Solar PV Portfolio Owner What Management Solution Should I Buy ?

Options - Total Cost

- No monitoring
- Inverter manufacturer portal
- SolarVu equipment portals/enterprise
- Asset management software

Show me the money !

Minimize downtime = maximize energy revenue Reduce O&M costs, faster fault notification Meet LDC compliance requirements Verify correct LDC payments Performance analysis & financial reports

Energy Portal Selection Considerations

Product benefits & features Single interface for many brands of equipment Initial & ongoing cost Vendor competence & reputation Vendor support Future expansion flexibility

Example 20MW Portfolio

of 100 sites at 200kW ea 65,000 panels 5,400 strings 800 25kW inverters



INITIAL COST INVERTER OEM MONITORING SOLORYOU EMERGY PORTAL 1st YEAR 20 YEARS

A comprehensive monitoring system offsets its initial cost by minimizing downtime with effective O&M and reporting

REVENUE LOSS FROM FAULTY EQUIPMENT

1 String 4,500kWh/yr = **\$2,500/yr** 25kW inverter 31MWh/yr = **\$18,000/yr** = **\$1,500/mo** 200kW site shut down 1,200kWh/summer day = **\$760/day**



Solar PV Managment Issues

STUFF HAPPENS

COMMISSIONING

Incorrect comms settings in inverters and BOS devices Serial wiring errors by electrician Meter CT/PT wiring errors/settings Router network settings Weak 3G cellular reception Wrong/missing equipment data supplied

EQUIPMENT FAILURE

Inverter failure Solar panels fail Corroded connections Loose connection = overheating, fire hazard Equipment left off after maintenance BOS equipment failure weather sensors, meter, SCADA etc

ENVIRONMENT

Combiner box water ingress Rodent chews through panel wires Lightning damages equipment Grid issues cause shutdown - under/over voltage Snow cover / dirt buildup

COMMUNICATIONS

Loss of internet connection Router/network configuration Customer changes router settings Router/ network failure 3G SIM card disconnected non-payment Weak reception in rural areas Equipment loss of communications

Faulty connection Incorrect settings after replacement Noisy environment, data corruption Inverter design - firmware bugs

GETTING PAID

Utility payment below expected - meter fault / accounting LDC SCADA problem = shutdown by LDC RMA for warranty claim - support data











Combiners



SCADA & BOS equipment





Managing A Large Distributed Portfolio

Portfolio Summary for owner, O&M, investors

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fi l	٠		Stanfield 2562	224 Days	5,168 lb	60 %	400 kW	21,907 kWh	\$ 0.54	\$ 11,808
6			Corporate 1205	256 Days	6,753 lb	62 %	500 kW	28,628 kWh	\$ 0.54	\$ 15,430
7		۲	Atherley 130	155 Days	713 lb	20 %	160 kW	3.021 kWh	\$0.54	\$ 1,628
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9	•	۰	640 Rowntree Dairy	316 Days	2.414 lb	45 %	250 kW	10.235 kWh	\$ 0.54	\$ 5.527
0	٠	۲	Trowers 164	252 Days	518 lb	48 %	50.0 kW	2,196 kWh	\$0.55	\$ 1,203
1	۲	٠	Passmore 328	225 Days	2,605 lb	45 %	250 kW	11,045 kWh	\$ 0.54	\$ 5,953
2	٠	٠	West Beaver Creek # 135	268 Days	1,846 lb	43.%	200 kW	7.824 kWh	\$ 0.54	\$ 4,217
3	٠	۲	Emblem 50	206 Days	2,297 lb	39 %	300 kW	9,738 kWh	\$ 0.54	\$ 5.249
4	•	۲	Bertal #60	186 Days	1,805 lb	56.%	150 kW	7.656 kWh	\$ 0.54	\$ 4.127
5	٠	٠	50 McCleary	310 Days	2,029 lb	47%	200 kW	8,603 kWh	\$0.54	\$ 4,637
6	٠	٠	420 Passmore	319 Days	1,242 lb	28 %	200 kW	5,266 kWh	\$ 0.54	\$ 2,838
7	٠		651 Harwood	350 Days	1,391 lb	13 %	500 kW	5,898 kW/v	\$ 0.54	\$ 3.179
8			Fima 37	252 Days	429 lb	66 %	30.0 kW	1.819 kWh	\$ 0.55	\$ 997

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SolarVu SMART Enterprise Benefits

Portfolio alarm status	Print custom reports
Diagnostic tools	🗹 View / download
Reduce routine checks	Online document retri
✓ One GUI for mixed vendors	Download data for an
✓ One login for all sites	✓ Free to SolarVu owner

S	Print custom reports
	View / download

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Detailed screens by site

Solar Flow Th

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Live & lifetime energy/revenue



Portfolio performance reports

Cachelan

Equipment status & logs



Troubleshooting tools



Email performance reports & alarm notifications



SolarVu gateway enclosure





Site conditions



LDC SCADA monitor/control





Energy Portal Requirements

SolarVu portals address these issues

Debug wiring, network, comms settings, equipment settings Prove all devices 100% working before signoff & payment Performance meets specs, monitor after initial installation LDC SCADA testing & signoff for connection permission

