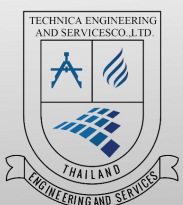




TECHNICA ENGINEERING AND SERVICES CO.,LTD.



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Head Office : 136/8 M.4, Ban-Boong Subdistrict, Mueang District, Phichit 6600 โทร. 094-714-2954

Website: <http://technicaengineers.com/>

SOLAR ROOFTOP FACT SHEET



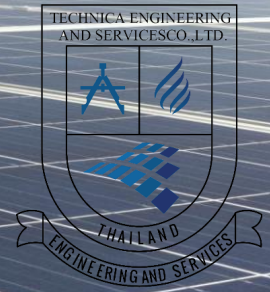
Solar Rooftop Design and Maintenance Services

Our Services

- 1. Provide Financial Feasibility Analysis**
- 2. Provide Engineering and Design**
- 3. Provide Required Documents to Submit to Concern Parties**
- 4. Provide Installation and Maintenance**



SOLAR ROOFTOP FACT SHEET



Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

1. Provide Financial Feasibility Analysis

1.1) Payback Period Method : PB

1.2) Discount Payback Period Method : DPB

1.3) Net Present Value Method : NPV

1.4) Profitability Index Method : PI

1.5) Internal Rate of Return Method : IRR

1.6) Modified Internal Rate of Return Method : MIRR



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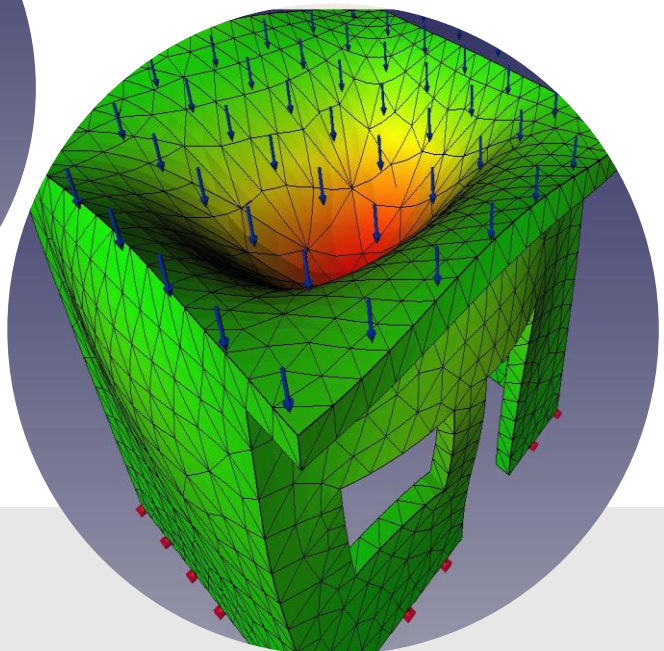
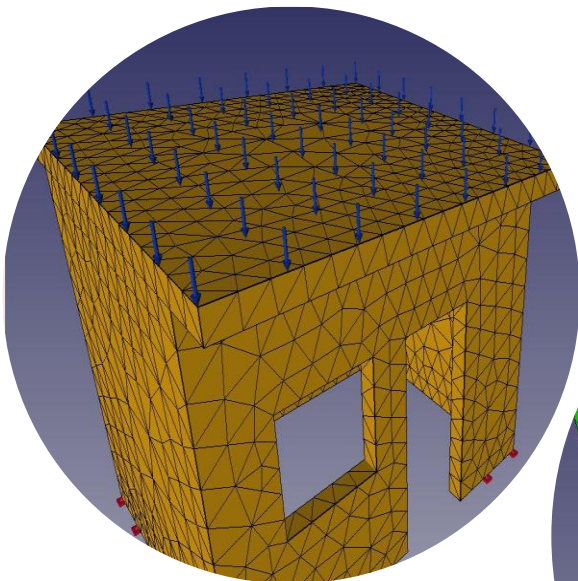
Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

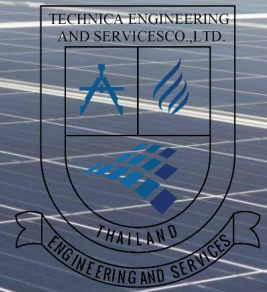
2. Provide Engineering and Design

2.1) Structure Calculation and Finite Element Analysis by Professional Civil Engineer

- To ensure the existing structure can support addition weight from solar modules.



