

CORNING

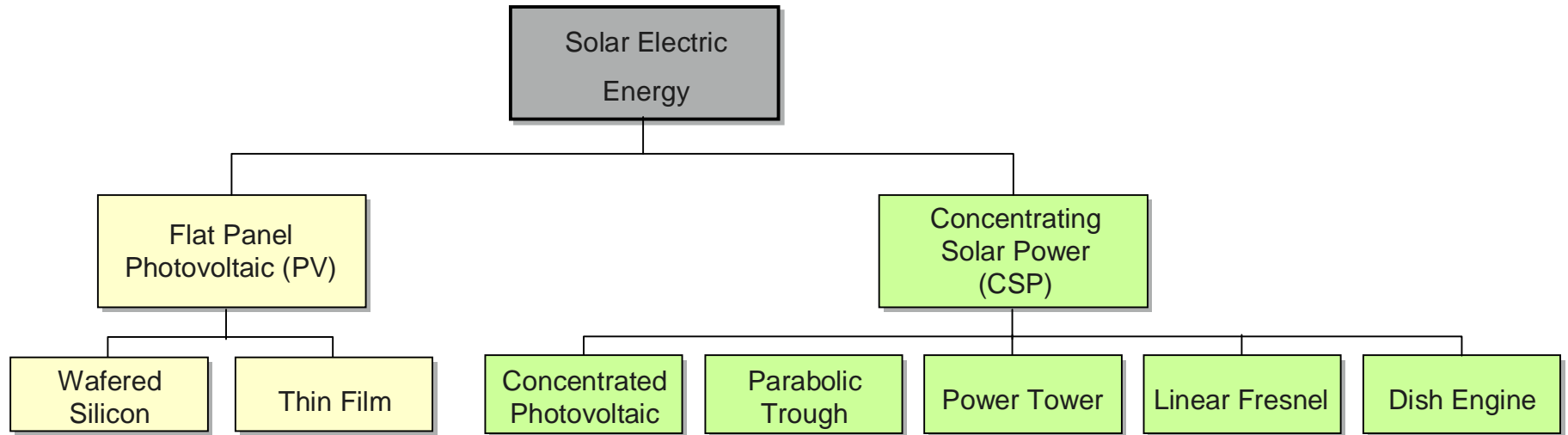
Science &
Technology

Photovoltaic Technology

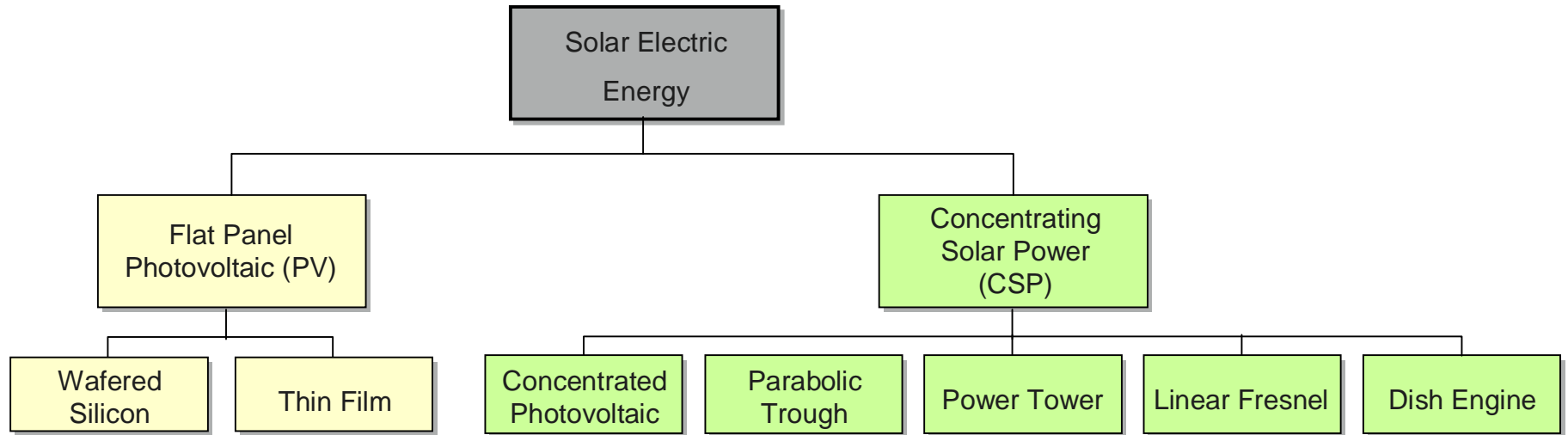
*Optical Society of America and
the Environmental and Energy Study Institute*
Solar Briefing, July 11, 2008

