Energy Storage Project Case

Industrial and commercial energy storage cabinet

Vietnam

258*7=1.806Mwh ESS & 976kWP PV Project-Novotel resort

Energy storage projects

August 2024

Project Background---Vietnam's Time-of-Use Electricity Price Policy

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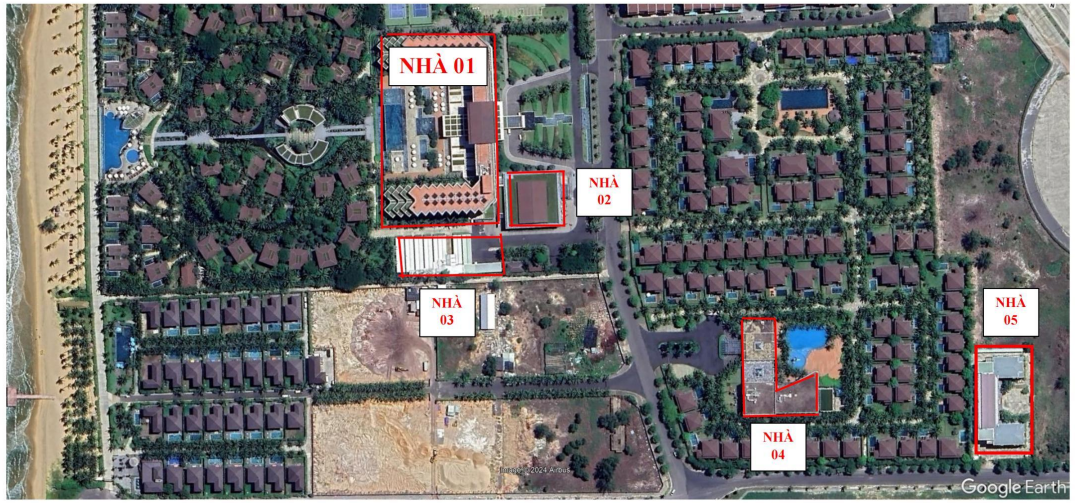
DỰ ÁN: HỆ THỐNG ĐIỆN MẶT TRỜI ÁP MÁI	KHÁCH HÀNG:
CÔNG SUẤT: 924.52 KWP - 03 PHA	**NOVOTEL PHÚ QUỐC**
THÁNG: 09/2024	PHÚ QUỐC, KIÊN GIANG

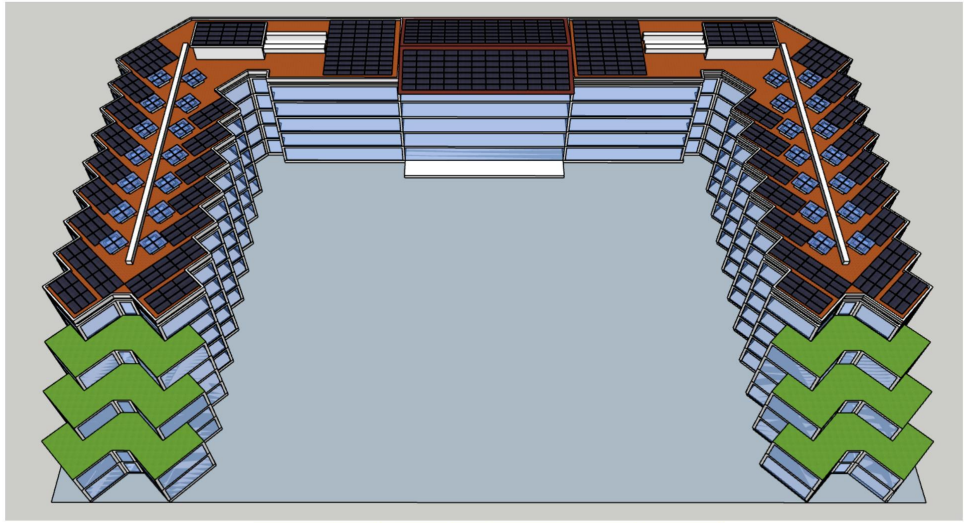
THIẾT KẾ 3D: MẶT BẰNG MÁI – VỊ TRÍ LẮP ĐẶT TẤM PIN