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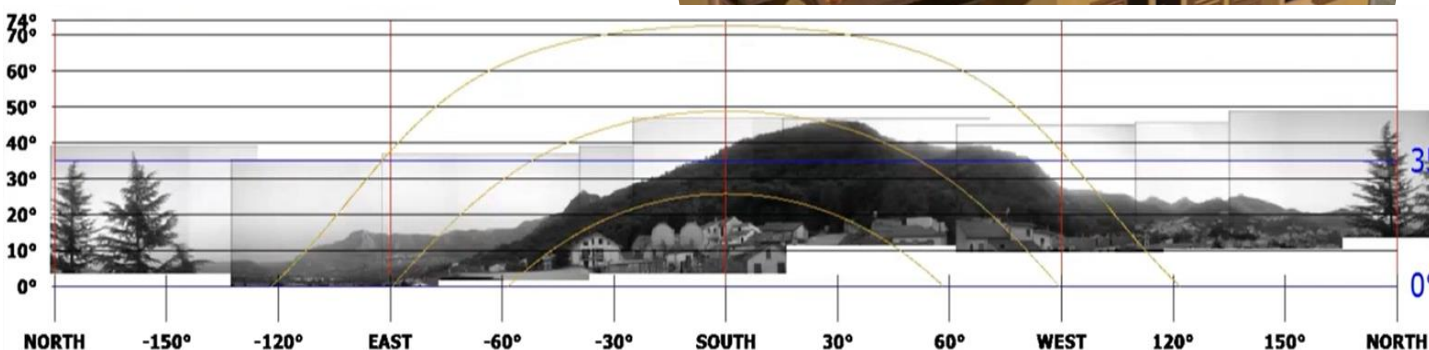
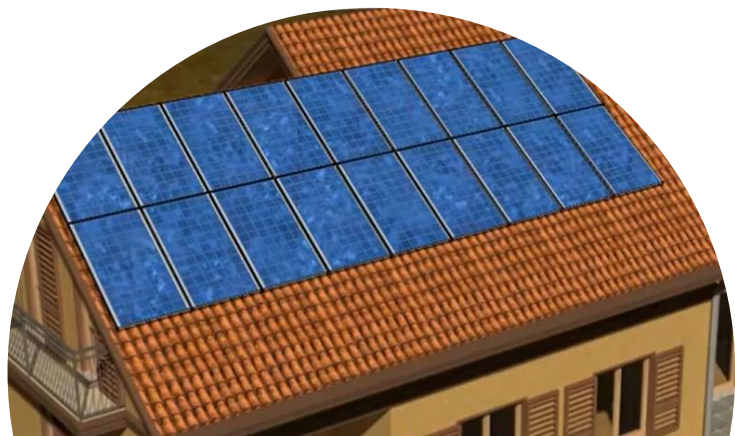
Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

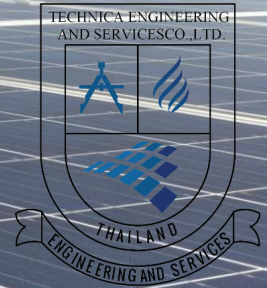
2. Provide Engineering and Design (Cond's)

2.1) Electrical Design and Finite Element Analysis by Professional Electrical Engineer

- Calculation and design base on professional standard such as PEA Regulation and Standard, The Engineering Institute of Thailand etc.



