				FIRST SOLAR		PVWatts V1		SAM 2013			PVSyst 6.02	
	Modeling Steps (Calculations)		**DESCRIPTION OF LOSS FACTORS (from First Solar)**	**LOSS FACTORS**	**DEFAULT VALUE**	**LOSS FACTORS**	**DEFAULT VALUE**	**LOSS FACTORS**	**UTILITY-SCALE DEFAULT VALUE**		**LOSS FACTORS**	**DEFAULT VALUE**
Irradiance Incident on Module Surface	Albedo (Snow, no snow)								0.2 (No Snow)			**0.2**
	Unshaded Irradiance Incident on Plane-of-Array **(POA)**	POA Orientation Normal Operation	Calculated Irradiance gain due to module tilt	Transposition on POA		Incident Total Irradiance on POA (no back track option)	Calc	Incident Total Irradiance on Plane of Array	Calc		Global incident in coll. Plane	Calculated
		Suboptimal POA Orientation	Loss due to wind-stow or non-operation of the tracker	Tracker wind stow losses		Tracking error	100%	Tracking Error	100%			
	POA Irradiance blocked by distant shading		Irradiance loss due to horizon shading	Far Shadings / Horizon		Shading	100%	Shading on subarray page	From external sources, e.g. SunEye		Irradiance loss due to far (≥ 10x PV Field) horizon shadings	Horizon (Far Shadings)
	POA Irradiance blocked by near shading		Irradiance loss due to row-on-row shading	Near Shading on Global		Shading	100%	Self-shading on array page	Calc for fixed tilt only		Near Shading Factor	1
	POA Irradiance blocked by soil on array		Average annual energy loss due to soiled modules	Soiling		Soiling	95%	Soiling	95% monthly table		Yearly or Monthly Loss Factors Applied to POA Irradiance	3.0%
	POA Irradiance blocked by snow on array					Shading	100%				Yearly or Monthly Loss Factors Applied to POA Irradiance	0.0%
	Spectral Content or Air Mass											
Light to DC Energy	Cell Temperature							Temperature calculated using 3-coefficient emperical model (a,b,dT)	a = -3.56, b = -0.075, dT = 3		Thermal Loss Factor used in thermal model	Free Standing = Uc = 29 W/m²·k Air Duct: Uc = 20 W/m²·k Fully Insulated: Uc = 15 W/m²·k
	Spectral/Air Mass Correction							Air Mass Correction	Calc (Sandia Model)	Module Model	Utilisation Factor (UF)	Calculated
	Incident Angle Correction		IAM Factor on Global	Irradiance loss due to glass reflection & absorption				Incident Angle Modifier (IAM) or Irradiance loss due to glass reflection & absorption	Calculate		Incidence Angle Modifier (Array Incidence Loss) (IAM)	Irradiance loss due to reflection that increases with the incidence angle
	Module Efficiency at Operating Conditions		Energy loss due to operation other than at STC	Non-STC Operation		Non-STC Operation	-0.5%/C temp corr	Module Performance at other than STC	Calculate		Module Performance at other than STC	Calculated
	Module Rating Correction					Nameplate Rating Correction	95%	Nameplate Rating Correction	100%		Module Quality Loss	Function of selected module
	Light-induced Degradation										Light Induced Degradation (LID) Loss Factor	module specific
	Module Degradation											
Losses in DC System	Losses in Diodes, Connectors, Fuses…		Energy loss due to DC array variability	DC Health		Diodes and connections	100%	Diodes and Connections	100%		Voltage drop across series diode	0 volts
	Losses in DC Wiring		Energy loss due DC wiring resistance	DC Wiring Loss		DC wiring	98%	DC Wiring Loss	98%		Global Wiring Loss fraction at STC, or Global Wiring Resistance	1.5%

				FIRST SOLAR		PVWatts V1		SAM 2013			PVSyst 6.02	
	Modeling Steps (Calculations)		DESCRIPTION OF LOSS FACTORS (from First Solar)	LOSS FACTORS	DEFAULT VALUE	LOSS FACTORS	DEFAULT VALUE	LOSS FACTORS	UTILITY-SCALE DEFAULT VALUE		LOSS FACTORS	DEFAULT VALUE
Array Utilization	ΣMod MPP ΣMod DC Out	Current Mismatch within String	Energy loss due to module manufacturing variability	Module Mismatch		Mismatch	98%	Mismatch	98%		Cell in module or module in array mismatch	1.0% Power Loss at MPP 2.5% loss at fixed voltage (not at MPP)
		Voltage Mismatch within Array										