MAINTENANCE

Alarms - immediate email faults, abnormal conditions eg sun low power, equipment faults Live status, Enterprise view of faults - navigate to site for details, by exception Understand problem before dispatch to minimize site labour & visits. Bring correct spares Diagnostic Tools for O&M service provider

Live inverter/meter values,

Equipment logs text and data last 30 days - detects intermittent problems Internet communication live status and 30 day reception log String level monitoring

Compare inverters to detect bad strings, performance problems

Best days - prove system achieves design capacity

Local weather conditions, panel snow cover, roof conditions (cameras) Communications

LAN network, setup settings, dropout

3G cellular SIM setup, antenna rural reception, bill management, renewals Notification

Email status and alarms with cause of fault, location, link to diagnostic screen Alarm indicators on screens

Single user interface for all equipment now and in future

Access anywhere - PC, phone, tablet, multiple locations, no software-browser access Documents and records

Online document retrieval, roof layout, manuals, error codes, drawings Online help & videos

V REPORTING & ANALYSIS

Live browser view any time period \$, energy, performance, carbon offset On demand PDF reports for any time period, required parameters, by all sites or subgroups Portfolio financial performance reports Human data download for spreadheet analysis

API for server data transfer to support Asset Manager Software programs Compare to similar sites

Verify utility payment for period is correct. Data to back up claims 3G SIM card management, view status, control on/off bill verification Equipment failure - data to expedite RMA warranty claim O&M provider maintenance records by site

FUTURE EXPANSION

Additional LDC compliance requirements- inverter control, power output New OEM devices - inverters, combiners, power opimizers, Storage - monitor, TOU (time of use control) FIT subsidies replaced by net metering & behind the meter EV charge control & metering





Installing SolarVu

For Each Project

Cachelan prepares SLD for communications showing options & connections from system details



Detailed quote for approval based on budget summary

Cachelan United States		3-102
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From quote select suitable options for each location

Standard SolarVu portal alarms, equipment logs, diagnostics, reports

- + WeatherTrak irradiance SunLowPower alarm for every inverter
- + SnoCam Local weather, roof snow cover
- + PayCheck Meter & log to verify utility payments
- + 3G cellular (if no LAN) + dataplan from Cachelan
- + LDC SCADA if required in CIA by LDC, design to spec & commission



Ship to installer



Add to Enterprise account

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cachelan.com			2345215 0	intario Inc.	Last 10 Days - From Jan 20, 2016 To Full 10				
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Learn More

Visit cachelan .com

Web pages and Videos describing features <u>SolarVu brochure</u> See live sites that use SolarVu

Installation guides, technical resources





SolarVu[®] INSTALLATION GUIDES Inverters -

AE 35-100TX (PVPowered PVP35-100kW) AE 250TX (PVPowered PVP250kW) AE 500TX (PVPowered PVP500kW) AE 500TX (AE Solaron 500 kW) AE 3TL(REFUsol) Canadian Solar CSI-23/28/36KTL-CT Eaton PV Series Fronius IG Plus V(422 Comm Card - IFP) Fronius IG Plus V(Modbus Comm Card - DataCom) Fronius Symo(DM2 Modbus) Kaco Blueplanet Kaco XP10U Kaco TL3 Kaco XP100 Series Outback Flex, FlexMax, FX, MX, Mate PowerOne PVI5000/6000/10/12 Santerno TG NA Satcon PG Plus Schneider Conext CL18000/25000 Schneider Xantrex GT5 Schneider Xantrex GT250 SMA Sunnyboy Series SMA Sunny Tripower TL Series(Speedwire) SolarEdge SE Series Solectria PVI-3000/4000/5000/5500 Solectria PVI 10-90K Sungrow Central Inverters Sundrow SG30/36KU Sunergy ELV

Accessories + BROCHURES

SolarVu[®] Energy Portal NRGPilot™ SmartGrid Portal WebFilm[®]

VIDEOS

Tutorials -Solar/Vu Tour Solar/Vu SMART Enterprise What is Solar/Vu? Solar/Vu WeatherTrak Solar/Vu Ark Fault Alarm Solar/Vu ANALYZER - Equipment Log Solar/Vu ANALYZER - Smart Strings K135 Indicators Fronius Installation Education +

NEWSLETTERS -

How much money did you make on Family Day? Solar PV Reports - 1 2 3 DONE! FIT4 Contract or Net Metering Its Sunny - Where Are My Watts? New Years Resolution - Solar PV Carbon Tax Calculator MicroGrids Monitor DG Storage 21st Century Archemedes Enterprise - Many Vendors, One Interface SolarVu Tour Not Your Grampas Weather Station Arc Faults Needle in a Haystack To Shovel or Not to Shovel No Jacket Required O&M Use the right tools Does your CIA require SCADA? Stuff Happens And the Winner Is Winter Blahs Show Me the Money

TECHNICAL & HOW TO +

GRAPHICS +



