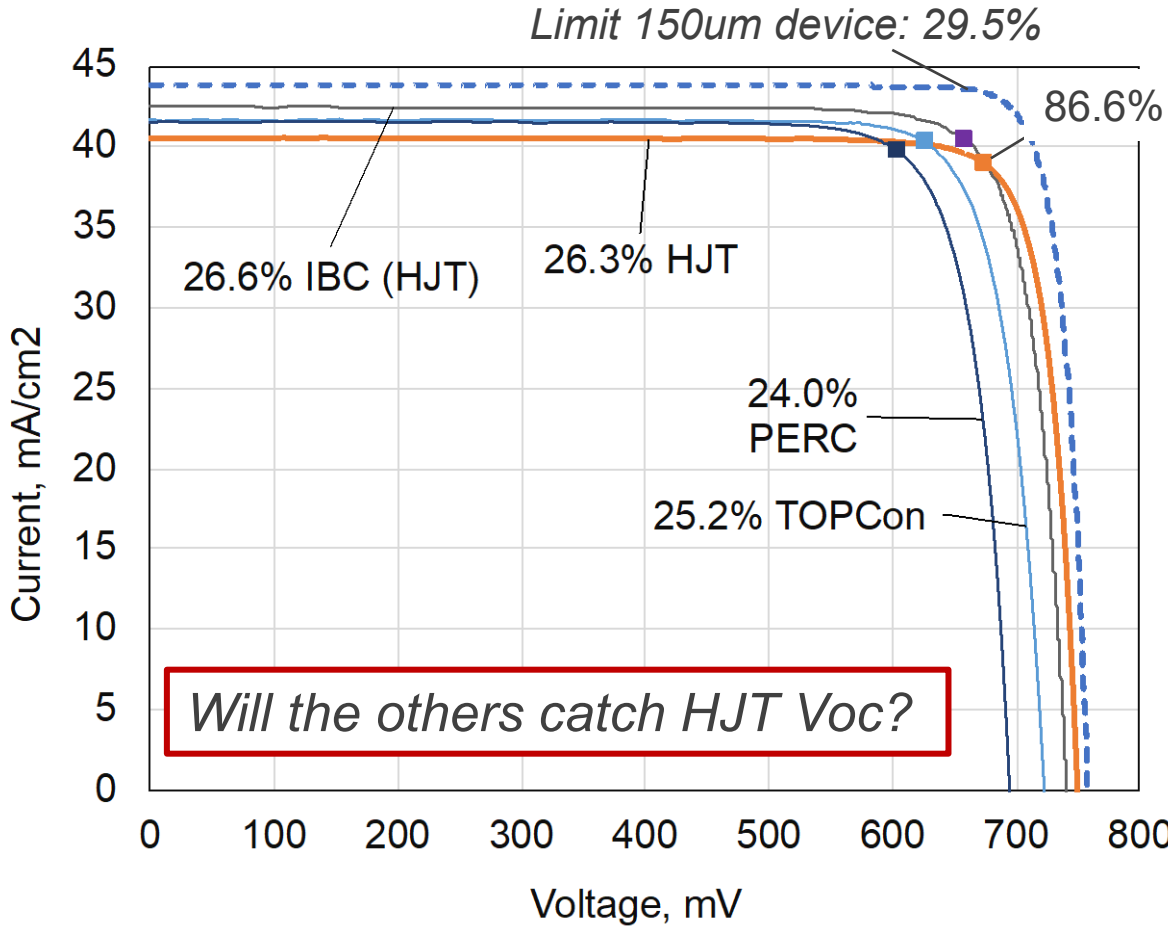


Figure SPM.7: Overview of mitigation options and their estimated ranges of costs and potentials in 2030.



