

Phoventus
10 YEARS
EST. 2009

BANKABILITY CREDENTIALS

PHOVENTUS BANKABILITY

The concept of bankability is critically important in the Renewable Power business due to the rapid growth of the PV and Wind Power market and the arrival of numerous new players all through the value chain.

SERVICES

- Independent Engineer
- Development Advisory
- Resource Consulting
- Construction Monitoring
- M&A Recapitalizations
- Advanced Technologies
- Asset Management
- Environmental Management
- Conflict Support



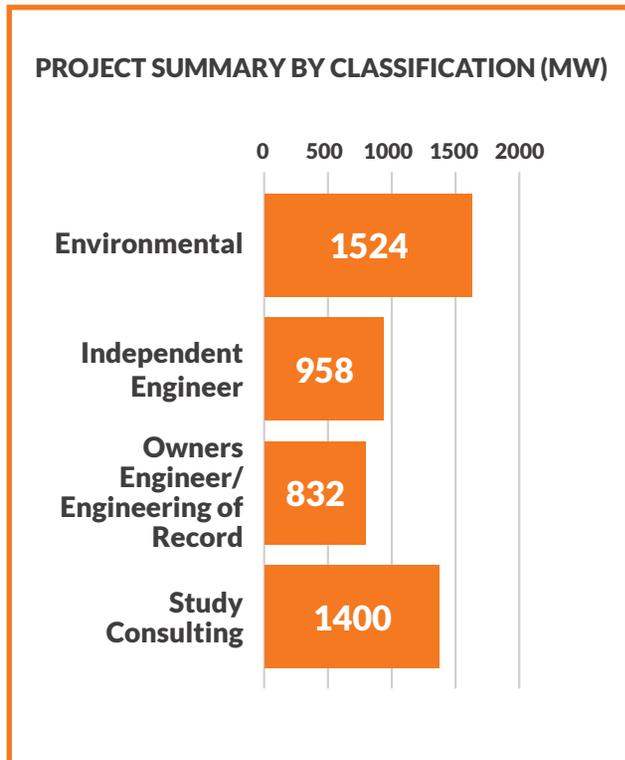
10 years of consulting and advisory service and a reputation for excellence in customer service.



Phoventus originally founded as Lydan Partners Inc in 2009 and rebranded Phoventus in 2016.



DEMONSTRATED EXPERIENCE AND LOCATIONS



INDUSTRY COLLABORATION



SELECT PROJECTS



*Size: 15 MW
Type: Solar
Location: Massachusetts*

Phoventus provided project management services for the late stage development and construction of this portfolio of 5 community solar projects. We supported the acquisition of the projects and managed the team in obtaining Interconnection Supply Agreements with National Grid, module procurement, detailed engineering, project controls, contracting and construction.



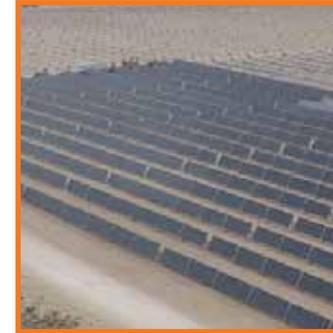
*Size: 33 MW + Storage 12Mwh
Type: Single Axis and L-ion Storage
Owner: Innergex
Location: Hawai'i*

The Hale Kuawehi Solar-Plus-Battery-Storage Project is a 33 MWac solar PV and battery energy storage project located in Hawai'i, in the United States. The project is in development and currently undergoing PPA negotiations. In November of 2018, Phoventus reviewed proposed methods of quantifying the performance of the plant for contractual purposes. Phoventus suggested an alternative MPR calculation based on the ASTM E2848-13(2018) standard for performance testing, along with the measurement standards recommended by the ASTM standard



*Size: 13MW/ 53MWh
Type: Energy Storage
Location: Ontario*

Phoventus reviewed the business case and completed a technical analysis of the Leclanché battery technology for a prospective buyer of the battery system. This system has a contract under IESO Energy Storage Procurement Phase 1 to provide ancillary grid services.



*Size: 250MWac
Type: Solar PV
Owner: Innergex Renewable Energy
Location: Texas*

Full Due Diligence services and energy production estimates for various technological scenarios using PVsyst 6.60. and FLSR Plant Predict Estimates were done over a 35-year period to show the effect of module degradation on production.

The project was modelled in different configurations to verify results.