SOLAR ROOFTOP FACT SHEET



Solar Rooftop Design and Maintenance Services

Example for Solar Rooftop 500 kw

PVSYS V6.43		29/06/19		Page 1/3																			
Grid-Connected System: Simulation parameters																							
Project :	Mechanics Workshop																						
Geographical Site	Bangkok	Country	Thailand																				
Situation	Latitude	13.7°N	Longitude	100.6°E																			
Time defined as	Legal Time	Time zone UT+7	Altitude	3 m																			
	Albedo	0.20																					
Meteo data:	Bangkok	MeteoNorm 7.1 station - Synthetic																					
Simulation variant :	New simulation variant																						
	Simulation date	29/06/19 13h07																					
Simulation parameters																							
Collector Plane Orientation	Tilt	15°	Azimuth	0°																			
Models used	Transposition	Perez	Diffuse	Perez, Meteornorm																			
Horizon	Free Horizon																						
Near Shadings	No Shadings																						
PV Array Characteristics																							
PV module	Si-mono	Model	CS6X - 320M																				
<small>Original PVSyst database</small>		Manufacturer	Canadian Solar Inc.																				
Number of PV modules		In series	20 modules	In parallel	66 strings																		
Total number of PV modules		Nb. modules	1320	Unit Nom. Power	320 Wp																		
Array global power		Nominal (STC)	422 kWp	At operating cond.	375 kWp (50°C)																		
Array operating characteristics (50°C)		U mpp	655 V	I mpp	572 A																		
Total area		Module area	2533 m²	Cell area	2271 m²																		
Inverter																							
<small>Original PVSyst database</small>		Model	Sunny Tripower 60-10																				
		Manufacturer	SMA																				
Characteristics		Operating Voltage	570-800 V	Unit Nom. Power	60 kWac																		
Inverter pack		Nb. of inverters	7 units	Total Power	420 kWac																		
PV Array loss factors																							
Thermal Loss factor	Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s																			
Wiring Ohmic Loss	Global array res.	20 mOhm	Loss Fraction	1.5 % at STC																			
Module Quality Loss			Loss Fraction	-0.4 %																			
Module Mismatch Losses			Loss Fraction	1.0 % at MPP																			
Incidence effect, user defined profile	<table border="1"> <thead> <tr> <th>10</th> <th>20</th> <th>30</th> <th>40</th> <th>50</th> <th>60</th> <th>70</th> <th>80</th> <th>90</th> </tr> </thead> <tbody> <tr> <td>1.00</td> <td>1.00</td> <td>1.00</td> <td>0.99</td> <td>0.99</td> <td>0.95</td> <td>0.89</td> <td>0.70</td> <td>0.00</td> </tr> </tbody> </table>					10	20	30	40	50	60	70	80	90	1.00	1.00	1.00	0.99	0.99	0.95	0.89	0.70	0.00
10	20	30	40	50	60	70	80	90															
1.00	1.00	1.00	0.99	0.99	0.95	0.89	0.70	0.00															

SOLAR ROOFTOP FACT SHEET



Solar Rooftop Design and Maintenance Services

Example for Solar Rooftop 500 kw (Cond's)

PVSYST V6.43 29/06/19 Page 2/3

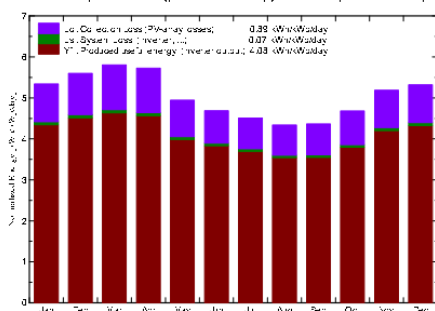
Grid-Connected System: Main results

Project : Mechanics Workshop
Simulation variant : New simulation variant

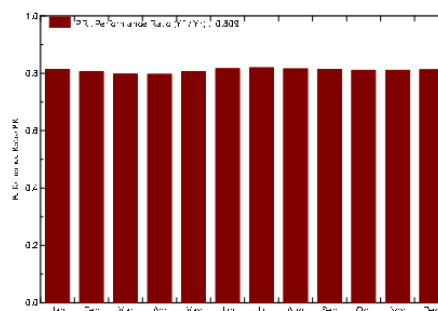
Main system parameters		System type	Grid-Connected	
PV Field Orientation		tilt	15°	azimuth 0°
PV modules		Model	CS6X - 320M	Pnom 320 Wp
PV Array		Nb. of modules	1320	Pnom total 422 kWp
Inverter		Model	Sunny Tripower 60-10	Pnom 60.0 kW ac
Inverter pack		Nb. of units	7.0	Pnom total 420 kW ac
User's needs		Unlimited load (grid)		

Main simulation results
System Production **Produced Energy 628.8 MWh/year** Specific prod. 1489 kWh/kWp/year
Performance Ratio PR **80.9 %**