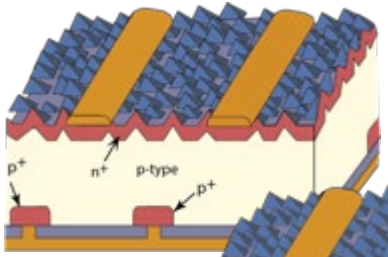



The contenders
PERC
p+
n+
p-type
p+
TOPCon
p+
n-type
tunnel oxide
Metal
n+ poly-Si
HJT
TCO
p+(a-Si)
i(a-Si)
n(c-Si)
i(a-Si)
n+(a-Si)
TCO
passivation layer
n-type c-Si
IBC
i-type a-Si
p-type a-Si
n-type a-Si
metal

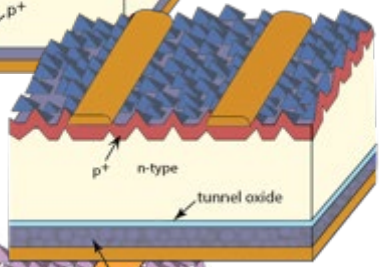

Limit 150um device: 29.5%
86.6%
26.6% IBC (HJT)
26.3% HJT
24.0%
PERC
25.2% TOPCon
Will the others catch HJT Voc?
Current, mA/cm2
Voltage, mV
0
5
10
15
20
25
30
35
40
45
0
100
200
300
400
500
600
700
800