		Not at MPP	Energy loss due to off-MPP tracking (clipping, etc.)	Inverter Limitation				Inverter Model with clipping. Includes cooling, and nighttime tare loss.	Calc	Inverter Model	Inverter Behavior at Limits	Maximum AC Power
DC to DC	DC to DC Efficiency		Energy loss due to inverter efficiency	Inverter Efficiency		Inverter and transformer	92%				SolarEdge Power Optimizer	
DC to AC	DC to AC Efficiency										Inverter Efficiency	Inverter Efficiency Curve based on Euro, CEC efficiency, or Custom
	Inverter Efficiency Adjustment											
	Inverter Loads, Fans, Controls...		Energy consumed by inverter cooling & heating	Inverter Cooling							Inverter cooling	Fans and night consumption
Transfomers	MV Transformer at Inverter Output		Daytime energy lost in medium voltage transformers	MV Transformers				Step-up transformer	100%		Daytime (can specifiy night disconnect) energy lost in 'low-voltage side' between inverter and transformer	Calculated Iron Loss 0.10 % (14 W) default. And Resistive/Inductive Losses at 1.00% of STC
	HV Transformer		Daytime energy lost in high-voltage transformer	HV Transformer							Daytime (can specify night disconnect) energy lost in 'high-voltage side' at the output of the transformer	Calculated Iron Loss 0.10 % (14 W) default. And Resistive/Inductive Losses at 1.00% of STC
Other AC Loads	Tracker Motors		Energy consumed by the tracker motors and controllers	Tracker Motor losses								
	Data Acquisition & Aux		Daytime energy consumed by DAS and auxilliary loads	Data Acquisition & Aux								
Losses in AC System	Plant AC Wiring Losses		Energy lost due to AC wiring resistance within the plant	AC Collection Lines		AC wiring	99%	AC wiring	99%			
	AC Wiring Losses to Interconnection (Meter)		Energy lost in first transmission line to grid interconnect	Transmission Line #1							AC circuit inverter to injection point	0%
Utility Interactions	AC Interconnection Capacity Limitation		Energy lost to control the output at the LGIA limit	AC Interconnection Capacity Limitation								
	Utility Line Loss		Credit Credit for energy lost in transmission line(s)	Utility Line Loss								
System Output	System Availability: component outages, loss of grid...					System availability	98%	System availability	100%		System Unavailability	2% at 7.30 days/yr (3 periods)
	System-Wide Degradation					Age	100%	Year-to-year decline	-0.5%/yr			

			FIRST SOLAR			PVWatts V1			SAM 2013			PVSyst 6.02				PV*SOL Expert			PR-FACT			PVSim v2.4 (SunPower)				SRCL in house model "Tester" used for testing/developing algorithms for different clients and checking performance measurements		
	Modeling Steps (Calculations)	DESCRIPTION OF LOSS FACTORS (from First Solar)	LOSS FACTORS	DEFAULT VALUE	FIRST SOLAR IMPLEMENTATION OF LOSS FACTORS	LOSS FACTORS	DEFAULT VALUE	PVWatts V1 IMPLEMENTATION OF LOSS FACTORS	LOSS FACTORS	UTILITY-SCALE DEFAULT VALUE	SAM 2013 IMPLEMENTATION OF LOSS FACTORS	LOSS FACTORS	DEFAULT VALUE	DIFFERENCE BETWEEN V5.64 & 6.02	PVSyst 6.02 IMPLEMENTATION OF LOSS FACTORS	LOSS FACTORS	DEFAULT VALUE	Implementation of Loss Factor	LOSS FACTORS	DEFAULT VALUE	Implementation of Loss Factors	DESCRIPTION OF LOSS FACTORS (SunPower)	LOSS FACTOR	DEFAULT VALUE	PVSim v2.4 IMPLEMENTATION OF LOSS FACTORS	LOSS FACTORS	DEFAULT VALUE	TESTER IMPLEMENTATION OF LOSS FACTORS
Unshaded Irradiance Incident on Plane-of-Array (POA)	Albedo (Snow, no snow)			0.2						0.2 (No Snow)			0.2		The Albedo component is the irradiance reflected by the ground "seen" by the plane : AlbInc = ρ * GlobHor * (1 - cos i) / 2 where i = plane tilt and ρ is the albedo coefficient. May be defined in monthly values (snow)	Yearly or Monthly Loss Factors	0.2		Usually not stated since taken as determined by METEONROM 6.1			Diffuse reflectivity or reflecting power of a surface		20%	Albedo is an input in the POA irradiance model; minor contributor to power production, given normal combinations of tilt & incident angles	User chosen Albedo per month	Albedo 0.2 if no snow	