Normalized productions (per installed kWp): Nominal power 422 kWp



Performance Ratio PR

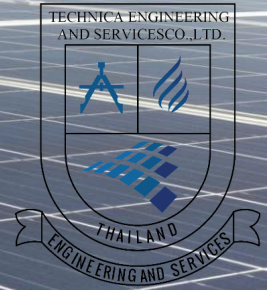


New simulation variant Balances and main results

	GlobHor kWh/m ²	T Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	EffArrR %	EffSysR %
January	145.0	27.53	165.6	161.2	57.87	56.89	13.80	13.56
February	143.7	28.69	156.8	152.6	54.32	53.41	13.68	13.45
March	174.4	29.82	180.0	175.0	61.71	60.68	13.53	13.31
April	174.6	30.46	171.8	166.9	58.83	57.84	13.52	13.29
May	163.4	29.92	153.4	148.3	53.12	52.21	13.67	13.44
June	152.0	29.16	140.7	135.9	49.40	48.54	13.86	13.62
July	148.9	29.35	139.7	134.9	49.23	48.37	13.91	13.67
August	138.7	29.18	134.6	130.3	47.18	46.36	13.84	13.60
September	130.0	28.35	130.9	126.7	45.80	44.99	13.81	13.57
October	137.7	28.77	145.2	141.0	50.56	49.66	13.75	13.51
November	139.8	28.03	155.6	151.6	54.20	53.27	13.75	13.52
December	141.9	27.63	164.9	160.9	57.58	56.60	13.79	13.55
Year	1790.1	28.91	1839.2	1785.2	639.80	626.84	13.73	13.50

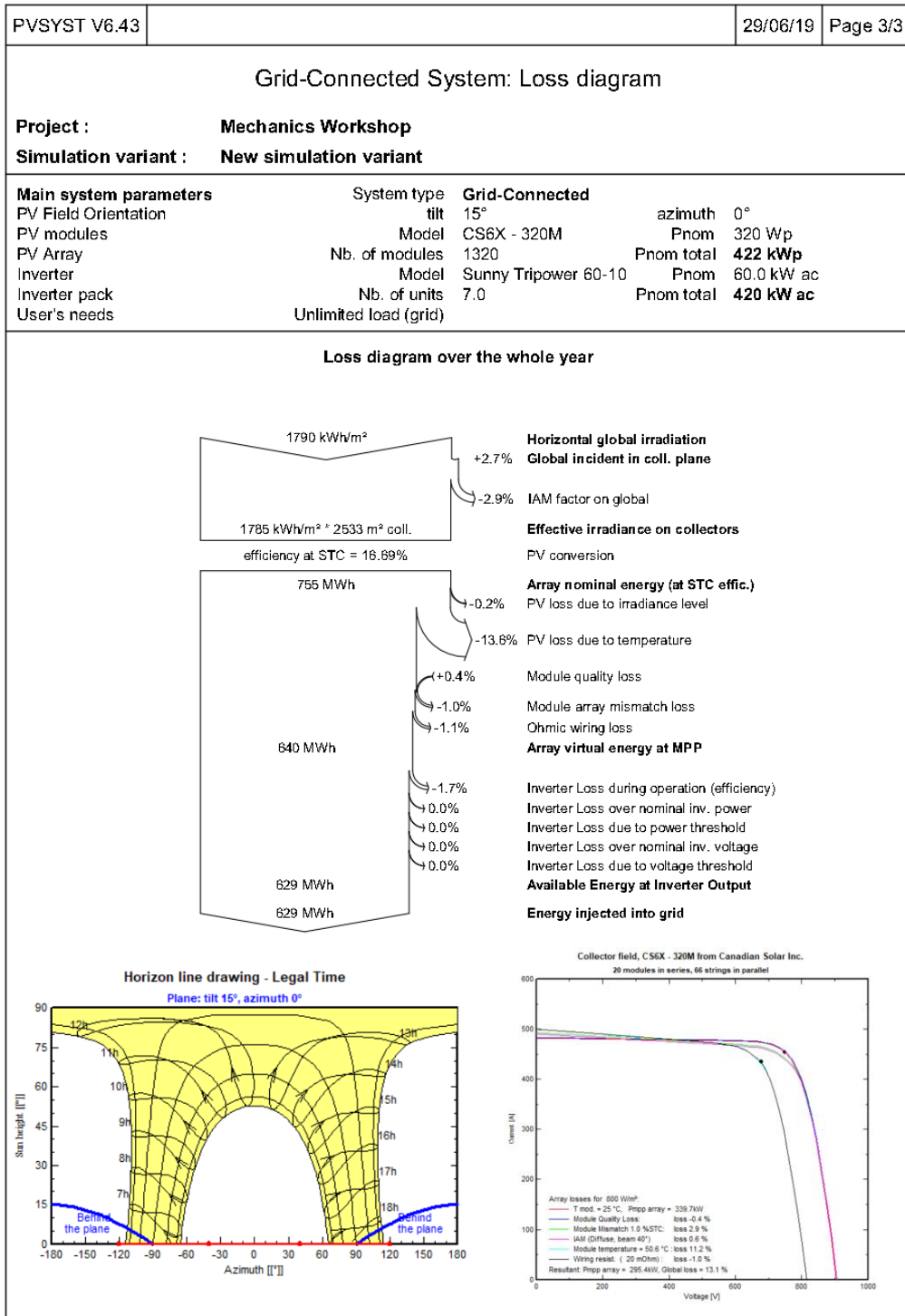
Legends: GlobHor Horizontal global irradiation
T Amb Ambient Temperature
GlobInc Global incident in coll. plane
GlobEff Effective Global, corr. for IAM and shadings
EArray Effective energy at the output of the array
E_Grid Energy injected into grid
EffArrR Effic. Eout array / rough area
EffSysR Effic. Eout system / rough area