The contenders

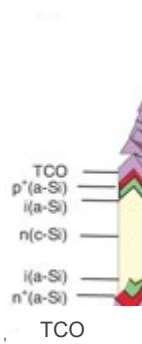
PERC



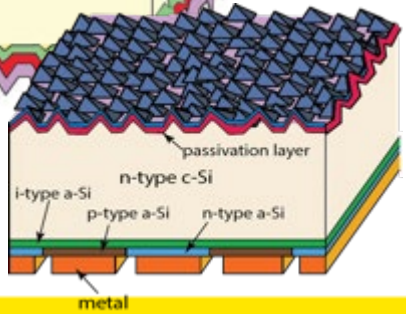
TOPCon



HJT

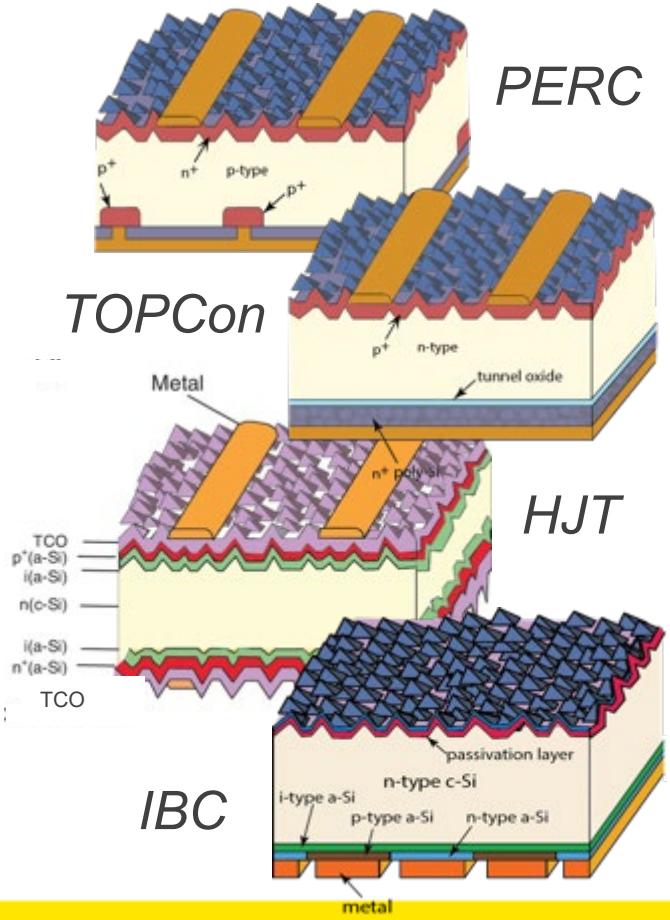


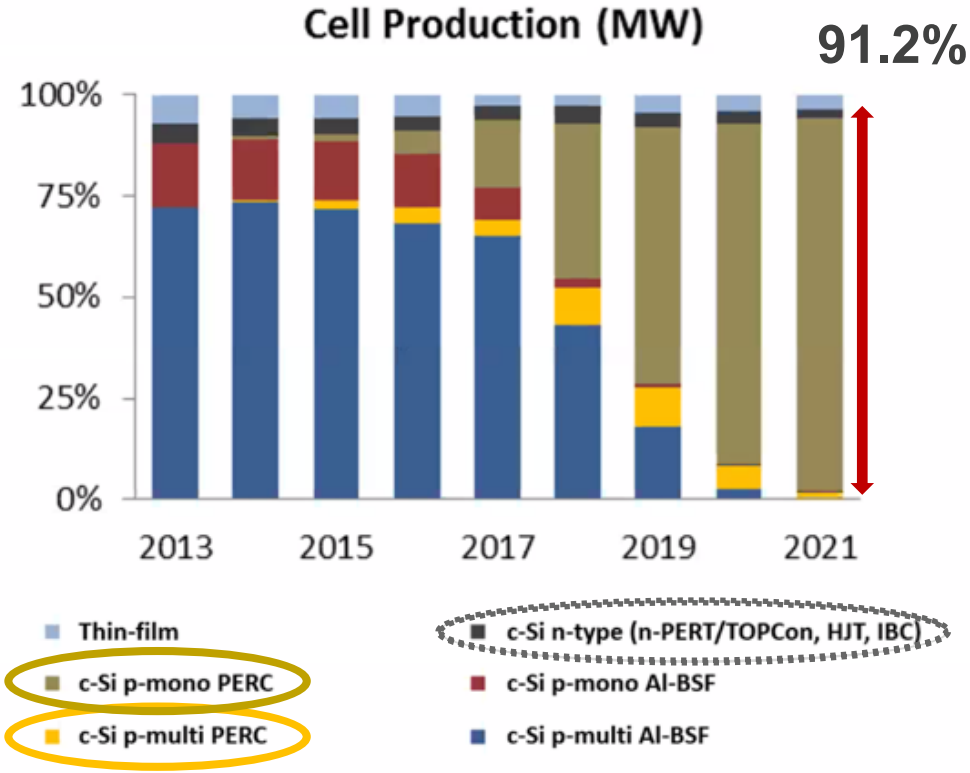
IBC