Dr. Doug Hall
Director, Photovoltaic Glass Technologies

Solar Electric Technologies



Solar Electric Technologies



2008 Market Share

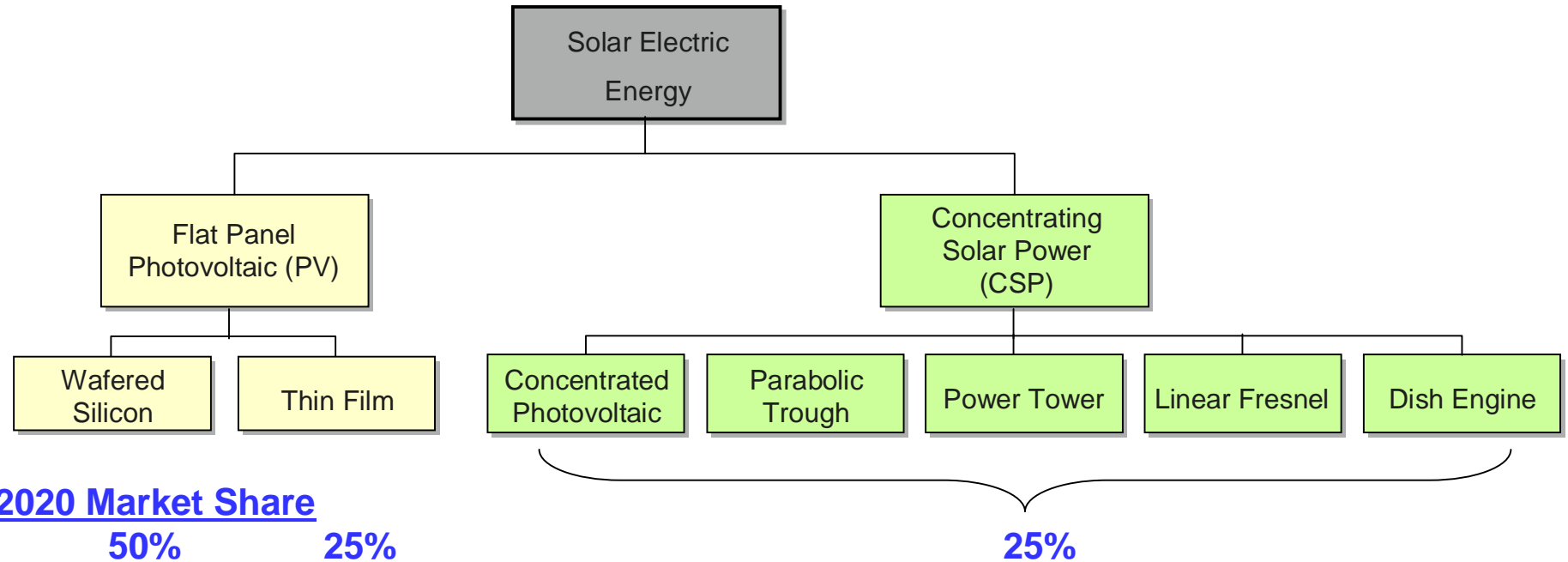
