

The following list provides the worldwide granted patent assets of BeamReach Solar , as of 15 May 2017. The confidential data room contains the full list of BeamReach Solar assets, including granted patents and pending patent applications (by technology grouping), equipment and inventory.

### Beamreach Solar - Granted Patent Assets

Country Code	Patent Number	Title
JP	5528809	Template For Three-Dimensional Thin-Film Solar Cell Manufacturing And Methods Of Use
US	8,129,822	Template For Three-Dimensional Thin-Film Solar Cell Manufacturing And Methods Of Use
US	8,084,684	Three-Dimensional Thin-Film Solar Cells
US	8,324,499	Three-Dimensional Thin-Film Solar Cells
US	9,349,887	Three-Dimensional Thin-Film Solar Cells
US	7,999,174	Solar Module Structures And Assembly Methods For Three-Dimensional Thin-Film Solar Cells
US	8,742,249	Solar Module Structures And Assembly Methods For Three-Dimensional Thin-Film Solar Cells
US	7,786,376	High Efficiency Solar Cell
CN	ZL200780045520.2	Pyramidal Three-Dimensional Thin-Film Solar Cells
JP	5519285	Pyramidal Three-Dimensional Thin-Film Solar Cells
JP	5739037	Pyramidal Three-Dimensional Thin-Film Solar Cells
US	8,035,028	Pyramidal Three-Dimensional Thin-Film Solar Cells
US	8,035,027	Solar Module Structures And Assembly Methods For Pyramidal Three-Dimensional Thin-Film Solar Cells
US	8,847,060	Solar Module Structures And Assembly Methods For Pyramidal Three-Dimensional Thin-Film Solar Cells
US	7,745,313	Substrate Release Methods And Apparatus
US	8,293,558	Method For Releasing A Thin-Film Substrate
US	8,193,076	Method For Releasing A Thin Semiconductor Substrate From A Reusable Template
US	9,397,250	A Releasing Apparatus For Separating A Semiconductor Substrate From A Semiconductor Template
US	8,512,581	Methods For Liquid Transfer Coating Of Three-Dimensional Substrates
US	9,093,323	Methods For Selectively Coating Three-Dimensional Features On A Substrate
DE	EP2356675	Methods And Systems For Manufacturing Thin-Film Solar Cells (Validated in DE FR GB & NL)
EP	EP2356675	Methods And Systems For Manufacturing Thin-Film Solar Cells (Validated in DE FR GB & NL)
FR	EP2356675	Methods And Systems For Manufacturing Thin-Film Solar Cells (Validated in DE FR GB & NL)
GB	EP2356675	Methods And Systems For Manufacturing Thin-Film Solar Cells (Validated in DE FR GB & NL)
NL	EP2356675	Methods And Systems For Manufacturing Thin-Film Solar Cells (Validated in DE FR GB & NL)
US	8,168,465	Three-Dimensional Semiconductor Template For Making High Efficiency Thin-Film Solar Cells
US	8,664,737	Three-Dimensional Semiconductor Template For Making High Efficiency Thin-Film Solar Cells
US	9,590,035	Three-Dimensional Semiconductor Template For Making High Efficiency Solar Cells
US	8,053,665	Truncated Pyramid Structures For See-Through Solar Cells
US	8,853,521	Truncated Pyramid Structures For See-Through Solar Cells
US	8,828,517	Structure And Method For Improving Solar Cell Efficiency And Mechanical Strength
DE	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
DK	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
EP	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
FR	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
GB	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
NL	EP2387458	Porous Silicon Electro-Etching System And Method (Validated in DE DK FR GB & NL)
US	8,926,803	Porous Silicon Electro-Etching System And Method
US	8,937,243	Structures And Methods For High-Efficiency Pyramidal Three-Dimensional Solar Cells
US	9,595,622	Structures And Methods For High-Efficiency Pyramidal Three-Dimensional Solar Cells
US	8,278,192	Trench Formation Method For Releasing A Thin-Film Substrate From A Reusable Semiconductor Template
US	9,343,299	Trench Formation Method For Releasing A Substrate From A Semiconductor Template
CN	ZL201080021690.9	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor
DE	EP2419306	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor (Validated in DE FR GB & NL)