TaiyangNews Overview Highest Efficient Commercial Solar Modules 03/2022

The contenders





PERC offers new functionalities: Cheap bifacial cells!

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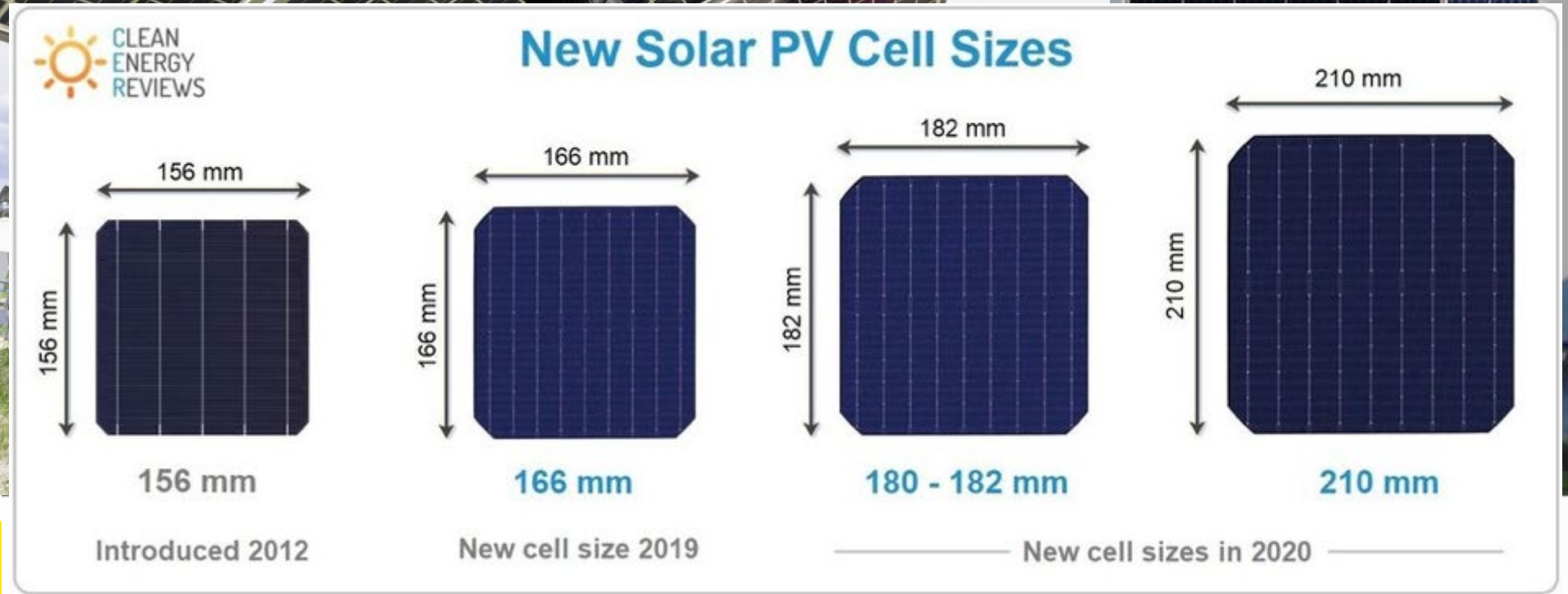