	POA Orientation Normal Operation	Calculated Irradiance gain due to module tilt	Transposition on POA	Calc		Incident Total Irradiance on POA (no back track option)	Calc		Incident Total Irradiance on Plane of Array	Calc		Global incident in coll. Plane	V5: Hay Model as Default V6: Perez Model as Default		Highly depends on the diffuse part (with any transposition model) Diffuse model (if diffuse not in the data) = Liu-Jordan (Erbs) correlation - Not very good…	Incident Total Irradiance on Plane of Array	Calculated		Global plane-of-array irradiation	Calculated		Plane-of-Array Irradiance: available solar irradiance normal to the glazing surface on flat-plate PV		Calculated	Perez DNI & Tilted-plane anisotropic sky models; Not displayed as a gain/loss in the PVSim loss table	Global incident in coll. Plane	Calculated or imported from TMY, meteonorm etc. Allows no tracking if cloudy, etc.	
	Suboptimal POA Orientation	Tracker not working/mistracking/ misalignment							Tracking Error	100%												Loss due to tracker drift	Tracker misalignment loss	0.5% for CPV, 0% otherwise	Static loss applied at the array level. Dynamic model is under development	Tracking Error from non optimal tracking	user defined tracking limits or steps;	
		Tracker stow due to wind	Tracker wind stow losses	Calc		Tracking error	100%								Specified stroke mechanical limits, backtracking													
	Calculate Spectral Content or Air Mass		Spectral Sift for CdTe	Calc									Acc. To CREST calculations		For Amorphous modules "convolution integral between the incident spectrum and the spectral sensitivity." "The fraction of the spectrum effectively usable for generating photocurrent" Reference to this is from measurement in European climates only. Not advised for CdTe											If not measured then Clear sky defined from solar altitude; constant factor (blue rich) under diffuse conditions	100nm bins 350-1050nm	
Irradiance Obstructers	POA Irradiance blocked by distant shading	Irradiance loss due to horizon shading	Far Shadings / Horizon	0%		Shading	100%		Shading on subarray page	From external sources, e.g. SunEye		Irradiance loss due to far (≥ 10x PV Field) horizon shadings	Horizon (Far Shadings)		Impact on beam component as either 'on' or 'off'. Some diffuse effect. "integral of an isotropic radiation over portion of sphere "seen" by the plane, above the horizon line, independent of sun position." Diffuse factor based on distance to far shading object. Diffuse factor decreases (from 1) as far object increases in size. Albedo decreases at the same time as far object increases in size.	Irradiance loss due to far horizon shadings	No Shading		Correction factor for horizon shadowing	Calculated		Loss due to shade from environmental obstructions	Site Shading Loss	From external sources, e.g. SunEye	Percent site shading input (monthly or annual) applied at the array level	Far Shadings / Horizon user defined every 10° of azimuth	Diffuse irradiance only when sun behind shading	
	POA Irradiance blocked by near shading	Irradiance loss due to row-on-row shading	Near Shading on Global	Calc		Shading	100%		Self-shading on array page	Calc for fixed tilt only		Near Shading Factor	1		No shading, linear ("Irradiance Loss") shading (default 100%), or shading according to module strings with fraction (default 80%) for electrical effect. Function of beam, diffuse, albedo (issue with first row of 'shed'), and electrical losses (on beam only).	Calculated with 3D model	Calculated		Correction factor for mutual shadowing	Calculated		Loss due to shade from within the array	Inter-Array Shading Loss	Calculated for all systems except residential rooftop	Internally-developed geometry model calculates array shading for every interval in the simulation	"self shading" (regular arrays) ok "random near shades" (poles etc.) Not yet modelled	100%	
