

# YOUR SIMPLE GUIDE TO GO SOLAR

## Solar 101



# Disclaimer

*This is meant to be a guide to help you to decide whether solar photovoltaic is the right technology for you. The information contained in this ebook is strictly for educational purposes. We have used our best effort in preparing this ebook. We make no representation or warranties with respect to the accuracy, applicability or completeness of the contents of this ebook.*

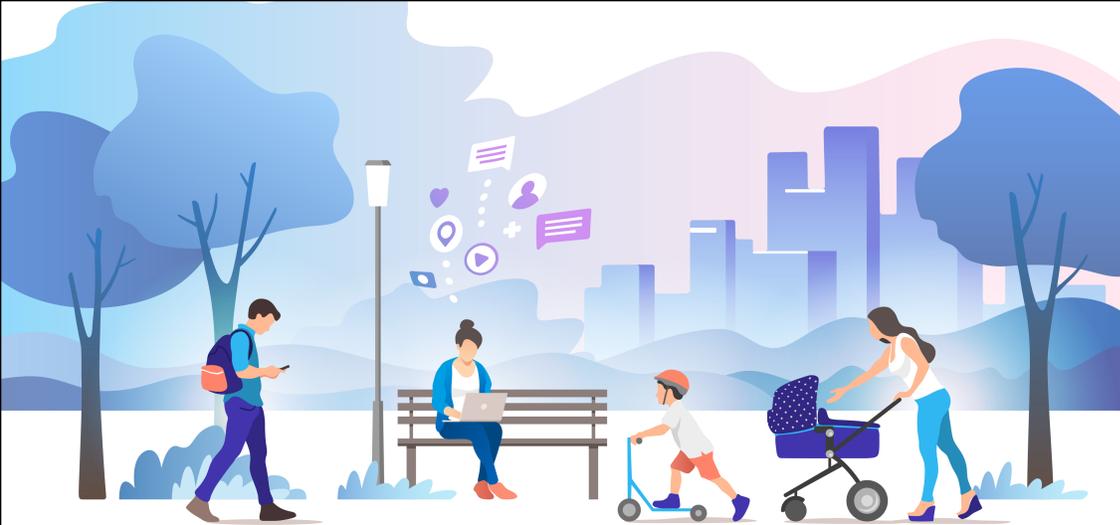
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# INTRODUCTION

Are you interested to go solar but find it hard to understand what it is all about? We know how you feel. When we first embarked on our solar journey few years back, we were in the exact same shoes you are in (and we are a bunch of electrical engineers). But you know what? The good news is that photovoltaic system is easy to understand. You only need to know 2 main components – solar panel and inverter.

In this ebook, we will share with you practical knowledge about solar that we picked up along the way. We will cover the ABC of solar photovoltaic (pv) technology and the 123 of solar financing...





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10 THINGS YOU NEED TO KNOW BEFORE GOING SOLAR

## 01

## 10 THINGS YOU NEED TO KNOW BEFORE GOING SOLAR

### 1. Make sure you understand your electricity rates

For residential customers, there are 5 tiers of usage. Higher energy usage results in higher rates. In this tariff structure, the more you use, the more expensive your energy rates will be.

TARIFF CATEGORY	UNIT	CURRENT RATE (1 JAN 2018)
Tariff A - Domestic Tariff		
For the first 200 kWh (1 - 200 kWh) per month	sen/kWh	21.80
For the next 100 kWh (201 - 300 kWh) per month	sen/kWh	33.40
1. For the next 300 kWh (301 - 600 kWh) per month	sen/kWh	51.60
For the next 300 kWh (601 - 900 kWh) per month	sen/kWh	54.60
For the next kWh (901 kWh onwards) per month	sen/kWh	57.10
The minimum monthly charge is RM3.00		

Figure 1: Residential electricity tariff

When your electricity bill exceeds RM 395.60, you will fall under tier 5, i.e. the most expensive bracket. Now that you and your family are at home most of the time due to Covid-19, your electricity consumption can easily shoot up to the highest tier. So how does this relate to your solar plan? When you go solar, you will reduce your electricity purchase from your utility at the most expensive tier. Hence, your solar investment will yield faster return on investment and higher cost savings.

### 2. Get an accurate idea of the amount of energy you use each month

If you are looking for ways to reduce your electricity bill, we always advise our clients that going solar goes hand in hand with energy efficiency. Reduce your energy consumption by energy saving changes and upgrades such as setting your air conditioners at 24°C, clean the filters, buy 5 Star energy rated appliances and replace incandescent to energy efficient bulbs. Plan your solar pv system size based on the efficient usage of electricity.



