

Solar energy applications in apparel production

Tapping the sun's energy for manufacturing operations is an increasingly feasible, pragmatic and profitable option

In July, 2019 the Myanmar government increased electricity tariffs. The impact on the manufacturing sector is significant, with average electricity prices for garment factories increasing by approximately 20%. With this increased electricity price, and if one assumes continued need for diesel back-up generator supply similar to the previous few years, the **payback period for solar PV systems has decreased to less than 5 years.**

Why is solar an excellent choice for garment factories in Myanmar?

- With a tropical climate, Myanmar enjoys excellent sunshine for most of the year.
- Myanmar's situation of being highly dependent on hydroelectricity results in national grid supply being lowest during the dry season, when dams are at reduced capacity, at the same time when sunshine is most abundant and solar can produce the most benefit.
- Garment factories are most typically large, single story structures with abundant roof space, providing ample free space for panel arrays.
- Panels act as a form of insulation against the sun and can help keep buildings cooler.
- Brands and retailers using the Higg Index award points to factories with renewable energy sources. As such, having solar panels can increase the factory's negotiating power with some buyers.
- When grid power cuts off, factories can also use solar systems in-sync with diesel generators.



An electrical engineer from SMART Myanmar evaluates an 80 kW solar PV system at a garment factory in Yangon in Nov., 2018.

The main parts of a solar PV system

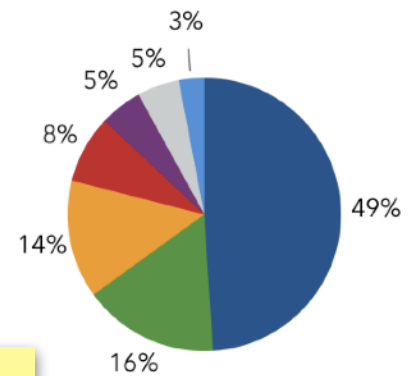
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|-------------------------------------|--|
| 1) Solar PV panels | <p>The most visible part of a solar PV system, panels generate electricity from sunlight. The more sunlight, the more electricity can be produced, but even in cloudy weather panels produce electricity. Garment factory rooftops in Myanmar are typically large enough to accommodate substantial panel arrays. The quality of panels matters, and options abound, with panels manufactured in many different countries. German-made panels and components often score highly in consumer reviews and technical grading assessments.</p> |
| 2) Storage battery | <p>Batteries are optional in a solar PV system. They increase the cost of installation greatly, but they provide the option to store surplus electricity. For garment factories which operate 6 days per week, batteries would mostly only be useful in the early morning and on Sundays. Factories might want to consider partial battery storage solutions for office applications.</p> |
| 3) Inverter | <p>The inverter converts the variable direct current from the panels to usable alternating current. If the panels are like the stomach of the system, the inverter is more like the brain or heart. As such getting a good quality inverter is especially important to ensure a well-functioning and long-lasting PV set-up. A charge controller is only needed if the system has linked battery storage.</p> |
| 4) Charge controller | <p>The charge controller prevents the batteries from over-charging, which can be a fire risk. A charge controller is only needed if the system has battery storage.</p> |
| 5) AC and DC wiring | <p>Direct current (DC) wiring and (alternating current) AC wiring are different. This is one of several areas where an untrained electrician can make a mistake that an experienced solar engineer would know how to avoid.</p> |

Did you know...

- The area required to install 1 kWp capacity solar PV system is approx. 8 to 10 m².
- Solar panels produce approx. 10 kWh of electricity per square foot.
- It is possible to install a solar PV system without battery to reduce installation cost.
- The orientation of solar panels (solar angles) are best aligned according to the latitude of location.
- Solar PV also produces electricity during cloudy days, but in lesser amount.
- The cost of solar panels has dropped by 80% since 2008.
- Most solar panels comes with a 25 year warranty.
- Solar energy is a completely free source of energy and is found in abundance.
- Using a solar PV system reduces carbon dioxide (CO₂) emissions for our environment.

- Solar energy can also be used to generate hot water or steam for process applications at garment factories.

Cost breakdown of a typical solar PV system



For apparel factories, rooftop systems present freely available space, saving 16% of common costs.



- PV modules
- Land
- Balance of system
- Module mounting structures
- Pre operative expenses
- Civil works
- Others



A garment factory in Patheingyi which participated in the SMART Management Systems Program. As of mid-2019 this factory's 250 kW rooftop system is the largest rooftop solar system in the Myanmar garment industry.

What should factories do?

To better understand the practical benefits solar can provide, factories should conduct **solar feasibility assessments** to find out how solar could work for their own companies. As part of this assessment, a skilled service provider will estimate the return on investment for the recommended system.

A solar feasibility assessment mostly involves...

- **Evaluating the most practical space & location** to install the panels and inverter.
- **Estimating the potential return on investment for the system.** Currently, this is about 5 years for garment factory rooftop systems in Myanmar. To be clear, after the solar PV system has paid itself off, energy from the sun is nearly free (one ought to assume small routine maintenance costs and the need to replace the inverter after 10 or 15 years).
- **Proposing a solar PV solution fit for purpose.** Different factories have different expectations, needs and budgets. The engineer conducting the solar feasibility assessment ought to speak with the factory management and determine how the system will be used and how large an array is practical. In particular, the assessor will also need to decide if battery storage is required or not.