	POA Irradiance blocked by soil on array	Average annual energy loss due to soiled modules	Soiling	Measured		Soiling	95%		Soiling	95% monthly table		Yearly or Monthly Loss Factors Applied to POA	3.0%	V5: DC Array Loss V6: Irradiance Loss	Completely depends on the situation. Default value doesn't make sense.	Output losses due to Pollution	0.0%		Correction factor for effect due to soiling	Calculated		Irradiance loss due to soiling	Soiling Loss	Static annual (user-specified) or dynamic hourly model	Dynamic model is based on Kimber soiling model	Daily soiling factors from increase in dry periods and wash off from rain	User choice ~0.1-0.25%/dry day ~1-3mm rain/24h to wash clean	
	POA Irradiance blocked by snow on array		Included in Soiling			Shading	100%					Yearly or Monthly Loss Factors Applied to POA Irradiance	0.0%		Included in the soiling factor. No information about "Lying snow" in the meteo data.	Output losses due to Pollution	0.0%		Correction factor for effect due to snow coverage	0.0%			Snow Cover Loss		Production set to zero for days with snow cover; determined by user input or from weather data. Planned to be included in next PVSim release	Monthly input or Snow loss from TMY snow depth	Exponential drop with user chosen snow depth	
Module Conversion Efficiency	Incident Angle Correction	IAM Factor on Global	Irradiance loss due to glass reflection & absorption	Calc					Incident Angle Modifier (IAM) or Irradiance loss due to glass reflection & absorption	Calc		Incidence Angle Modifier (Array Incidence Loss) (IAM)	Irradiance loss due to reflection that increases with the incidence angle		Calculated for each sub-array using ASHRAE model with bo of 0.05 for crystalline modules, or user defined profile. Calculated as an integral (like for shading factors) for diffuse component (considered isotropic). This is the dominant contribution.	Incidence Angle Modifier (Array Incidence Loss) (IAM)	Calculated. Default IAM at an angle of 50° is 95%		Correction factor for effect due to IAM	Calculated	Based on model of Martin et al.		Angle-of-Incidence Loss	Calculated	Sandia Photovoltaic Array Performance Model	Incidence Angle Modifier (Array Incidence Loss) (IAM) from Beam Fraction	curve fit to x% at 75degree loss from beam component; assumed constant from diffuse	
	Spectral/Air Mass Correction								Air Mass Correction	Calc (Sandia Model)		Utilisation Factor (UF)	Calculated (correlation) f(Air Mass and Kt)		Spectral Correction applied only to Amorphous Silicon. Possibility of using the Spectral correction of the Sandia model when using the Sandia model for PV modules in the simulation.	Losses due to deviation from standard spectrum AM 1.5	1%		Correction factor for effect due to spectral variations	Cell Technology dependent	Default value depending on cell technology		Air Mass Adjustment	Calculated		If not measured then Extrapolated / Interpolated from SR at AM1, AM1.5 and AM3	100%	
	Calculate Cell Temperature	Energy loss due to operation other than at STC	Non-STC Operation	Calc					Temperature calculated using 3-coefficient emperical model (a,b,dT)	a = -3.56, b = -0.075, dT = 3	Module Model	Thermal Loss Factor used in thermal model (energy balance)	Free Standing = Uc = 29 W/m²·k Air Duct: Uc = 20 W/m²·k Fully Insulated: Uc = 15 W/m²·k	V5.64: User can opt to input default NOCT (45C) as opposed to using Uc and Uv coefficients.	Temperature calculated using thermal model. "Determined by an energy balance between ambient temperature and cell's heating up due to incident irradiance" If no wind velocity is stated, default added to Uc calculation is 1.5 m/s	Thermal Loss Factor used in thermal model	Free-standing installation: ΔT_{1000} = 20°C Roof integration, rear ventilation: ΔT_{1000} = 30°C Roof or facade integration, no rear ventilation: ΔT_{1000} = 45°C				Module temperature determined based on mounting situation	Thermal losses due to cell voltage & current response to operating temperature	Operating Temperature Adjustment	Calculated	Module Model Internally-developed energy balance model	From NOCT calcs with exponential wind cooling	~ 3.5C/sun/(ms^-1) at ws=0, falls to 0 at 10ms^-1	