### **3. Discuss with your solar consultant on the solar size**

Don't fall into the trap of installing solar panels more than you require not unless you want to. Seek explanation from your solar consultant on estimated solar energy generated and how it will impact your overall monthly electricity cost.

### **4. Get the latest update on green incentives from government**

If you are a business owner, you are eligible for Green Investment Tax Allowance (GITA) for renewable energy, energy efficiency, green building, green data center and integrated waste management activity projects until 2023.. Do note that, you are eligible if the investment is via cash or loan. Solar PPA and Solar Lease is not yet eligible. More on the financial investment in Chapter 5.

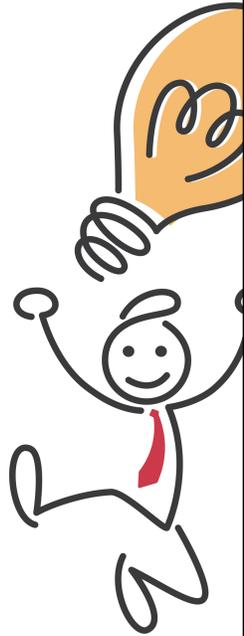
***“Investment Tax Allowance (ITA) of 100% for qualifying capex incurred on green technology project. The allowance can be offset against 70% of statutory income in the year of investment. Unused allowances can be carried forward until they are fully absorbed”***

### **5. Find out the various solar scheme arrangement with your utility**

There are 5 schemes currently available, namely Feed-In-Tariff (FIT), Net Energy Metering (NEM), Large Scale Solar (LSS), New Enhanced Dispatch Arrangement (NEDA) and Self Consumption (SELCO). Except for SELCO, all the schemes allow you to sell solar energy to your utility. More on this in Chapter 2.

### **6. How much savings you can get by going solar?**

Savings is determined by various factors such as electricity tariff, solar pv size and cost, financing option chosen and actual solar energy production and performance. You can find out estimated savings at TNB website. Refer to the “Useful Links” at the end of this ebook.



### 7. Ask about your solar warranties

There are 3 types of warranties offered. First is solar panel product warranty by manufacturer. Typical product warranty for solar panel is between 20 to 25 years. For inverter, typical manufacturer warranty is between 5 to 10 years. Second warranty by manufacturer is performance guarantee. This is to guarantee that the energy output will be as specified in warranty document. The third warranty is on the workmanship by solar installer. Typical warranty on workmanship is between 1 to 2 year. Do note that neither of these warranties cover theft, fire or other damages. You may also want to consider taking up solar insurance policy. Currently, the only insurance company that offers solar insurance in Malaysia is Allianz. Contact us and we will hook you up.

### 8. How long do solar and inverter last?

For solar panel, the oldest we have seen is over 40 years in the USA. For inverter, we typically estimate between 5 to 10 years.

### 9. Will solar panels harm your rooftop

The panels will not harm your rooftop if properly installed. You may also find that your house is cooler as the panels protect the area from light and heat. Choosing verified solar installer will go a long way to ensuring job well done.

### 10. Find out options available in the market to help you finance your solar investment

Cash will give you the fastest payback and return on investment. Same goes to 0 % easy payment plan using credit card.

Other options available are solar loan with banks with typical interest rate between 5 to 7%. Solar lease is also gaining traction in Malaysia where you make installments with your solar provider. For businesses, if you do not plan to have solar panel in your balance sheet and fork out capital expenditure to go solar, Solar Energy Purchase (SEP) is the right option for you. More on this in Chapter 5.





## 02

## SOLAR SCHEMES IN MALAYSIA

## APPLICABLE FOR BOTH HOMES AND BUSINESSES

**FEED-IN TARIFF (FIT)**

Launched in December 2011, FIT scheme enables companies and house owners to produce renewable energy from 4 sources – solar, biogas, biomass and small hydropower – and sell it directly to TNB in Peninsular and SEB in Sabah. The rate is attractive, and hence the quota especially for solar is all taken up. So skip this as it is no longer an option for solar.

**NET ENERGY METERING (NEM)**

NEM is a mechanism for you to use solar energy that you produce for your own consumption. Any excess energy generated will be exported to TNB grid automatically. The energy flow from the grid to your premise and from your premise to the grid is read by a special meter called “bi-directional meter.” The energy sold by you to TNB will be used to offset final electricity bill. Click [here](#) to watch NEM video.