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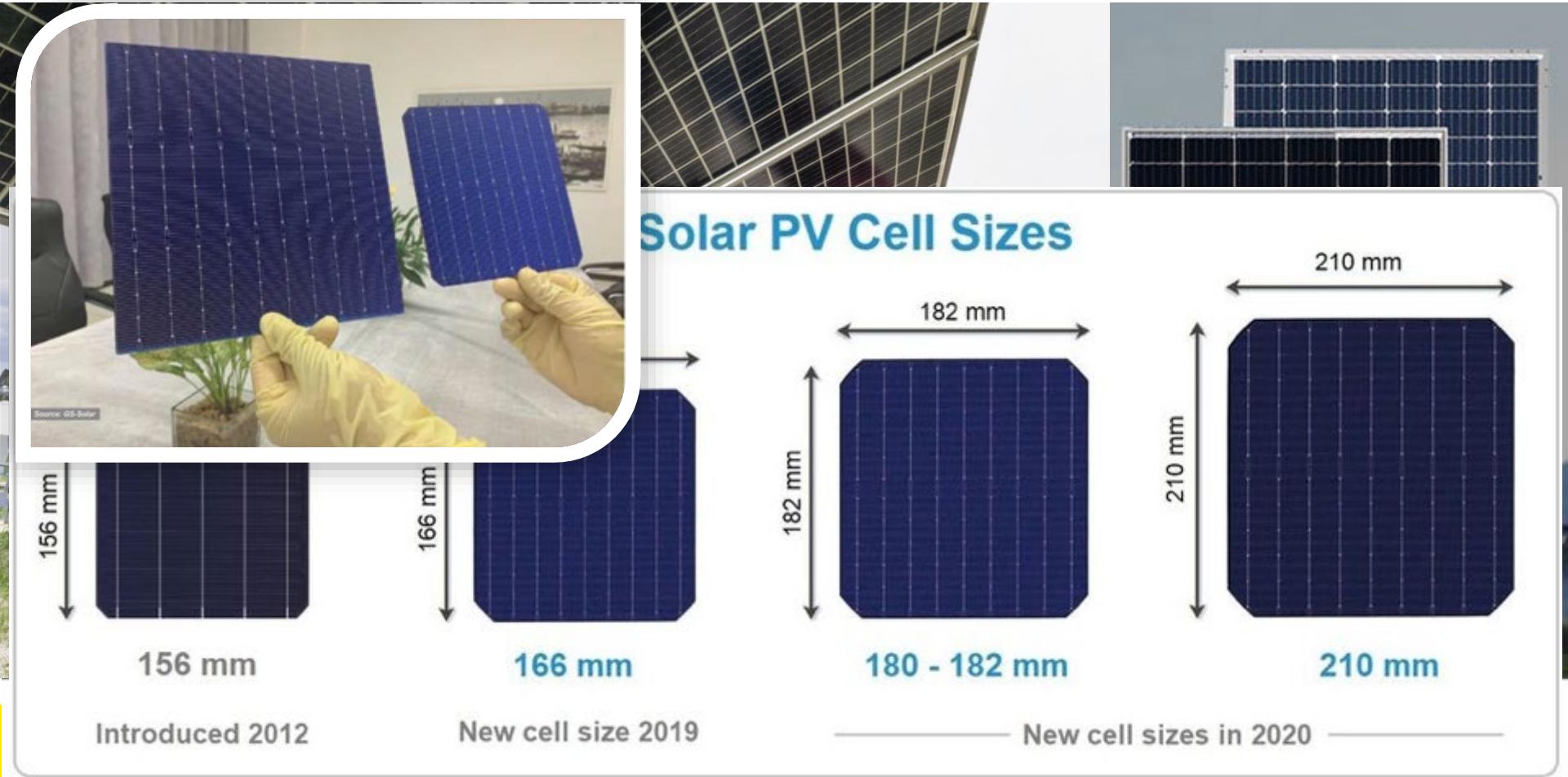