90%

5%

5%

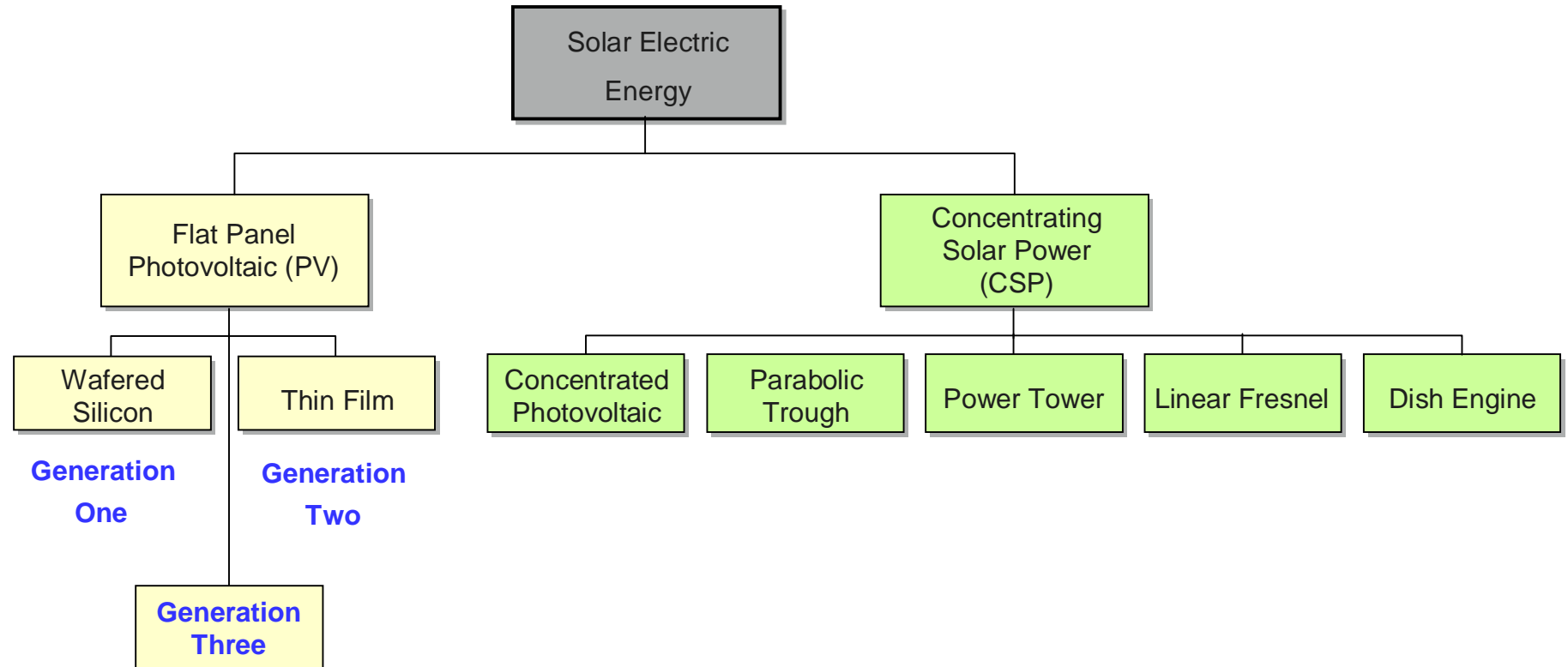
2008 Market Size ~ 4 GW

Solar Electric Technologies

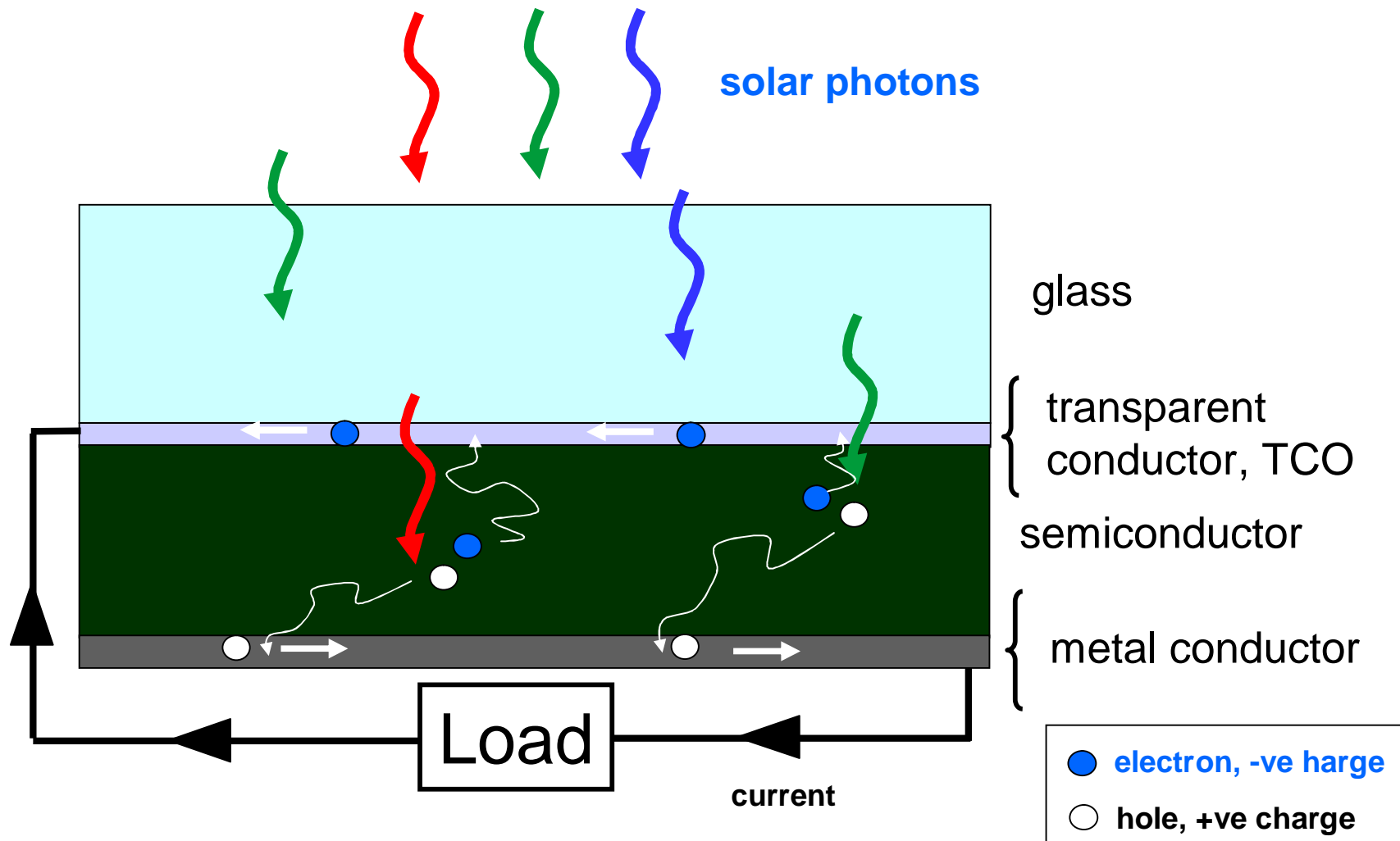