**SELF CONSUMPTION (SELCO)**

SELCO allows you to generate electricity from solar to reduce your electricity cost and carbon footprint. However, you cannot sell any excess energy generated to TNB. The idea here is to consume all, and not to sell.

**Ninja Tip!**

NEM quota is expiring in 2020. Get your quota fast if you are interested to participate.

# SOLAR SCHEMES

## APPLICABLE FOR BUSINESSES ONLY



### **NEW ENHANCED DISPATCH ARRANGEMENT**

Launched in 2015, it allows non-PPA/SLA Generators such as co-generators and expired PPA/SLA Generators to operate as Merchant Generators to sell energy to Single Buyer. NEDA allows these power generators to bid their variable cost (fuel and O&M) than those stated in the PPAs and SLAs. It is designed to enhance competitions and cost efficiency of the market.



### **LARGE SCALE SOLAR (LSS)**

LSS is a scheme that lets you generate electricity via solar pv farm with installed capacity of 1 MW or more and sell to the grid. This scheme is administered by the Energy Commission and the selection for potential developers will be done through competitive bidding.



03

SOLAR 101

HOW SOLAR PV WORKS

## 03

## HOW SOLAR PV WORKS

Remember when your science teacher taught that energy cannot be created or destroyed but can be transformed? Click [here](#) if you prefer to watch a video on how the magic works.

This is how solar panels transform sun energy to electricity.

- Solar panels convert the energy of photons into electricity. This process is called the photovoltaic effect
- When a photon hits a photovoltaic device, its energy is transferred from the photon to the local electrons in the material. These excited electrons begin to flow, producing an electric current
- Solar cells produce direct current (DC) electricity, which is typically converted to alternating current (AC) electricity by an inverter, to deliver energy to the grid (which operates with AC).

Electricity from the sun is one of the cleanest forms of renewable energy available on the planet. It is abundant and a powerful source of energy. Minimal components are required to tap into sun power, making it cheap to maintain. In short, it's awesome!

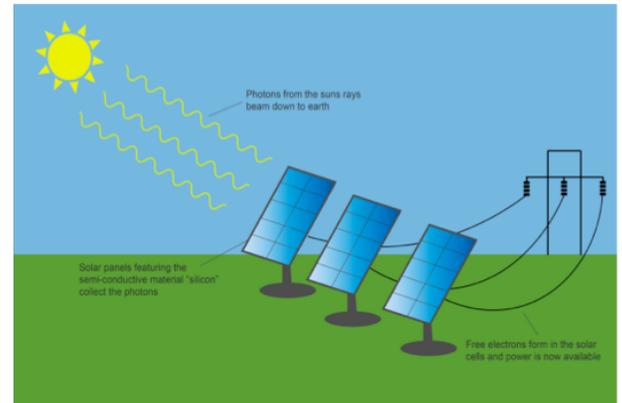


Figure 2: From sun energy to electricity

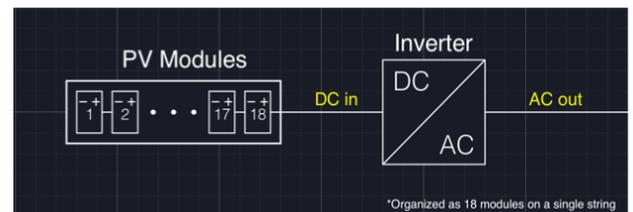


Figure 3: Inverter converts direct current (DC) from pv modules to alternating current (AC)



**SOLAR PV SYSTEM COMPONENTS**

## 04

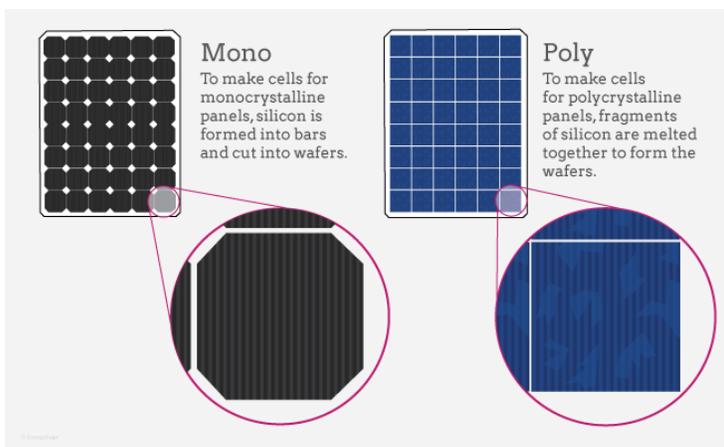
## SOLAR PV SYSTEM COMPONENTS

This is a brief description of the major components of solar pv system. There are additional small components required for a complete installation that are not described here.