Module = FSLR Series 6



*Size: 996 MW (513) Projects
Type: Dual Axis, Single Axis and Fixed PV
Owner: Terraform Power*

Phoventus completed a series of multi-scope site inspections for four NERC compliant utility-scale PV solar facilities, net 377 MWdc of installed capacity. Scope of inspections included data collection for arc-flash studies, a comprehensive parts catalogue of equipment in use, as well as an inspection of spare parts inventory. Including completed a Failure Mode Effect Analysis (FMEA) for approximately 500 MW of installed capacity, on a part-by-part basis. For each component in each project, a Risk Priority Number (RPN) was calculated, indicating the impact of failure of that part. Though this methodology, critical components were identified as necessary for spare parts stocking. A database was created for easy viewing, fleet wide.

TESTIMONIALS



“All of us at Entropy would like to express our appreciation for the work of the team performed as Independent Engineer for the project finance of Entropy’s 5MW Cayman Solar Project by CIBC First Caribbean International Bank.

The project was the first utility scale solar project developed in Cayman Islands, which posed a unique set of challenges. A number of unusual design and engineering principals needed to be incorporated to address hurricane force wind loading, difficult soil and rock conditions, and the lack of a substantial service and support infrastructure to accommodate the service and maintenance needs of the plant. The team worked with us to fully understand and address potential risks, delivering their work professionally, on time, and on budget.”

David March, Managing Partner, Entropy Investment Management



“The team at Phoventus bring dedication, critical insights and rare in-depth industry experience to our projects. They are knowledgeable, practical and dedicated to delivering high-quality outcomes. We enjoy working with Phoventus and welcome the opportunity to recommend them to others.”

Lee Anderson , CBRE Caledon Capital Management



”Rob and his team are among the best professional engineers that we have worked with in solar space. They provide timely advice and critical insight into design, procurement and development problems that reduce costs, reduce risk and move projects forward.

Thomas J. Timmins, Gowling WLG

THIRD PARTY RECOGNITION BloombergNEF

BloombergNEF

BloombergNEF PV Module Tier 1 List Methodology
March 3, 2019

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BloombergNEF PV Module Tier 1 List Methodology

BloombergNEF has developed a tiering system for PV module makers based on bankability, to create a transparent differentiation between the hundreds of manufacturers of solar modules on the market. Since this basic categorisation has been used as an advertisement by certain manufacturers, but should never replace a proper due diligence process in product selection, this document explains the tiering criteria and its limitations.

1. Why divide the PV market into tiers?

BloombergNEF is frequently requested by clients for a list of 'major' or 'bankable' suppliers - in common industry parlance, tier 1 suppliers - for use in manufacturing forecasts, preliminary competitor analysis, and other internal comparisons. It is very common for industry players to refer to 'tier 1' players, but these terms are seldom defined or described, which is unhelpful for firms outside the solar industry trying to get a basic overview.

We strongly recommend that module purchasers and banks do not use this list as a measure of quality, but instead consult a technical due diligence firm such as Edif ERA (formerly OST Energy), ATA Renewables, Sgurr Energy, DNV GL, Black & Veatch, TUV, E3, STS Certified, Clean Energy Associates, Solarbuyer, Pvbuyer, Enertis, Oravia, Leidos Engineering or Phoventus. These would usually consider what factory the module comes from, as well as the brand, and give an informed opinion on whether the modules will perform as expected.

2. Definitions

'Bankability' - whether projects using the solar products are likely to be offered non-recourse debt financing by banks - is the providers, are extremely BloombergNEF therefore by our database - 26,300

We reserve the right to consider information added to BloombergNEF capacity are included in the defined locations, and when portfolio underperforms the

We only tier manufacturers. Companies which outsource production under brand names are not tiered.

3. Tier 1

Tier 1 module manufacturers are those which have provided own-brand, own-manufacture products to six different projects, which have been financed non-recourse by six different (non-development) banks, in the past two years.

"Phoventus has provided input to the Bloomberg Tier 1 survey for 3 years. We are proud to be recognized."

We strongly recommend that module purchasers and banks do not use this list as a measure of quality, but instead consult a technical due diligence firm such as **Edif ERA (formerly OST Energy), ATA Renewables, Sgurr Energy, DNV GL, Black & Veatch, TUV, E3, STS Certified, Clean Energy Associates, Solarbuyer, Pvbuyer, Enertis, Oravia, Leidos Engineering or Phoventus.** These would usually consider what factory the module comes from, as well as the brand, and give an informed opinion on whether the modules will perform as expected.