	Module Efficiency vs. Temperature					Non-StTC Operation	-0.5%/C temp corr		Module Performance at other than STC	Calc		Thermal Loss Factor used in thermal model (energy balance) Module Performance at other than STC	Free Standing = Uc = 29 W/m²·k Air Duct: Uc = 20 W/m²·k Fully Insulated: Uc = 15 W/m²·k Calculated One-diode model			Module Performance at other than STC	Calculated		Correction factor for effect due to module temperature (module temperatur determined based on…)	Calculated					Sandia Photovoltaic Array Performance Model	Modelled from Low light losses (200W/m²) I²R losses and Temperature derating	Calculated, default low light = 95% data from LFM	
	Module Efficiency vs. Irradiance																		Correction factor for effect due to low irradiance behaviour of PV modules	Calculated		Module operating efficiency relative to the standard test condition	Efficiency vs. Irradiance Adjustment	Calculated				
	Module Rating Correction					Nameplate Rating Correction	95%		Nameplate Rating Correction	100%		Module Quality Loss	1/4 of the distance between low and high tolerance specifications	V5: 1/2 the inferior tolerance V6: 1/4 the tolerance between low and high specifications	Default in V5: Half the inferior tolerance. Default in V6: a quarter of the distance between low and high tolerance specifications	Nameplate Rating Correction for each subarray	No Correction		Correction factor for effect due to power tolerance at delivery	Calculated	From datasheet tolerance or as given by information from flasherlist	Delivered mean/median DC flash rating relative to nameplate rating	Module Flash Adjustment	0% if no flash data available	Estimated on a per-SKU basis from flash data taken at manufacturing facilities for SunPower modules	Pactual / Pnominal user choice	100.0%	
	Light-induced Degradation											Light Induced Degradation (LID) Loss Factor	module specific	Light Induced Degradation (LID) Loss Factor added in 6.02	0% to 10% range of input values. No general default value possible (depends on the technology and quality)								Module LID Adjustment	2% for most crystalline modules, 0% for non-Boron doped crystalline modules		User defined (should be allowed by manufacturers)	technology specific	
	Module Degradation																								Covered in System Wide Degradation	Linear / year	after LID default -0.5%/y	
	Seasonal Annealing																									Some thin film only allows better autumn/ worse spring	up to ±5%/y	
n DC em	Losses in Diodes, Connectors, Fuses…	Energy loss due to DC array variability	DC Health	1.50%		Diodes and connections	100%		Diodes and Connections	100%		Voltage drop across series diode	0 volts		May be specified in the wiring loss definitions	Losses in Diodes	0.5%								Minor contributor to total loss; accounted for in DC Wiring Loss	not modelled yet	100%	

	Modeling Steps (Calculations)	DESCRIPTION OF LOSS FACTORS (from First Solar)	FIRST SOLAR LOSS FACTORS	FIRST SOLAR DEFAULT VALUE	FIRST SOLAR IMPLEMENTATION OF LOSS FACTORS	PVWatts V1 LOSS FACTORS	PVWatts V1 DEFAULT VALUE	PVWatts V1 IMPLEMENTATION OF LOSS FACTORS	SAM 2013 LOSS FACTORS	SAM 2013 UTILITY-SCALE DEFAULT VALUE		SAM 2013 IMPLEMENTATION OF LOSS FACTORS
Losses Syst	Losses in DC Wiring	Energy loss due DC wiring resistance	DC Wiring Loss	1.5% @ STC		DC wiring	98%		DC Wiring Loss	98%		
Array Utilization	ΣMod DC Out / ΣMod DC MPP — Current Mismatch in String & Voltage Mismatch in Array	Energy loss due to module manufacturing variability	Module Mismatch	1.50%		Mismatch	98%		Mismatch	98%		
		Energy Loss due to Temperature Gradient										
		Energy Loss due to partial shading										
	Not at Array MPP	Energy loss due to clipping due to utility constraints										
		Energy loss due to clipping due to high inverter operating temperature										
		Energy loss due to imperfect MPPT										