### 1. Photovoltaic modules (also known as Solar Panels or PV modules)

They are typically made of silicon crystals, a polymer back and aluminum frame. There are 2 major types of pv module, namely monocrystalline and polycrystalline. There is also thin film but it is less common. Table below compares mono and polycrystalline.

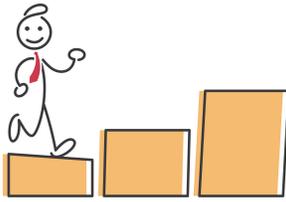
Monocrystalline	Polycrystalline
Made from slicing one silicon cell	Made from melting down multiple cells
More space efficient – requires less space with same energy output	Less space efficient
More expensive	Less expensive
With distinct aesthetic quality	Less aesthetic



As you can see, mono's color is darker than polycrystalline. The darker color makes it less prominent on the roof compared to poly.

Figure 4: Mono vs Poly

Source: Energy Sage



inverters takes DC from pv module and turn it into AC which is used to run your electrical appliances.

Inverters also act as safety protection. In the event of power outage at the utility side, the inverter will switch off, and therefore stopping current flow from solar panels to electrical appliances.

There are 3 commonly used inverters, namely central, string and micro inverters. Central inverters are used for utility scale solar pv system. For homes and businesses, string and micro inverters are typically used. Let's look at the pros and cons of both types of inverters.

**Ninja Tip!**



Typical warranty for inverters is between 5 to 10 years. Some installers offer extended warranty. Do check with your solar installer how you are covered.



String Inverter (1 per solar system)

or

Micro-inverter (1 per solar panel)

Figure 5: Sting vs Micro Inverter

Source: SolarQuote

String Inverter	Micro Inverter
1 central inverter that converts all the DC electricity produced from installed pv modules	Usually installed on the back of every individual panel and are only responsible for the conversion on the panel on which they are installed
Typical size from 1.5 to 5 kW for residential application	Much smaller, usually 200 to 250 W
Less expensive	More expensive
Performance very much impacted by underperforming panels that will cause overall energy output to be lowered down	Perform better as underperforming panels either due to shading or degradation do not negatively impact the output of other panels



**W**arranty is a very important aspect often overlooked by buyers. If you own the solar pv system, it is smart to pay attention to the fine prints to avoid negative impact on your solar investment. If you opt for Solar Energy Purchase or Solar Leasing, you do not have to worry as system faults are under the responsibility of solar investor.



Product Warranty	Performance Guarantee	Workmanship Warranty
Given by manufacturer	Given by manufacturer	Given by solar installer
Covers product defects in materials and workmanship	If a panel's output is lower than promised as stated in the warranty document, manufacturer will replace, repair or reimburse you for the panel depending on the warranty terms	Covers damage to the rooftop and bad wiring and installation
Does not cover wear and tear, extreme environmental sources (e.g. pollution), acts of nature (e.g. lightning), vandalism and third party damage, micro cracks during transport and poor installation	Does not cover if the low energy output is caused by other factors that are not related to manufacturing defects	
Typically between 10 to 12 years	Typically between 20 to 25 years	Typically between 1 to 2 years

**Ninja Tip!**



1. Ask about what's excluded in your warranty
2. Find out what might void your warranty
3. Investigate hidden costs that you may incur
4. Insure your solar pv system investment to cover the gap not covered



**SOLAR FINANCING**

## 05

## SOLAR FINANCING

You can choose from several financing options that suit your budget requirement and financial goals. Every financing option will impact your savings and returns. Summarize here are three types of financing options available in the market.

	Cash/Loan	Solar Lease	Solar Energy Purchase
Definition	Owner buys the system from solar provider by cash	Means an agreement whereby a third party pays for and owns the system while customer pays a fixed fee	Means an agreement whereby a third party owns, develops, and finances the project's installation, recovering their costs via the sale of solar energy generated at contracted rates
Applicable for residential?	Yes	Coming soon	No
Applicable for businesses?	Yes	Coming soon	Yes
Upfront payment	Yes	Zero	Zero
Payment schedule	One time payment for cash option or monthly repayment for loan	Term: Monthly Amount: Fixed	Term: Monthly Amount: Fluctuate based on solar energy units generated
System ownership	You own the system	Owned by solar provider (also known as Asset Owner)	Owned by solar provider (also known as Asset Owner)
System maintenance & repair cost	Borne by you	Borne by solar provider throughout contract period	Borne by solar provider throughout contract period
System warranty	Yes	Yes	Yes
Contract term	Not applicable	3 to 10 years	15 to 21 years



