

**Table S1.** Physical parameters of the incident, transmitted spectrum definitions, and their units.

Symbol	Definition	Unit
$S(\lambda)$	The power density of the light spectrum transmitted from the top sub-cell to the bottom sub-cell	W/m <sup>2</sup>
$S_o(\lambda)$	The incident spectrum is AM 1.5	
$x$	The layer number	
$n$	The total number of layers of the sub-cell	
$\alpha$	The absorption coefficient	cm <sup>-1</sup>
$d$	The thickness of each layer	cm
$A_\alpha$	A pre-factor of 10 <sup>5</sup>	cm <sup>-1</sup> .eV <sup>-1/2</sup>
$h$	The Plancks constant	eV.sec
$\nu$	The spectrum frequency	Hz
$E_g$	The energy gap of the material	eV

**Table S2.** Parameters of defect interfaces [33,34,71].

Parameters	ETL/absorber layer/HTL
Defect type	neutral
Electron and hole capture cross-section (cm <sup>2</sup> )	1E-15
Total density (integrated over all energies) (1/cm <sup>2</sup> )	1E10
Reference for defect energy level $E_t$	Above Highest $E_v$
Energetic distribution	Single
Characteristic energy (eV)	0.1
Energy level with concerning Reference (eV)	0.6

**Table S3.** Comparison of experimental PSC data [27], and simulations utilizing SCAPS-1D with different perovskite thicknesses.

Absorber	Perovskite thickness (nm)	Type	PCE (%)	$J_{sc}$ (mA/cm <sup>2</sup> )	$V_{oc}$ (V)	FF (%)
Perovskite	300	experimental	16.22	20.68	1.09	72.00
		Simulation	16.22	20.60	1.09	72.12
	400	experimental	18.12	23.02	1.09	72.21
		Simulation	18.11	22.95	1.09	72.33
	500	experimental	16.77	23.64	1.09	65.08
		Simulation	16.71	23.65	1.09	65.08