2020 Market Size ~ 15-30 GW << 10% of annual electricity capacity increase

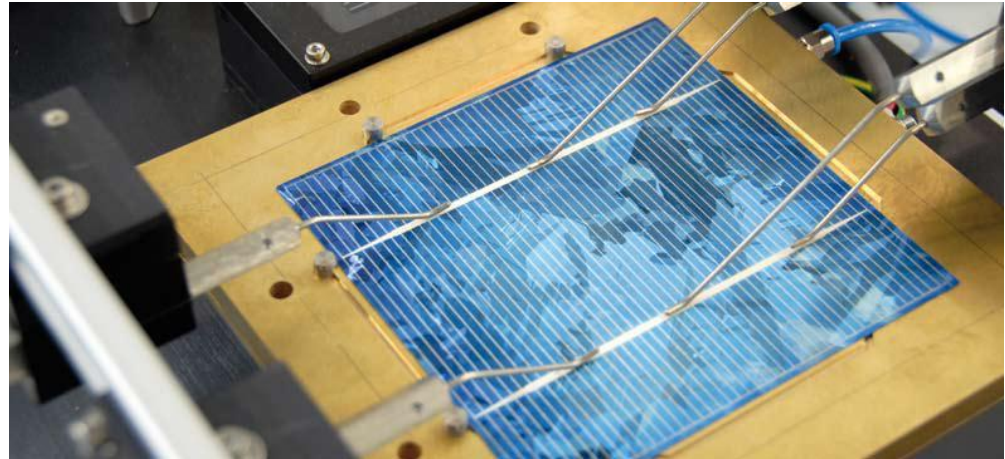
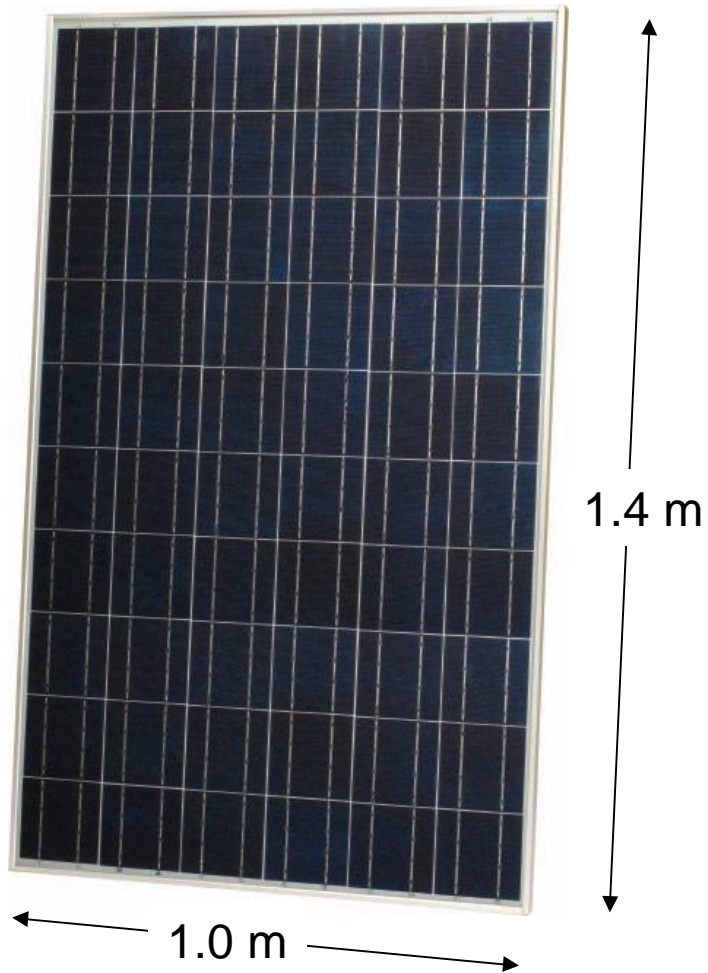