EP	EP2419306	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor (Validated in DE FR GB & NL)
FR	EP2419306	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor (Validated in DE FR GB & NL)
GB	EP2419306	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor (Validated in DE FR GB & NL)
NL	EP2419306	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor (Validated in DE FR GB & NL)
US	8,656,860	High Efficiency Epitaxial Chemical Vapor Deposition (Cvd) Reactor
US	9,099,584	Integrated Three-Dimensional And Planar Metallization Structure For Thin Film Solar Cells
US	8,445,314	Method Of Creating Reusable Template For Detachable Thin Film Substrate
US	9,053,957	Structure And Method For Creating A Reusable Template For Detachable Thin Film Substrates
CN	ZL201080030023.7	High-Productivity Porous Silicon Manufacturing Equipment
JP	5872456	High-Productivity Porous Silicon Manufacturing Equipment
US	8,999,058	High-Productivity Porous Silicon Manufacturing Equipment
US	8,420,435	Ion Implantation Fabrication Process For Thin-Film Crystalline Silicon Solar Cells
DE	EP2436028	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing (Validated in DE FR GB & NL)
EP	EP2436028	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing (Validated in DE FR GB & NL)
FR	EP2436028	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing (Validated in DE FR GB & NL)
GB	EP2436028	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing (Validated in DE FR GB & NL)
MY	MY159405-A1	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing
NL	EP2436028	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing (Validated in DE FR GB & NL)
US	8,551,866	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing
US	8,916,772	Three-Dimensional Thin-Film Semiconductor Substrate With Through-Holes And Methods Of Manufacturing
MY	MY-159267-A	Method For Fabricating A Three-Dimensional Thin-Film Semiconductor Substrate From A Template
US	8,288,195	Method For Fabricating A Three-Dimensional Thin-Film Semiconductor Substrate From A Template
US	8,294,026	High-Efficiency Thin-Film Solar Cells
CN	ZL201080063494.8	High-Efficiency Photovoltaic Back-Contact Solar Cell Structures And Manufacturing Methods Using Thin Planar Semiconductor Absorbers
CN	ZL201080063303.8	High-Efficiency Photovoltaic Back-Contact Solar Cell Structures And Manufacturing Methods Using Semiconductor Wafers
CN	ZL201080063496.7	High-Efficiency Photovoltaic Back-Contact Solar Cell Structures And Manufacturing Methods Using Three-Dimensional Semiconductor Absorbers
NO	9,196,759	High-Efficiency Photovoltaic Back-Contact Solar Cell Structures And Manufacturing Methods
US	8,962,380	High-Efficiency Photovoltaic Back-Contact Solar Cell Structures And Manufacturing Methods Using Thin Planar Semiconductor Absorbers
CN	ZL201080064953.4	Mobile Electrostatic Carriers For Thin Wafer Processing
DE	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
DK	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
EP	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
FR	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
GB	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
NL	EP2519967	Mobile Electrostatic Carriers For Thin Wafer Processing (validated in DE DK FR GB & NL);
US	9,330,952	Bipolar Mobile Electrostatic Carriers For Wafer Processing
CN	ZL201180018589.2	Double-Sided Reusable Template For Fabrication Of Semiconductor Substrates For Photovoltaic Cell And Microelectronics Device Manufacturing

Country Code	Patent Number	Title
US	8,241,940	Double-Sided Reusable Template For Fabrication Of Semiconductor Substrates For Photovoltaic Cell And Microelectronics Device Manufacturing
US	9,401,276	Apparatus For Forming Porous Silicon Layers On At Least Two Surfaces Of A Plurality Of Silicon Templates
KR	10-1381305	Passivation Methods For Achieving Ultra-Low Surface Recombination Velocities For High-Efficiency Solar Cells