INDUSTRY STANDARD SOFTWARE TOOLS



ETAP DC Arc Flash software calculates the incident energy for different types of direct current applications, including mission critical facilities, electrochemical plants, substation battery banks, photovoltaic plants, nuclear plants, and transportation systems.

Key Features

- Incident energy & shock protection boundary calculations
- Maximum Power, Stokes & Oppenlander, Paskert Methods
- NFPA 70E 2018 compliant
- Powerful graphical DC Arc Flash Calculator
- Interface with intelligent one-line diagram
- Embedded DC Short Circuit module
- Seamless integration with Star[™] Protective Device software
- Comprehensive DC protective device library
- Incident energy plots
- Multi-language labels
- MS Excel[®] export & report
- Result Analyzer with worst-case evaluation

Analyze Mitigate Comply

PVSYST v8.75 160519 Page 1/4

Grid-Connected System: Main results

Project : Oxye Solar
Simulation variant : Preliminary Layout Phase 1

Main system parameters

System type	Unlabeled sheets	approx	D'
Shade description: 00	30'		
PV Modules	Model: JKS1 300W-72-V	From total	300 Wp
Nb. of modules	28312	From total	8472 kWp
Inverter	Model: Sunny Central 2000-EV	From total	2000 kW ac
Inverter pack	Nb. of units: 3.0	From total	7500 kW ac
User's needs	Unlimited local grid		

Main simulation results

System Production: Produced Energy: 13582 MWh/year Specific prod.: 1434 kWh/kWp/year
Performance Ratio PR: 81.22 %

Summary statistics per selected sheet: Incident power: 1434 Wp

Performance Ratio PR

Preliminary Layout Phase 1

Balances and main results

	Generator	Gridfeed	T loss	Gridloss	Gridloss	Gridloss	Energy	E_Solar	PR
	kWh/year	kWh/year	%	kWh/year	kWh/year	kWh/year	MWh	MWh	%
January	40.9	13.65	-12.44	82.6	77.4	899	637	0.719	
February	62.9	21.27	-12.24	112.4	102.9	1208	829	0.860	
March	113.2	34.43	-11.74	162.8	148.5	1407	1340	0.960	
April	169.3	53.61	-8.89	179.4	162.2	1479	1471	0.994	
May	183.8	60.43	-7.82	163.4	179.3	1378	1328	0.959	
June	188.8	60.79	-8.16	107.7	165.7	1560	1521	0.972	
July	207.7	62.06	-8.38	203.7	199.1	1474	1451	0.981	
August	171.4	50.93	-7.62	146.2	161.1	1492	1498	0.998	
September	116.1	40.69	-8.28	147.9	137.2	1209	1188	0.986	
October	74.5	28.07	-8.34	146.3	113.8	1452	1212	0.836	
November	38.2	13.98	-8.28	75.2	63.4	976	921	0.771	
Yearly	1358.2	414.26	-8.22	1358.2	1274.7	14340	14340	0.8122	

PROPRIETARY SOFTWARE TOOLS

Phoventus
Project Execution Plan | Intergen Renewable Energy

Table 3 - Seed Stock Analysis

Failure Mode & Effects Analysis (FMEA)

Project ID: TX-20-0002
Project Name: Phoebe Solar
Data Team: J. Derrall, J. Arden

REF ID	Group	System	Component	Description	Manufacturer	Part Number	Risk Prioritization Number (RPN)	Notes
300002	General	Power Electronics	HEAT EXCHANGER					
300003	General	Power Electronics	FUSE	8452 RUS BUL 30A 320VDC 1P DPHV 12038	Fuse			
300004	General	Power Electronics	WIRETIE	WIREBUNDTOR 1660-3034-8342-LINK 3032-237	Power			
300005	General	Power Electronics	POWER SUPPLY	POWER SUPPLY 24VDC-5A 24VDC 200W	Power			
300006	General	Power Electronics	DIODES (MOS)	THYRISTOR MALL 2004A DTL MLL 200-0	Power			
300007	General	Power Electronics	TRICAPACITOR					
300008	General	Power Electronics	TRICAPACITOR					
300009	General	Power Electronics	TRICAPACITOR					
300010	General	Power Electronics	TRICAPACITOR					
300011	General	Power Electronics	TRICAPACITOR					
300012	General	Power Electronics	TRICAPACITOR					
300013	General	Power Electronics	TRICAPACITOR					
300014	General	Power Electronics	TRICAPACITOR					
300015	General	Power Electronics	TRICAPACITOR					
300016	General	Power Electronics	TRICAPACITOR					
300017	General	Power Electronics	TRICAPACITOR					
300018	General	Power Electronics	TRICAPACITOR					
300019	General	Power Electronics	TRICAPACITOR					
300020	General	Power Electronics	TRICAPACITOR					