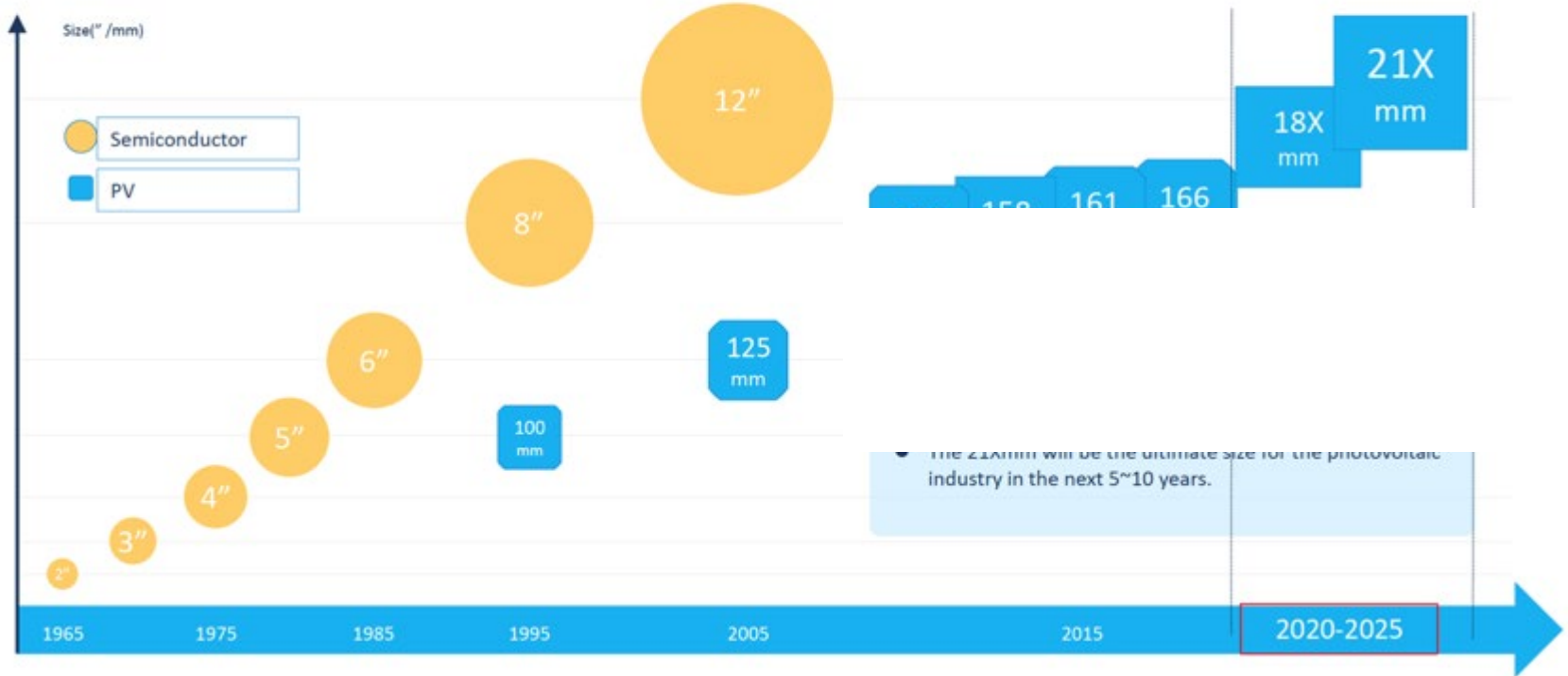
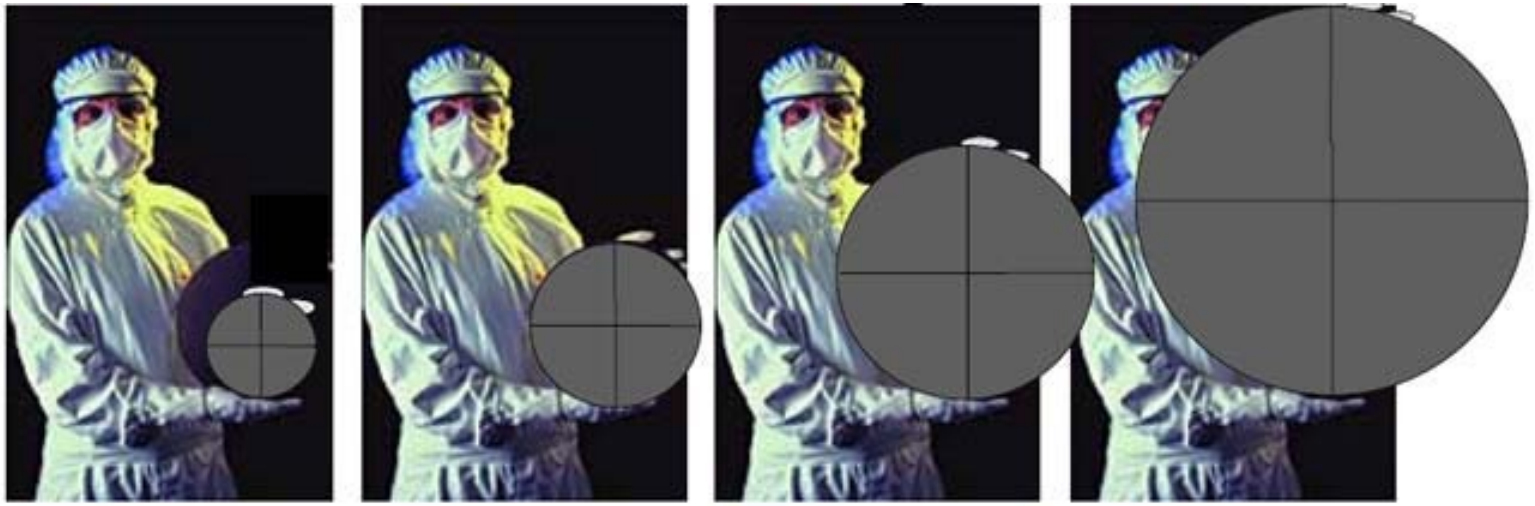