		Energy loss due to clipping due to inverter capacity limit	Inverter Limitation						Inverter Model with clipping. Includes cooling, and nighttime tare loss.	Calc	Inverter Model	
DC to DC	DC to DC Efficiency	Energy loss due to inverter efficiency	Inverter Efficiency	Calc		Inverter and transformer	92%					
DC to AC	DC to AC Efficiency											
	Inverter Efficiency Adjustment											
	Inverter Loads, Fans, Controls…	Energy consumed by inverter cooling & heating	Inverter Cooling	Calc								
Transfomers	MV Transformer at Inverter Output	Daytime energy lost in medium-voltage transformers	MV Transformers	0.3% no load / 0.7% full load					Step-up transformer	100%		
	HV Transformer	Daytime energy lost in high-voltage transformer	HV Transformer	0.1% no load / 0.7% full load								
Other AC Loads	Tracker Motors	Energy consumed by the tracker motors and controllers	Tracker Motor losses	Calc								
	Data Acquisition & Aux	Daytime energy consumed by DAS and auxilliary loads	Data Acquisition & Aux	200 W/PCS								
Losses in AC System	Plant AC Wiring Losses	Energy lost due to AC wiring resistance within the plant	AC Collection Lines	1%		AC wiring	99%		AC wiring	99%		
	AC Wiring Losses to Interconnection (Meter)	Energy lost in first transmission line to grid interconnect	Transmission Line #1	Calc								
Utility Interactions	AC Interconnection Capacity Limitation	Energy lost to control the output at the LGIA limit	AC Interconnection Capacity Limitation	Calc								
	Utility Line Loss	Credit for energy lost in transmission line(s)	Utility Line Loss	Calc								
System Output	System Availability: component outages, loss of grid…		Part of O&M guarantee, not energy estimate	0		System availability	98%		System availability	100%		
	System-Wide Degradation					Age	100%		Year-to-year decline	-0.5%/yr		

Modeling Steps (Calculations)	DESCRIPTION OF LOSS FACTORS (from First Solar)	PVSyst 6.02 LOSS FACTORS	PVSyst 6.02 DEFAULT VALUE	DIFFERENCE BETWEEN V5.64 & 6.02	PVSyst 6.02 IMPLEMENTATION OF LOSS FACTORS	PV*SOL Expert LOSS FACTORS	PV*SOL Expert DEFAULT VALUE	PV*SOL Expert Implementation of Loss Factor
Losses in DC Wiring	Energy loss due DC wiring resistance	Global Wiring Loss fraction at STC, or Global Wiring Resistance	1.5%		Default of 1.5% at STC, or calculated in mOhm based on detailed wiring computation. Calculated at each simulation step (goes with $Rw * I^2$)	Cable length and Cross section	10 meters	
Current Mismatch in String & Voltage Mismatch in Array	Energy loss due to module manufacturing variability	Cell in module or module in array mismatch	1.0% Power Loss at MPP 2.5% loss at fixed voltage (not at MPP)	2.0% Power Loss at MPP 4.0% loss at fixed voltage (not at MPP) version 5.64 defaults	Still some work to do on this topic. Especially include possibility of importing specified set of modules, and evaluate the mismatch evolution with annual degradation dispersion	Mismatch due to module mfg variability	2%	
	Energy Loss due to Temperature Gradient							
	Energy Loss due to partial shading	Shading Factor according to strings				Mismatching due to shading within string and array is calculated	Calculated	
Not at Array MPP	Energy loss due to clipping due to utility constraints							
	Energy loss due to clipping due to high inverter operating temperature							
	Energy loss due to imperfect MPPT	Inverter Behavior at Limits	Maximum AC Power					
	Energy loss due to clipping due to inverter capacity limit				Min and max Power limits, Min and max voltage limits	Inverter Behavior at Limits	Calculated	
DC to DC Efficiency	Energy loss due to inverter efficiency	SolarEdge Power Optimizer			No mismatch losses, near shadings are defined as 'linear'	MPP matching Efficiency	Calculated	
DC to AC Efficiency		Inverter Efficiency	Inverter Efficiency Curve based on Euro, CEC efficiency, or Custom		Also customized efficiency profile. May be defined for 3 input voltages.	Inverter Efficiency Curve	Calculated	