NHÀ	TONG PV	kWp
	1594	**924.52**
NHÀ 01	658	381.64
NHÀ 02	168	97.44
NHÀ 03	353	204.74
NHÀ 04	219	127.02
NHÀ 05	196	113.68

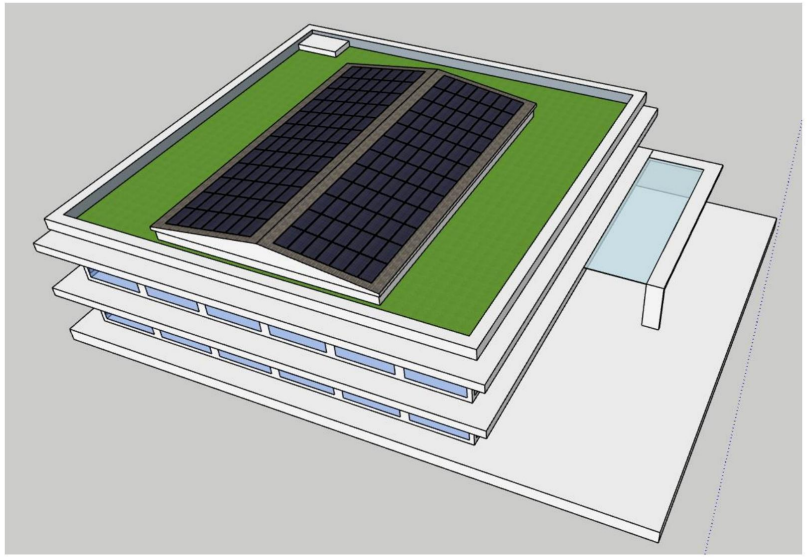
Project Background---Vietnam's Time-of-Use Electricity Price Policy

THIẾT KẾ 3D: NHÀ 01



NHÀ	MÁI	Hàng	Cột	TONG PV	kWp	TONG KWP
NHÀ 01	A	13	9	117	67.86	381.64
	B	1	48	48	27.84	
	C	1	20	20	11.60	
	D	5	12	60	34.80	
	E	12	7	84	48.72	
	F	12	7	84	48.72	
	G	5	12	60	34.80	
	H	1	20	20	11.60	
	I	1	48	48	27.84	
	J	13	9	117	67.86	