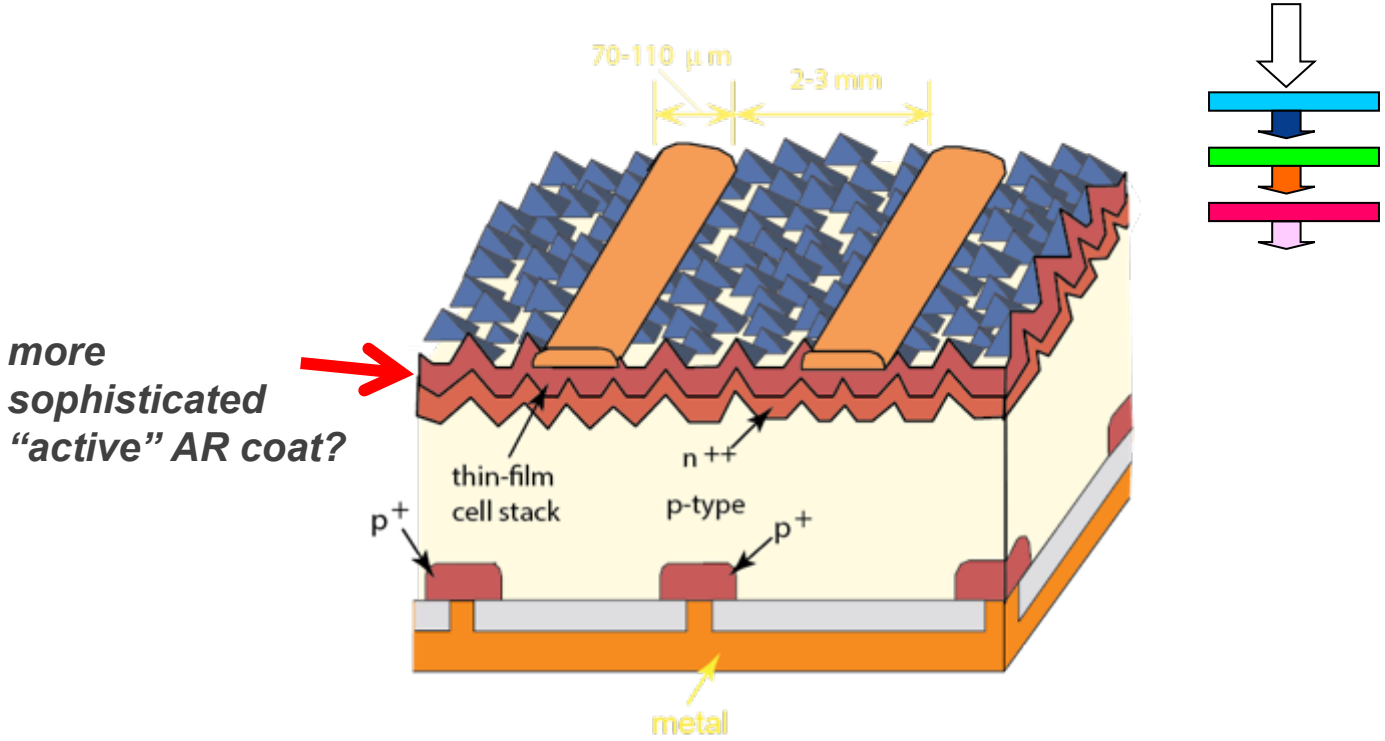
Trinasolar
天合光能

Size trend of silicon wafer in semiconductor and PV industry



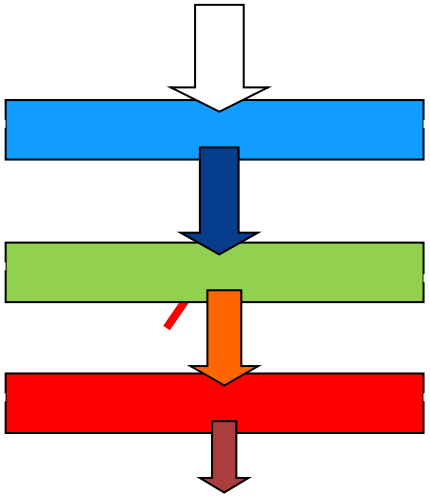

200mm/1990
300mm/2001
450mm/2012
675mm/2019?
(125/150mm - 1981)
9 yrs + 2yrs delay*
11 yrs + 0yrs delay
9 yrs + 0yrs delay

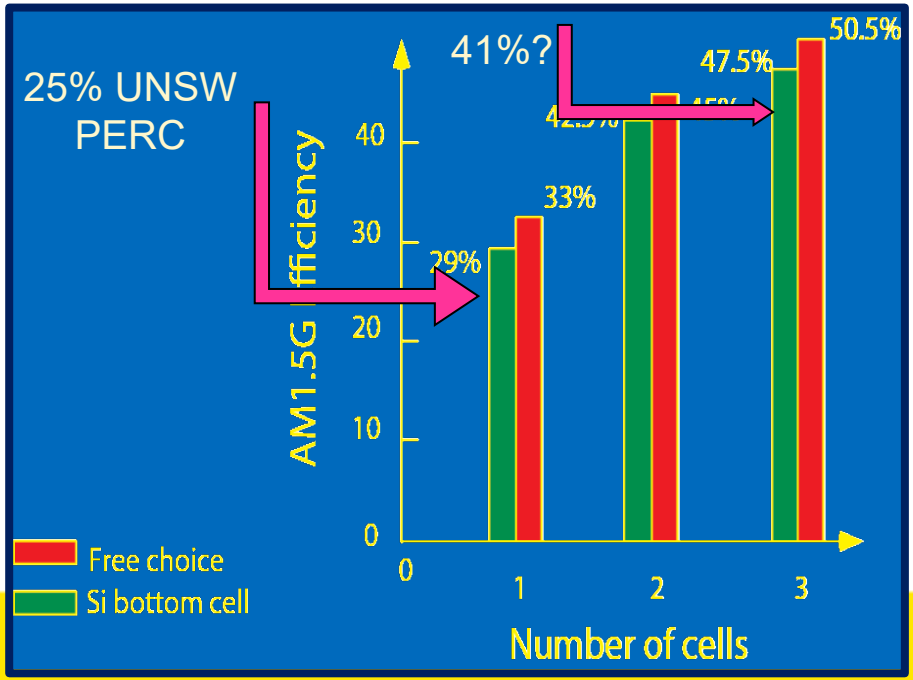
After PERC?



Supercharged tandem PERC?