Inverter Efficiency Adjustment								
Inverter Loads, Fans, Controls…	Energy consumed by inverter cooling & heating	Inverter cooling	Fans and night consumption	Inverter Cooling and auxillary consumption added in 6.02		Stand-By Consumption and Night Consumption	Database	
MV Transformer at Inverter Output	Daytime energy lost in medium-voltage transformers	Daytime (can specifiy night disconnect) energy lost in 'low-voltage side' between inverter and transformer	Default is 0.1% of Pnom (AC)		To be developed soon: tool for normalizing to the Transformer nominal power			
HV Transformer	Daytime energy lost in high-voltage transformer	Daytime (can specify night disconnect) energy lost in 'high-voltage side' at the output of the transformer	Default is 0.1% of Pnom (AC)					
Tracker Motors	Energy consumed by the tracker motors and controllers							
Data Acquisition & Aux	Daytime energy consumed by DAS and auxilliary loads							
Plant AC Wiring Losses	Energy lost due to AC wiring resistance within the plant							
AC Wiring Losses to Interconnection (Meter)	Energy lost in first transmission line to grid interconnect	AC circuit inverter to injection point	0%		Specify the cable length and diameter (or resistivity) Either before or after the transformer if any			
AC Interconnection Capacity Limitation	Energy lost to control the output at the LGIA limit				Should be defined through the Pnom(AC) inverter capability.			
Utility Line Loss	Credit for energy lost in transmission line(s)							
System Availability: component outages, loss of grid…		System Unavailability	2% at 7.30 days/yr (3 periods)	System Unavailbility added in 6.02	This can be scheduled as a "fraction of time or number of days" Periods of unavailability can also be defined randomly before the simulation			
System-Wide Degradation						Year-to-year decline	0%	

Modeling Steps (Calculations)	DESCRIPTION OF LOSS FACTORS (from First Solar)	PR-FACT LOSS FACTORS	PR-FACT DEFAULT VALUE	PR-FACT Implementation of Loss Factors	PVSim v2.4 (SunPower) DESCRIPTION OF LOSS FACTORS (SunPower)	PVSim v2.4 LOSS FACTOR	PVSim v2.4 DEFAULT VALUE		PVSim v2.4 IMPLEMENTATION OF LOSS FACTORS	SRCL in house model "Tester" used for testing/developing algorithms for different clients and checking performance measurements — LOSS FACTORS	Tester DEFAULT VALUE	TESTER IMPLEMENTATION OF LOSS FACTORS
Losses in DC Wiring	Energy loss due DC wiring resistance	Correction factor for effect due to voltage drop on DC wiring	Calculated			DC Wiring Loss	1.0%-1.5%		Either an annual loss OR dynamically calculated as a function of cable lengths and specs	DC Wiring Loss	I^2R, x% at I.stc	
Current Mismatch in String & Voltage Mismatch in Array	Energy loss due to module manufacturing variability	Correction factor for effect due to mismatch	Calculated	Based on model of Deist, Laschinski and Wagner	Module current & string voltage mismatch Loss	Module Mismatch Loss	0.8%-1.0%		Applied as a static loss to the array voltage just before the inverter	not modelled yet		
	Energy Loss due to Temperature Gradient											
	Energy Loss due to partial shading											
Not at Array MPP	Energy loss due to clipping due to utility constraints									user can define behaviour outside mpp limits and over Pin	0%, constant efficiency or constant Pmax	
	Energy loss due to clipping due to high inverter operating temperature											
	Energy loss due to imperfect MPPT	Correction factor for effect due to MPP tracking efficiency of inverter	Estimated									
	Energy loss due to clipping due to inverter capacity limit			Estimated based on test results and/or the like								
DC to DC Efficiency	Energy loss due to inverter efficiency				Losses associated with inverter efficiency and operating limits	Inverter DC Limit Loss, Inverter Efficiency Loss, Inverter AC-Capacity Clipping Loss	Calculated	Inverter Model	Sandia Performance Model for Grid-Connected Photovoltaic Inverters, based on CEC inverter test data	not modelled yet		