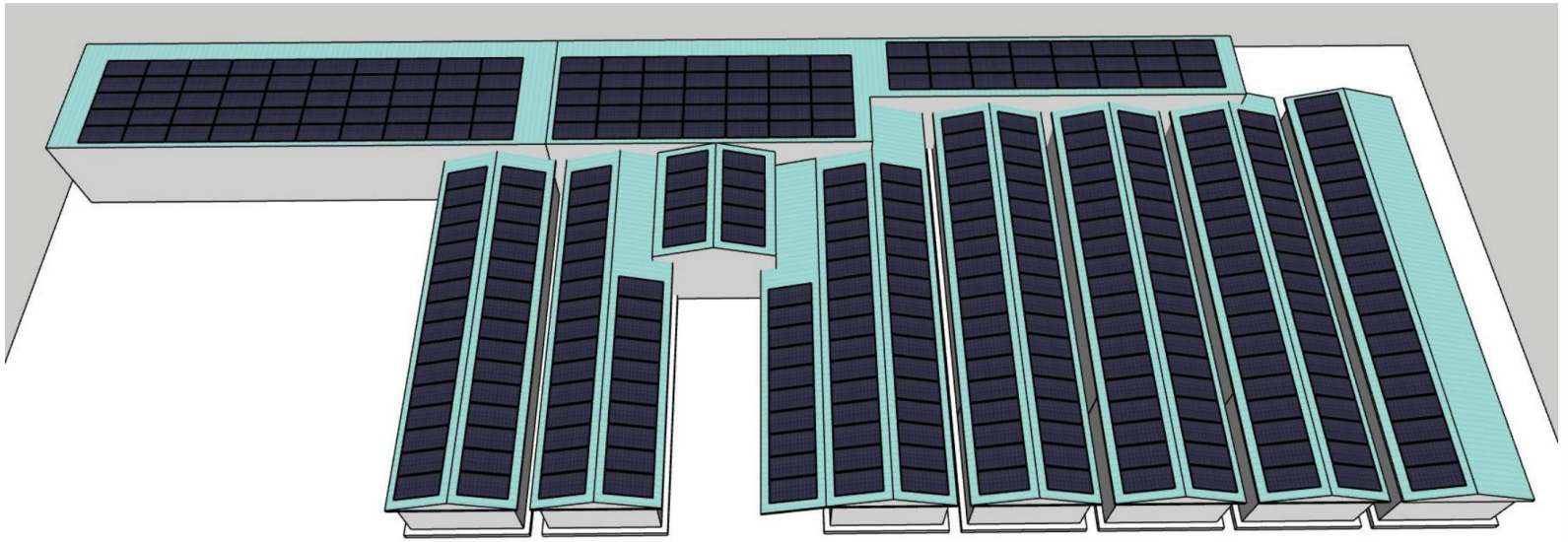
THIẾT KẾ 3D: NHÀ 02



NHÀ	MÁI	Hàng	Cột	TONG PV	kWp	TONG KWP
NHÀ 02	A	7	12	84	48.72	97.44
	B	7	12	84	48.72	

Project Background---Vietnam's Time-of-Use Electricity Price Policy

THIẾT KẾ 3D: NHÀ 03



NHÀ	MÁI	Hàng	Cột	TONG PV	kWp	TONG KWP
NHÀ 03	A	5	10	50	29.00	204.74
	B	5	7	35	20.30	
	C	3	8	24	13.92	
	D	16	1	16	9.28	
	E	16	1	16	9.28	
	F	16	1	16	9.28	
	G	10	1	10	5.80	
	H	5	1	5	2.90	
	I	5	1	5	2.90	
	J	10	1	10	5.80	
	K	16	1	16	9.28	
	L	16	1	16	9.28	
	M	19	1	19	11.02	
	N	19	1	19	11.02	
	O	19	1	19	11.02	
	P	19	1	19	11.02	
	Q	19	1	19	11.02	
	R	19	1	19	11.02	
	S	20	1	20	11.60	

Project Background---Vietnam's Time-of-Use Electricity Price Policy

TIME – OF – USE ELECTRICITY CHARGE

a) Definition of hours:

+ Standard hour

From Monday to Saturday

- From 4.00 a.m. to 9.30 a.m. (5 hours and 30 minutes);
- From 11.30 a.m. to 5.00 p.m. (5 hours and 30 minutes);
- From 8.00 p.m. to 10.00 p.m. (2 hours).

Sunday

From 4.00 a.m. to 10.00 p.m. (18 hours).

+ Peak hour

From Monday to Saturday

- From 9.30 a.m. to 11.30 a.m. (2 hours);
- From 5.00 p.m. to 8 p.m. (3 hours).