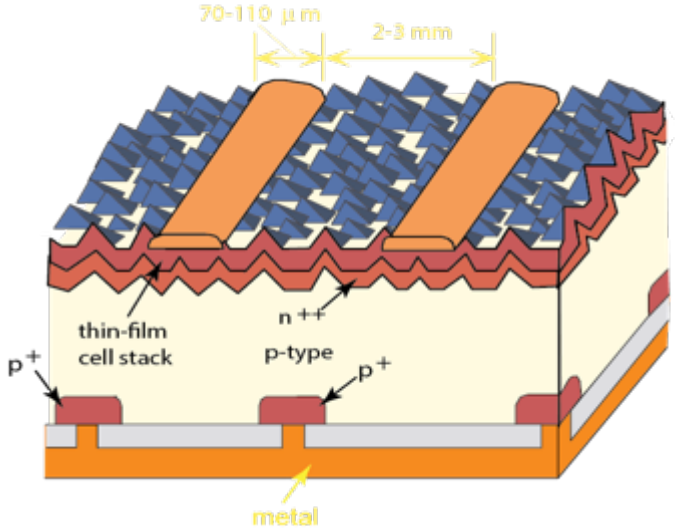
After PERC?



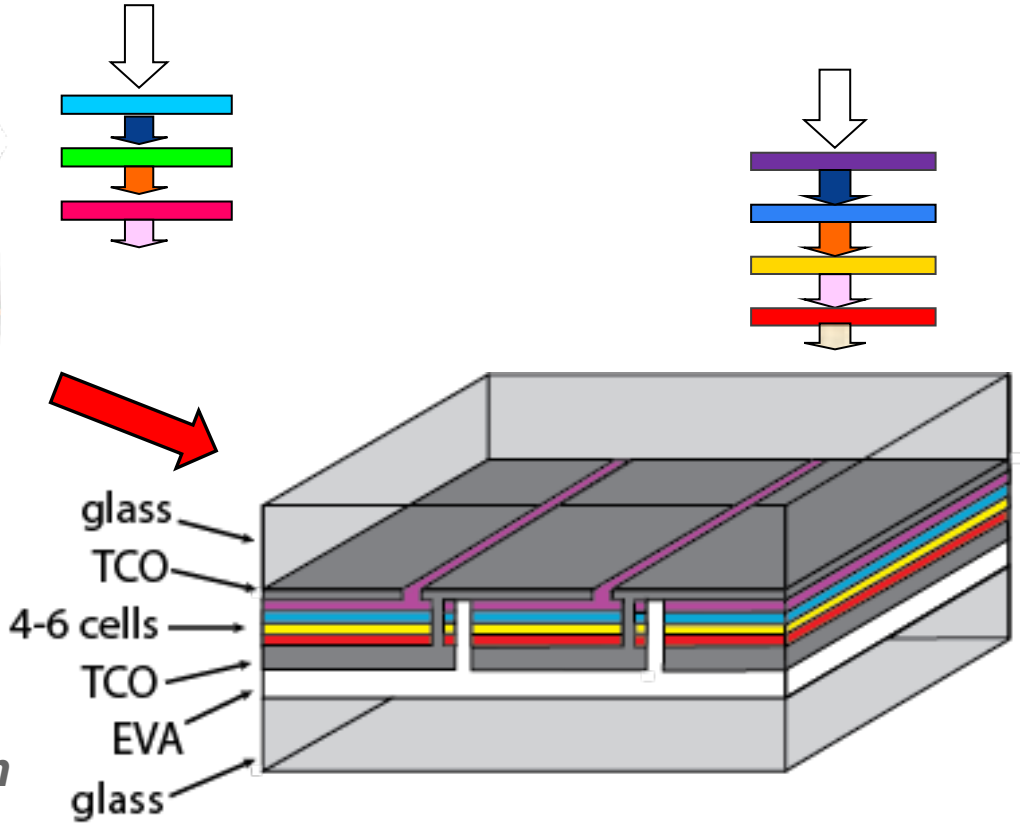


Free choice or Si

What then? – *the end for silicon?*



Si - 3 cell tandem



4-6 cell thin-film tandem

“Photovoltaic state of the art and perspectives”

ARENA

Australian Government
Australian Renewable Energy Agency

ACAP

. *To become “insanely cheap”! (Ramez Naam)*

. *PERC continues to accelerate pace of change*

. *10c/Watt (US$) modules within next few years (& 1c/kWh electricity prices)!*

. *Solar to play a major role in mitigating global warming.*