Solar Electric Technologies



Photovoltaic Cell- electric current from photons

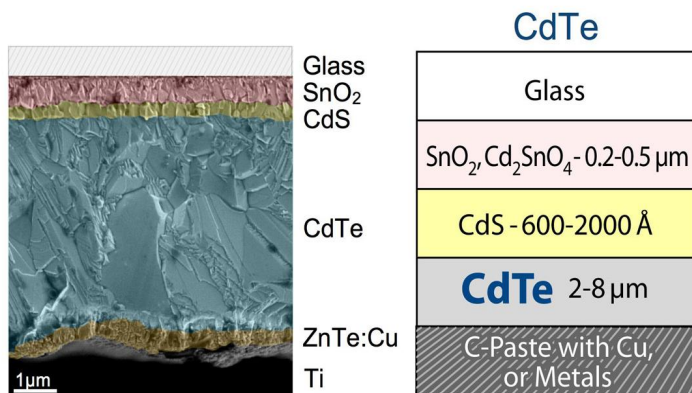
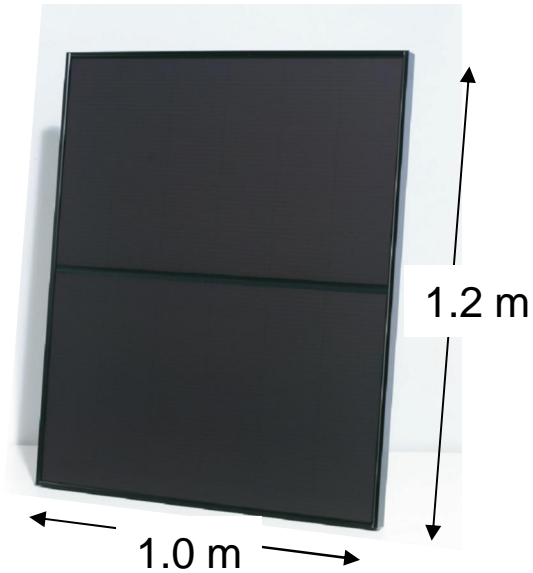