Regarding quality

Good inverters can last more than 10 years, sometimes up to 15 years or more. Decent solar panels ought to last 25 years and should come with a clear quality assurance warranty from the manufacturer.

Quality of installation also matters. Only experienced electrical engineers with a background in solar systems installation should be contracted to set-up a rooftop solar PV system. This is to ensure the system is set-up in an efficient, correct and safe manner,

Leading companies in Myanmar providing grid-connected rooftop solar solutions for factories and other businesses include:

Mandalay Yoma

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Indigo Energy

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Maintenance & cleaning

Like any piece of valuable factory equipment, panels and inverters need to be maintained properly. At minimum, an annual maintenance check on the entire system should be conducted, ideally by the service provider who installed it. The inverter will need to be replaced after about 10 years, although a high-quality inverter may last 15 or more years. Basic cleaning with a non-abrasive water/soap solution should be done bi-weekly. To facilitate regular cleaning & maintenance, factories with rooftop solar systems should also install a permanently affixed access ladder for safer & more effective rooftop access for staff.



Shwe Zarmani, an SME garment factory in Yangon, installed a 66 kW solar PV system with Mandalay Yoma in early 2019.

To learn more about **SMART Myanmar** visit: www.smartmyanmar.org or contact: khinoo@smartmyanmar.org

To learn more about **GIZ FABRIC** contact: hnin.hlaing@giz.de

The statements in this research note represent the views of SMART Myanmar and do not necessarily reflect the views of the European Union or the German Federal Ministry for Economic Cooperation and Development.

The other solar option...

The largely undiscovered potential of **solar thermal** systems - another attractive option for garment and textile factory applications

Garment and textile plants quite typically need steam. Depending on production processes, sometimes large quantities of steam are required. For "typical" contract manufacturing garment factories, inputting a small solar thermal assist for the boiler feed water tank can be a reasonable option. For large textile mills with significant hot water requirements, a compound parabolic concentrator can be an idea worth considering. Although the technology can cost more up-front, once set-up free energy from the sun can be harnessed, with some expense for maintenance of the equipment.

Basic 'solar thermal assist'

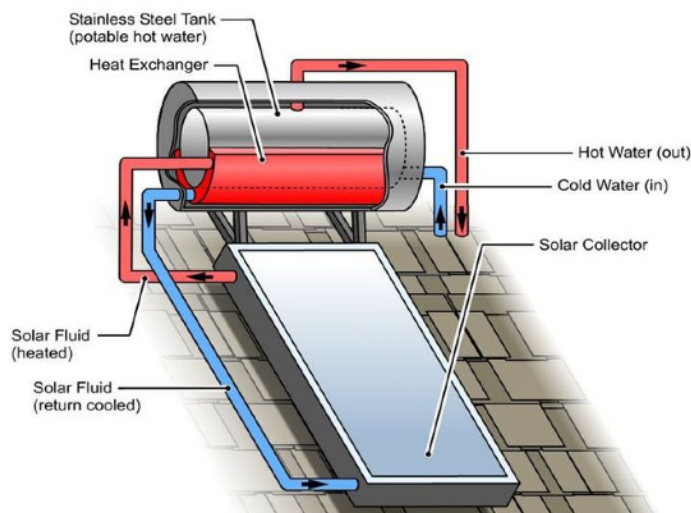


Illustration provided by ttz Bremerhaven

There are several possible ways to set-up a 'solar thermal assist' feed-in system for a garment factory. One application is to use it for staff dormitories - this has been done successfully by Karisma Apparel in Bago. Another application would be to use it to supplement boiler feed water tanks. **Every degree the temperature of boiler feed water can be raised = energy and money saved.** A solar thermal system on the rooftop of a garment factory can feasibly be set-up to raise boiler feed water temperature by up to 20 or 30 degrees celsius - assuming normal garment factory steam applications for only an ironing department. Such a solar thermal assist feed-in supplement can result in substantial carbon emissions reductions and fuel savings for the factory. The payback period for such systems must be based on several site-specific factors, but can be as little as 3 years.

Direct steam generation via parabolic concentrators

A technology only occasionally used in textile industry steam applications, compound parabolic concentrators and parabolic troughs are nonetheless starting to gain more attention for their potential to save money and reduce carbon footprints.

Compound parabolic systems focus and concentrate the sun's rays in such a way as to generate intense heat, allowing for **direct steam generation**. Industrial applications for garment and textile factories could include the provision of a parabolic trough system which can supplement a traditional boiler. The trough can provide **free steam via the sun's rays** when the sunlight is adequate (most of the year).



Parabolic troughs for at a dairy processing factory in Gandhinagar, India. Designed and installed by Thermax, this factory receives direct steam generation from the trough system of approx. 300 kg/hr., complementing the factory's regular boiler system with carbon-free, cost-free steam.

To learn more about Thermax solutions & services for solar thermal applications, contact:
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