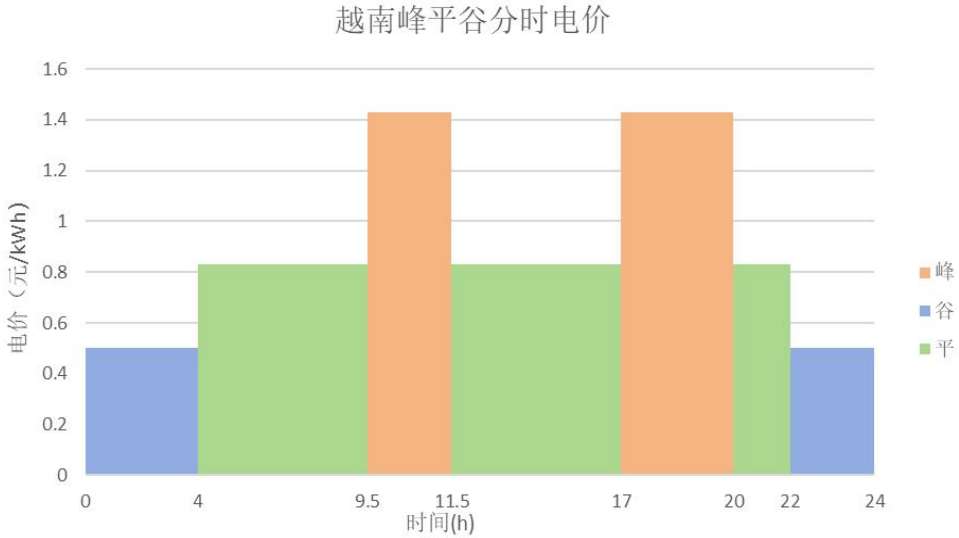
Sunday: No peak hours.

+ Off-peak hours:

All days: from 10 p.m. to 4 a.m. of the following day (6 hours).

b) Electricity purchasers subject to three-rate pricing:

- Customers using electricity for production, business, services, using electricity supplied via dedicated transformers of 25 kVA or above or having average electricity consumption of 2,000 kWh/month for three consecutive months;
- Retailers of electricity in industrial zones;
- Electricity purchasers buying electricity in order to retail electricity for non-household consumption purposes in commerce – service – residential building complex;



According to the electricity price list of commercial and industrial users of Vietnam Electricity Company EVN, the time periods are divided as follows:

peak： 9:30-11:30 、17:00-20:00

Flat section：4:00-9:30、11:30-17:00、 20:00-22:00

Lows：22:00-次日4:00

Project Background---Vietnam's Time-of-Use Electricity Price Policy

Load-side power consumption analysis and photovoltaic installation capacity (KWp)

NOVOTEL(Residential area NHA01, 02, 03)	2023/03/16-2023/04/15			2023/4/16-2023/05/15			2023/05/16-2023		
Electricity consumption time statistics	normal（13h)	peak(5h)	valley(6h)	normal（13h)	peak(5h)	valley(6h)	normal（13h)	peak(5h)	valley(6h)
Electricity consumption (kwh)	269,421.00	86,100.00	97,902.00	238,526.00	78,828.00	86,046.00	232,314.00	77,941.00	81,307.00
Average load(kw)	690.82	574.00	543.90	611.61	525.52	478.03	595.68	519.61	451.71
Load end normal average value	633	KW							
Minimum load peak value	520	KW							
Maximum value of valley at load end	544	KW							
Solar power generation NHA01 residential installed capacity	422.4	KWp	Total rooftop photovoltaic installed capacity 975.15KWp				Electricity Prices(yuan)	normal	0.81
Solar power generation NHA02 residential installed capacity	334.95	KWp						peak	1.41
Solar power generation NHA03 residential installed capacity	217.8	KWp						valley	0.45

Project Background---Statistical Analysis of Enterprise Electricity Bills (CHI NHANH DNTN)

Electricity bill and electricity statistics			Electricity period per day (5hours)		Electricity peroid per day(13hours)		Electricity peroid per day(6hours)
Year	month	Power Consumption (kwh) in peak	consumption load (kw) in peak	Consumption In normal time(kwh)	Consumption load in normal (kw)	Consumption power(kwh)in valley	Consumption load in Valley(kw)
2023	3/16-4/15	86100	570.00	269421	690.82	97902	543.90
2023	4/16-5/15	78828	525.52	238526	611.61	86046	479.03
2023	5/16-6/15	77941	519.61	232314	595.68	81307	451.71

Analysis of total power consumption

- The basic electricity fee payment method for enterprises is to pay according to capacity, and the payment capacity is 1250*2kVA/0.4KV
- The load of the enterprise during peak hours is about 519kW, the load during normal hours is about 633kW, and the load during valley hours is about 543kW;
- According to Vietnam's time division policy, energy storage power stations can achieve two charge and two discharge per day (valley charging and peak discharge & solar charge and peak discharge).