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Doc ID: 2020-01-03
Rev: 1

Project ID: AZ01
Project Name: Phoenix
Procurement: J. Derrall, J. Arden

RPN Risk Priority Number is Calculated Severity x Occurrence x Procurement - 100. The team decides they want to use a number less than 30.

Item	Part Number	Description	Quantity	Unit Price	Total Price	Lead Time	RPN	Engineering Actions and Mitigation	Procurement Actions
1	8452 RUS BUL 30A 320VDC 1P DPHV 12038	FUSE	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
2	WIREBUNDTOR 1660-3034-8342-LINK 3032-237	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
3	POWER SUPPLY 24VDC-5A 24VDC 200W	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
4	THYRISTOR MALL 2004A DTL MLL 200-0	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
5	TRICAPACITOR	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock

Engineering Actions and Mitigation

Item	Part Number	Description	Quantity	Unit Price	Total Price	Lead Time	RPN	Engineering Actions and Mitigation	Procurement Actions
1	8452 RUS BUL 30A 320VDC 1P DPHV 12038	FUSE	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
2	WIREBUNDTOR 1660-3034-8342-LINK 3032-237	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
3	POWER SUPPLY 24VDC-5A 24VDC 200W	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
4	THYRISTOR MALL 2004A DTL MLL 200-0	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
5	TRICAPACITOR	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock

Procurement Actions

Item	Part Number	Description	Quantity	Unit Price	Total Price	Lead Time	RPN	Engineering Actions and Mitigation	Procurement Actions
1	8452 RUS BUL 30A 320VDC 1P DPHV 12038	FUSE	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
2	WIREBUNDTOR 1660-3034-8342-LINK 3032-237	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
3	POWER SUPPLY 24VDC-5A 24VDC 200W	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
4	THYRISTOR MALL 2004A DTL MLL 200-0	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock
5	TRICAPACITOR	Power	100	\$0.15	\$15.00	10	15	Identify alternate supply option	Calculate qty and procure stock

Project Details Administration | Select Project: AZ-13-0036 | AZ - Yavapai County - Detention Center

Projects	REF	Group	Project Name	Address	City	State	Country	
AZ-13-0049	3	AZ - Humboldt SD - Bookhouse HS	112 340090	112 340090	Humboldt	NS	USA	
AZ-13-0050	3	AZ - La Paz County - County Office	114 290423	114 290423	La Paz	Arizona	USA	
AZ-13-0051	3	AZ - La Paz County - Public Works Facility	114 231725	114 231725	La Paz	Arizona	USA	
AZ-13-0052	3	AZ - La Paz County - Golf Course	114 195806	114 195806	La Paz	Arizona	USA	
AZ-13-0056	3	AZ - Yavapai County - Detention Center	111 916271	111 916271	Yavapai	Arizona	USA	
AZ-13-0057	2	AZ - Quartzsite - WTP	114 220232	114 220232	Quartzsite	Le Pee	Arizona	USA
AZ-13-0058	2	AZ - Quartzsite - Town Hall	114 206438	114 206438	Quartzsite	Le Pee	Arizona	USA
AZ-13-0077	3	AZ - ASU - Rural Road Parking Structure 4	111 927231	111 927231	Tempe	Maricopa	Arizona	USA
AZ-13-0112	3	AZ - Yavapai County - Court	111 918335	111 918335	Yavapai	Arizona	USA	
AZ-13-0113	3	AZ - ASU - University Center Building B North	111 92148	111 92148	Tempe	Maricopa	Arizona	USA
AZ-13-0114	3	AZ - ASU - University Center Building C South	111 92067	111 92067	Tempe	Maricopa	Arizona	USA

Module Details: JC300M-24(A) (x1881)
Operation Date: 2014-10-16
Target Complete: []
Status: []

THOUGHT LEADERSHIP

"We maintain excellence in all we do so we can serve our clients better than anyone else. That aim is at the heart of our company's philosophy."





TORONTO — NEW YORK

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