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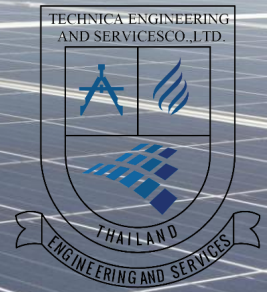


Solar Rooftop Design and Maintenance Services

Example for Solar Rooftop 500 kw (Cond's)



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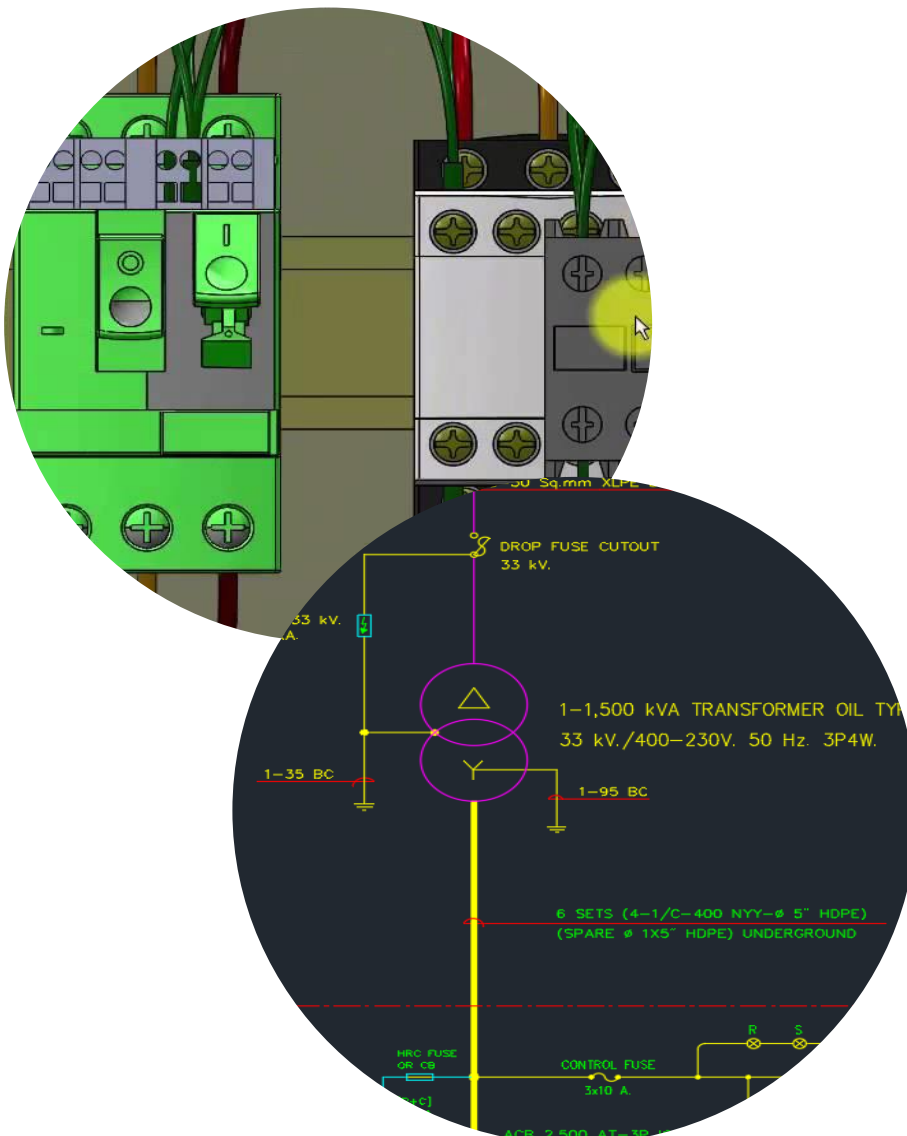