Construction scale and operational benefits

Construction scale

TTaking into account the power consumption of the enterprise and the benefits of the project, the designed energy storage scale is 258*7KWH and the photovoltaic scale is 976kWp.

This solution adopts 7 sets of 258kWh standard energy storage cabinet systems, with an overall size of W1578*D1400*H2132cm, and each set occupies an area of about 5 square meters ,total in 35square meters, Each energy storage cabinet consists of a battery system (6 PACKs), a high-voltage box PDU, an energy storage converter PCS, a liquid cooling unit, a fire protection system, an EMS, etc. The system has an external communication function, which transmits data to supporting HMI, EMS, fire protection and other equipment, and can operate safely and stably for a long time; the energy storage cabinet system is installed outdoors, close to the transformer (within 30m).

Project Benefits scale

Investment payback period:21.8 months

1) Investment in photovoltaics: RMB 1952000.
2) Investment in industrial and commercial energy storage cabinets: 7 energy storage cabinets with a capacity of 258*7KWH: RMB 2115729.
3) Annual income from photovoltaic power generation&Ess equipments: RMB 2235240.

Project Background---Vietnam's Time-of-Use Electricity Price Policy

Industrial and commercial energy storage cabinet investment and benefit analysis table										
Electricity usage period	TBA (T3)	Load (kW)	Photovoltaic load income Electricity income (yuan)	Surplus power (KW)	Photovoltaic power generation 976KWP	Photovoltaic surplus energy storage KWh	Equipped with energy storage cabinet valley charging KWh	Photovoltaic surplus power discharge income (yuan)	Energy storage valley charge peak discharge	Peak-to-valley arbitrage
VALLEY	0(24h00)	543.00		1,707.00						
VALLEY	1.00	543.00		1,707.00			451.00			
VALLEY	2.00	543.00		1,707.00			451.00			
VALLEY	3.00	543.00		1,707.00			451.00			
VALLEY	4.00	543.00		1,707.00			451.00			
NORMAL	5.00	633.00		1,617.00						
NORMAL	6.00	633.00		1,617.00						
NORMAL	7.00	633.00		1,617.00						
NORMAL	8.00	633.00		1,617.00					451.00	162.36
NORMAL	9h00:00	633.00		1,617.00					451.00	162.36
PEAK	9h30	519.00							451.00	162.36
PEAK	10h30	519.00							451.00	432.96
PEAK	11h30	519.00	731.79		966.24	447.24				
NORMAL	12h30	633.00	512.73	1,617.00	966.24	333.24				
NORMAL	13h30	633.00	512.73	1,617.00	966.24	333.24				
NORMAL	14h30	633.00	512.73	1,617.00	966.24	333.24				
NORMAL	15h30	633.00	512.73	1,617.00	966.24	333.24				
NORMAL	15h40	633.00	69.09	1,617.00	161.00	91.91				
NORMAL	16.00	633.00		1,617.00		1,872.11	6.57			
PEAK	17h00	519.00								
PEAK	18.00	519.00						731.79		
PEAK	19.00	519.00						731.79		
PEAK	20h00	519.00						731.79		
NORMAL	21.00	633.00		1,617.00				242.19		
NORMAL	22.00	633.00		1,617.00						
VALLEY	23.00	543.00								
			2,851.80					2,437.56		920.04

1) Invest in 976KWP photovoltaic power plant, 976/100*200000=1952000 yuan
2) Energy storage 7 units 258KWH, 258*1065*7*1.1=2115729 yuan
3) Photovoltaic + energy storage income: 6209*30*12=2235240 yuan
4) 2235240*2-1952000-2115729=402751 yuan (2 years income-investment=balance)
5) (1952000+215729)/6209*30=22.5 months, investment payback time 24 months