KR	10-1289787	Laser Processing For High-Efficiency Thin Crystalline Silicon Solar Cell Fabrication
KR	10-1384853	Laser Processing Methods For Photovoltaic Solar Cells
US	8,399,331	Laser Processing For High-Efficiency Thin Crystalline Silicon Solar Cell Fabrication
US	9,508,886	Method For Making A Crystalline Silicon Solar Cell Substrate Utilizing Flat Top Laser Beam
US	8,637,340	Patterning Of Silicon Oxide Layers Using Pulsed Laser Ablation
US	9,455,362	Laser Irradiation Aluminum Doping For Monocrystalline Silicon Substrates
US	9,419,165	Laser Processing For Back Contact Crystalline Silicon Solar Cell Fabrication
US	9,236,510	Patterning Of Silicon Oxide Layers Using Pulsed Laser Ablation
KR	10-1369282	High Productivity Thin Film Deposition Method And System
MY	MY-158500-A	Backplane Reinforcement And Interconnects For Solar Cells
US	8,946,547	Backplane Reinforcement And Interconnects For Solar Cells
KR	10-1289789	Apparatus And Method For Repeatedly Fabricating Thin Film Semiconductor Substrates Using A Template
KR	10-1347681	High-Throughput Batch Porous Silicon Manufacturing Equipment Design And Processing Methods
US	9,076,642	High-Throughput Batch Porous Silicon Manufacturing Equipment Design And Processing Methods
US	8,906,218	Apparatus And Method For Uniformly Forming Porous Semiconductor On A Substrate
KR	10-1368598	Deposition Systems And Processes
KR	10-1384872	Method For Reconstructing A Semiconductor Template
KR	10-1449891	Self-Activated Front Surface Bias For A Solar Cell
KR	10-1532721	Spatially Selective Laser Annealing Applications In High-Efficiency Solar Cells
KR	10-1389030	Method And Apparatus For Reconditioning A Carrier Wafer For Reuse
KR	10-1396027	Ion Implantation And Annealing For High Efficiency Back-Contact Back-Junction Solar Cells
US	9,318,644	Ion Implantation And Annealing For Thin-Film Crystalline Solar Cells
AU	2012294932	High-Efficiency Solar Photovoltaic Cells And Modules Using Thin Crystalline Semiconductor Absorbers
AU	2012340098	Smart Photovoltaic Cells And Modules
US	9,293,619	Smart Photovoltaic Cells And Modules
US	9,337,374	High Productivity Spray Processing For The Metallization Of Semiconductor Workpieces
AU	2012362505	Systems And Methods For Enhanced Light Trapping In Solar Cells
KR	10-1654548	Systems And Methods For Enhanced Light Trapping In Solar Cells
US	9,583,651	Systems And Methods For Enhanced Light Trapping In Solar Cells
US	9,214,353	Systems And Methods For Laser Splitting And Device Layer Transfer
US	8,828,784	Resistance Component Extraction For Back Contact Back Junction Solar Cells
US	9,461,582	Electrical Parametric Testing For Back Contact Semiconductor Solar Cells
KR	10-1528447	Structures And Methods Of Formation Of Contiguous And Non-Contiguous Base Regions For High Efficiency Back-Contact Solar Cells
AU	2013331304	Systems And Methods For Monolithically Integrated Bypass Switches In Photovoltaic Solar Cells And Modules
CN	ZL2013800592188	Systems And Methods For Monolithically Integrated Bypass Switches In Photovoltaic Solar Cells And Modules
JP	6063577	Systems And Methods For Monolithically Integrated Bypass Switches In Photovoltaic Solar Cells And Modules
KR	10-1563851	Systems And Methods For Monolithically Integrated Bypass Switches In Photovoltaic Solar Cells And Modules
US	9,219,171	Systems And Methods For Monolithically Integrated Bypass Switches In Photovoltaic Solar Cells And Modules
US	9,515,217	Monolithic Isled (Tiled) Solar Cell (cell) For Low-Cost High-Performance Photovoltaics Modules
US	9,214,585	Annealing For Damage Free Laser Processing For High Efficiency Solar Cells
US	9,379,258	Fabrication Methods For Back Contact Back Junction Solar Cells
US	9,130,076	Trench Isolation For Monolithically Isled Solar Photovoltaic Cells And Modules
US	8,992,746	Anodizing Apparatus
CN	ZL201210505374.X	Anodizing Apparatus, An Anodizing System Having The Same, And A Semiconductor Wafer
JP	5908266	Anodizing Apparatus, An Anodizing System Having The Same, And A Semiconductor Wafer