DC to AC Efficiency		Correction factor for effect due to conversion efficiency of inverter	Calculated							Inverter Efficiency from Sandia Inverter model		
Inverter Efficiency Adjustment		Correction factor for effect due to power limitation of inverter (Sizing ratio)	Calculated									
Inverter Loads, Fans, Controls…	Energy consumed by inverter cooling & heating	Correction factor for effect due to inverter aux. Consumption	Calculated	Without stand-by and night					Captured in LV Auxiliary Load Loss (below)	not modelled yet		
MV Transformer at Inverter Output	Daytime energy lost in medium-voltage transformers	Correction factor for effect due to medium voltage transformer	Calculated	Without stand-by and night		Padmount/Integrated Transformer Loss	Annual loss dependent on project type Res: 100 Comm Roof: 99		Annual loss percentage OR variable loss calculated as a function of no-load loss, peak variable loss, and grid voltage factor. Ability to specify whether to include nighttime loads.	Simple loss	I^2R, x% at I.stc	
HV Transformer	Daytime energy lost in high-voltage transformer	Correction factor for effect due to high voltage transformer	Calculated	Without stand-by and night		HV Step-Up Transformer Loss	Annual loss dependent on project type Res & Comm Roof: 100		Annual loss percentage OR variable loss calculated as a function of no-load loss, and peak variable loss. Ability to specify whether to include nighttime loads.			
Tracker Motors	Energy consumed by the tracker motors and controllers					LV Auxiliary Load Loss, MV Auxiliary Load Loss	System type-dependent Res: 0 Comm Roof: 0		Constant loads applied. Ability to specify whether to include nighttime loads.	not modelled yet		
Data Acquisition & Aux	Daytime energy consumed by DAS and auxilliary loads									not modelled yet		
Plant AC Wiring Losses	Energy lost due to AC wiring resistance within the plant	Correction factor for effect due to power loss on AC low voltage wiring	Calculated			MV Collector Loss	Annual loss dependent on project type		Annual loss percentage OR variable loss calculated as a function of no-load loss, peak variable loss, and grid voltage factor	Simple loss	I^2R, x% at I.stc	
AC Wiring Losses to Interconnection (Meter)	Energy lost in first transmission line to grid interconnect	Correction factor for effect due to power loss on AC medium voltage wiring	Calculated			Transmission Line Loss	Annual loss dependent on project type Res : 0.2 Comm Roof: 1.00		Annual loss percentage OR variable loss calculated as a function of no-load loss, and peak variable loss			
AC Interconnection Capacity Limitation	Energy lost to control the output at the LGIA limit				Curtailment loss due to LGIA limits	Interconnect Curtailment Loss	Project-specific		Applied by constraining calculated system output at the interconnect to a specified limit	not modelled		
Utility Line Loss	Credit for energy lost in transmission line(s)						Project-specific		Applied as a fixed loss to net annual energy; Post-processing step (if applicable)			
System Availability: component outages, loss of grid…		Correction factor for effect due to availability	Estimated depending on number of key components (either inverter or transformer)		Annual energy loss due to component outages, loss of grid, response time, etc.	Annual Availability Loss	98-99%/yr		Set by user depending on O&M site management level, & applied by reducing AC Energy output of every interval in simulation by availability loss	random downtime	user choice	
System-Wide Degradation		Correction factor for effect due degradation of PV modules	0.4 % p.a. for c-Si / 0.3...0.7 % p.a. for thin-film (depending on manufacturer statement and/or on basis of literature review)		Degradation of system components over time, dominated by module degradation		0.25%/yr		Degradation applied in PVSim's post-processing tool for calculating long-term production			