Solar Rooftop Design and Maintenance Services

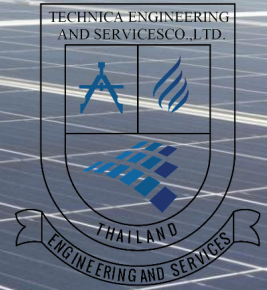
Our Services (Cond's)

3. Provide Required Documents to Submit to Concern Parties

3.1) Electrical (Single line Diagram) and Structure CAD Drawing



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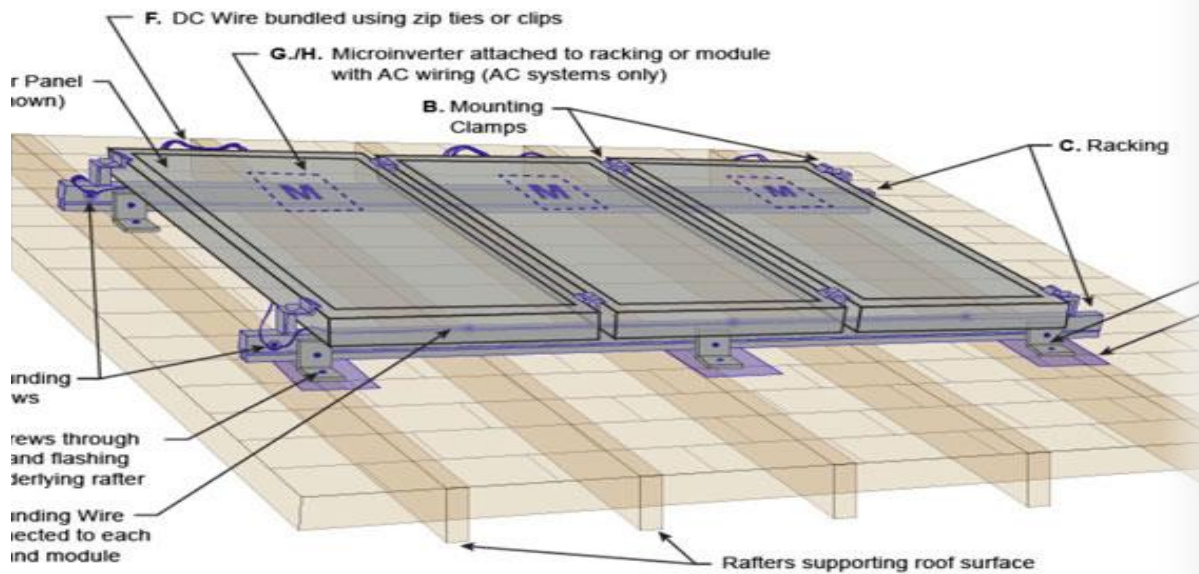


Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

3. Provide Required Documents to Submit to Concern Parties

3.2) Shop Drawing



SOLAR ROOFTOP FACT SHEET

Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

3. Provide Required Documents to Submit to Concern Parties (Cond's)

- 3.1 งานแจ้งประกอบกิจการพลังงานที่ได้รับการยกเว้นไม่ต้องขอรับใบอนุญาตสำนักงานคณะกรรมการกำกับกิจการพลังงาน
- 3.2) งานแจ้งยื่นใบอนุญาตก่อสร้างอาคาร, ดัดแปลงอาคาร (อ.1)
- 3.3) งานแจ้งยื่นใบอนุญาตเพื่อเข้าร่วมโครงการขออนานไฟกับ ก.ฟ.ภ. และ ก.ฟ.น.
- 3.4) ออกแบบ, ทำแบบ และรับรองแบบโดยวิศวกรไฟฟ้าและวิศวกรโยธา

SOLAR ROOFTOP FACT SHEET

Solar Rooftop Design and Maintenance Services

Our Services (Cond's)

4. Provide Installation and Maintenance



Free 1 year monthly cleaning