OPTIMIZING YOUR SOLAR ENERGY OUTPUT

## 06

**OPTIMIZING YOUR SOLAR ENERGY OUTPUT****1. Clean your solar pv modules periodically.**

As dust and dirt accumulate over time, the intensity of sunlight striking the pv modules will reduce and impact the energy output. Malaysia is blessed with rain all year round that automatically wash the dirt away from your solar panels. Nevertheless, in areas such as farmland, industrial area and ground mounted arrays, you may want to get the panels clean yearly.



Figure 6: Cleaning solar panels

Source: Solar Naturally

**2. Inspect the pv system annually**

Solar pv system is subjected to externalities that may lead to less efficient system. Typically, your solar installer will provide free maintenance for the first year, and some may extend to 2 years. During inspection, the engineer will look out for any defects, cracks and electrical joint hotspots in your system.



Figure 7: System inspection

Source: Solar Clean

**3. Monitor your solar energy output**

Typically, your solar pv system comes with online monitoring application that lets you monitor the energy output in real time. Look out for any sudden drop in output.



W W W . T N B X . C O M . M Y

## 5 COMMON MISTAKES TO AVOID



# 07

## 5 COMMON MISTAKES TO AVOID

### **Mistake 1: Making decision solely based on price**

Hopefully throughout this ebook, we have given you insights that investing on solar is the same as buying a house as you are in for the long haul. We are talking about 25 years of warranty and obligation. Therefore, when you make your decision, look out for other aspects as well such as track record of the solar installer, its warranty policy, certification, after sales support and quality of materials used. Do not cut corners to reduce cost.

### **Mistake 2: Not calling in the professionals**

Do not try to pull a McGyver when it comes to solar pv system. If you are not qualified and certified, do not try to assemble the solar pv system yourself by watching bunch of Youtube videos. In addition, do not hire your common electrician to do the wiring for you. While this may save you money in the short term, it will definitely come back to bite you in the long term.

### **Mistake 3: Not understanding warranties**

We cannot stress enough on this point. Read the fine prints and ask questions to your solar installer.

### **Mistake 4: Missing out on incentives**

Do not miss out on tax incentives on your solar investment. Furthermore, take full advantage of various solar schemes available as described in Chapter 2.

### **Mistake 5: Having unrealistic expectations**

Solar energy output varies according to the weather. It may take years before you receive payback from your investment. Be patient and think long term.

Hope you enjoy this ebook and find it helpful. Do reach out to us for any questions.

***ALL THE BEST!***





## USEFUL LINKS

Topic	Link
Solar electricity generation concept	<a href="https://youtu.be/OelhlcPVtKE">https://youtu.be/OelhlcPVtKE</a>
Residential electricity tariff	<a href="https://www.tnb.com.my/residential/pricing-tariffs/">https://www.tnb.com.my/residential/pricing-tariffs/</a>
Tax incentives for green industry	<a href="https://www.mida.gov.my/home/tax-incentives-for-green-industry/posts">https://www.mida.gov.my/home/tax-incentives-for-green-industry/posts</a>
Estimate solar pv cost and savings	<a href="https://www.tnb.com.my/solar/index.html">https://www.tnb.com.my/solar/index.html</a>
Solar Energy Purchase savings calculator	<a href="https://www.tnbx.com.my/sare">https://www.tnbx.com.my/sare</a>
Renewable energy schemes available in Malaysia	<a href="https://www.mytnb.com.my/renewable-energy/benefits-of-generating-your-own-re">https://www.mytnb.com.my/renewable-energy/benefits-of-generating-your-own-re</a>
Video on Solar Energy Purchase	<a href="https://youtu.be/B_tVN2vx6ml">https://youtu.be/B_tVN2vx6ml</a>
Video on Net Energy Metering	<a href="https://youtu.be/3p5V-btjBtA">https://youtu.be/3p5V-btjBtA</a>
NEM guidelines	<a href="http://www.seda.gov.my/reportal/nem/guidelines/">http://www.seda.gov.my/reportal/nem/guidelines/</a>
NEDA guidelines	<a href="https://www.singlebuyer.com.my/neda/guidelines.php">https://www.singlebuyer.com.my/neda/guidelines.php</a>

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