Generation One Wafered Silicon



- Efficiency (Watts/area)
 - Improved material growth
 - Silicon coatings
 - Cover glass transmission
- Cost (\$/area)
 - Thinner wafers
 - Lower purity silicon

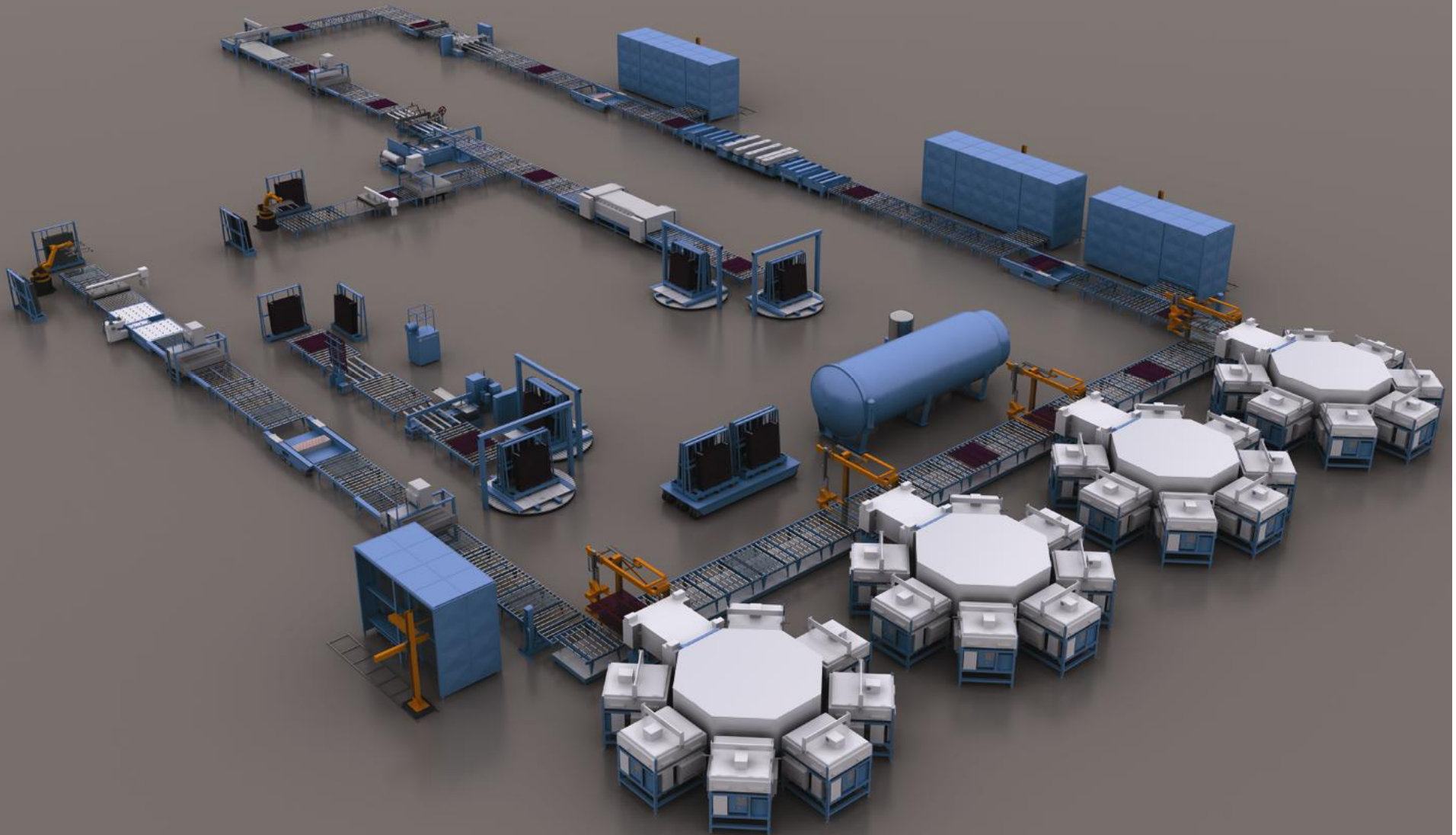
Generation Two Thin-Film Photovoltaics



- Efficiency (Watts/area)
 - Improved material growth
 - Improved light trapping
 - Improved transparent conductors
- Cost (\$/area)
 - Automation

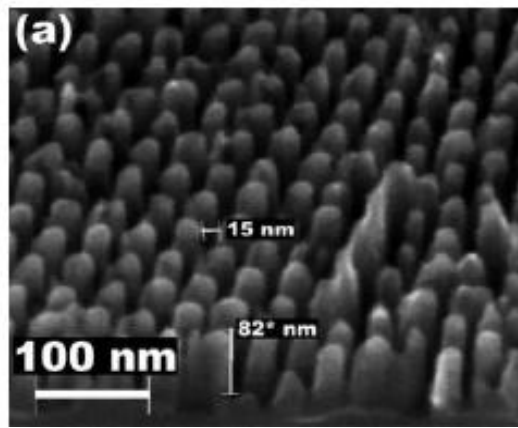
Micrograph courtesy NREL

Generation Two – Automation is key to lower cost



production layout
courtesy of Applied Materials
Illustration only. Actual design varies

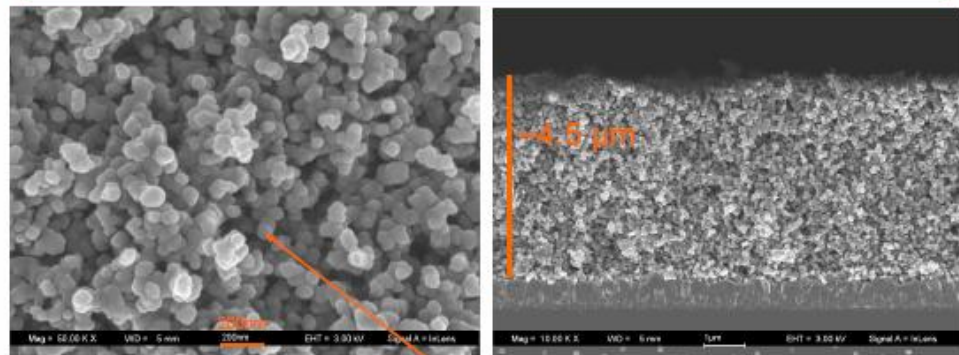
Generation Three The Future



Micrograph courtesy of
Dr. Michael D McGehee, Stanford U.



Photo courtesy of
Dr. Christophe Ballif, IMT, U. of Neuchatel



Sample #3
Fill Factors of 46%
Efficiencies ~3%

Rounded morphology ~60nm

Micrograph courtesy of
Dr. Carlton Truesdale, Corning Inc.

- Efficiency (Watts/area)
 - New materials
 - Nanotechnology
 - Improved light trapping
 - New transparent conductors
- Cost (\$/area)
 - Roll-to-roll production
 - Organic materials
 - Flexible substrates

Technology Challenges

- Many and inter-disciplinary
 - Optical Design and Engineering
 - Opto-Electronics Materials
 - Light-Matter Interactions
 - Electrical Engineering
 - Manufacturing Science
 - Reliability Science
 - Advanced Mechanical Design