SUSTAINABILITY ACTION PLAN FOR TP

DYEING UNIT

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E599A- Capstone Consulting Project

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HARVARD
Extension School

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BACKGROUND

About TP Dyeing Unit

TP Dyeing Unit is a global apparel and knitted garments manufacturing company located in Tiruppur. Tiruppur is a major textile and also knit wear hub in India contributing to about 90% of total cotton knit wear exports from India. The textile industry in Tiruppur employs about 600,000 people and recorded a contribution of about 200 billion INR/ $3.0 billion to exports in the year 2014-2015. TP Dyeing Unit operates with a mission to produce world-class garments and offers wide range of products – women's wear, men's wear and kid's wear. With more than two decades of experience in the knitted garments field, the company has been flourishing all directions under strong leadership.

The products are designed with care, to satisfy the latest trends in the fashion and also cater to any needs of the clients.

Figure 1 - Location of TP Dyeing Unit Process on google maps. (Google, 2018)

TP Dyeing Unit's Mission

"Our mission is to supply garments worldwide to fashion market, where the garments supplied provide better value in quality, price, and service than its competitors so that the whole chain is benefited"

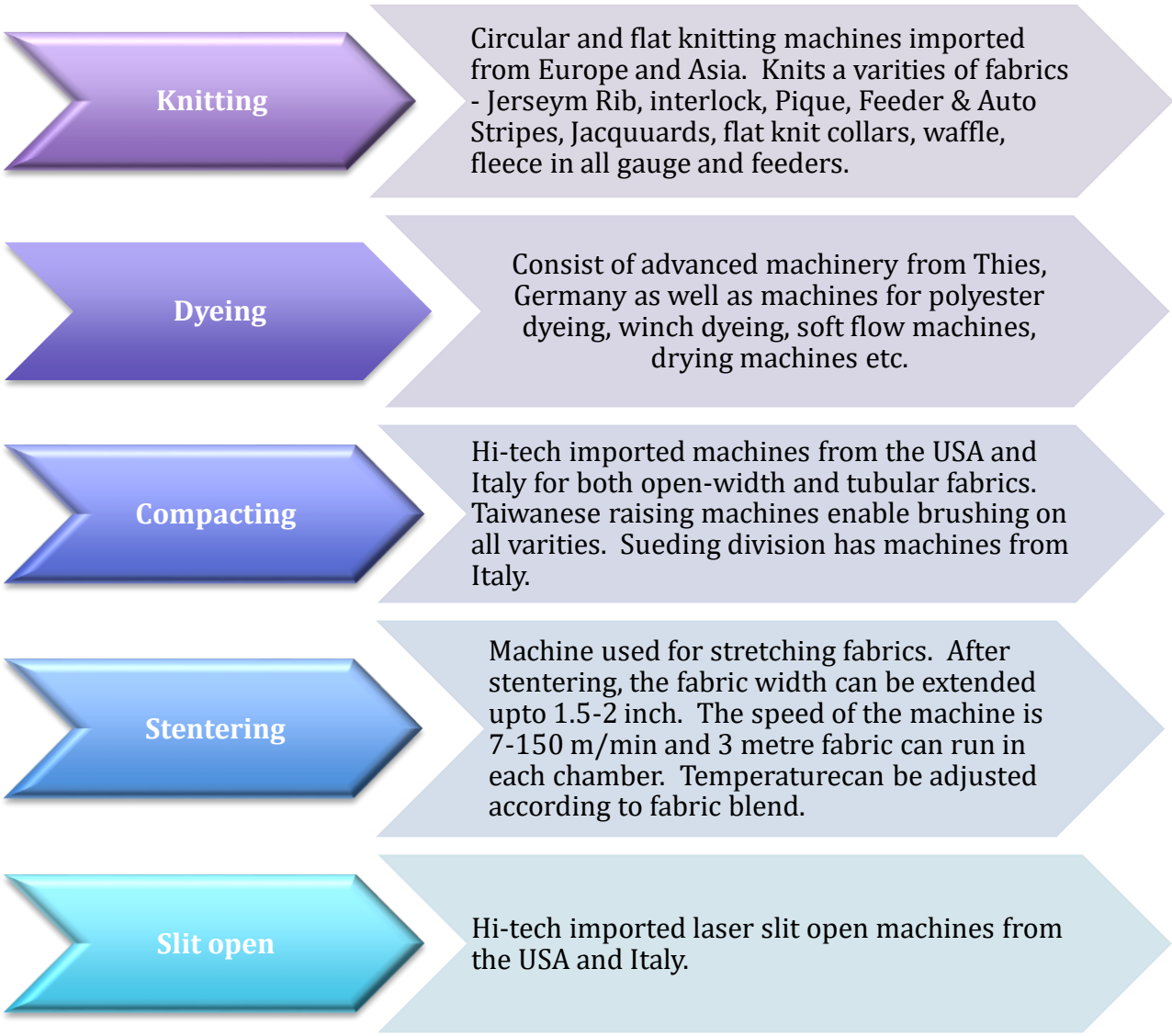
" MAKING BETTER SENSE OF BUSINESS "

Figure 2 - Dyeing unit at TP Dyeing Unit

TP Dyeing Unit process is equipped with sophisticated and important equipment for dyeing.

Figure 3 Dyeing unit at TP Dyeing Unit

Process map of dyeing in TP Dyeing Unit



The facility has in-house washing units that feature recyclable water and also has multiple wash options like silicon/stone and enzyme and bio-polish. It is also equipped with reverse osmosis feed tank plant that recycles discharged water suitable for irrigation testifying to their ***eco-friendly operations***. According to their flow chart, dyeing and stentering are built inside the dyeing unit and the energy consumption mentioned in the below sections are including dyeing and stentering process.

Environmental Issues in Tiruppur

The city has a long history of polluting their rivers and steam due to release of toxic chemicals into the environment. The dyeing industries in Tiruppur were unaware of the consequences until pollution control agencies educated them about what was happening in rivers and streams in their cities. Earlier in 2011, The Madras High Court issued directions that Tamil Nadu Pollution Control Board (TNPCB) should close all Common Effluent Treatment Plants (CTP) and Integrated Effluent Treatment Plants (IETP), bleaching and dyeing units in Tiruppur area. As a result, about 700 units were shutdown unless they came with a solution of Zero Liquid Discharge (ZLD) technology in the effluent treatment plants. This drastic move by the Madras High Court resulted in CTP and IETP getting ZLD technology for effective reuse of effluent (Sangameswaran, 2011). As of 2017, there are about 18 CETPs in Tiruppur supporting ZLD. According to Nagarajan, President of Dyer's Association of Tiruppur, the dyeing units are recycling about 92-95% of the water that is discharged as effluent. The dyeing units are able to reuse the same water almost a thousand times without a problem. The industries are also recovering salt and using the same for dyeing process. The sludge resulting from effluent treatment is sent to cement factories (Ravishankar, 2016).

Why is it important for TP Dyeing Unit Process to be energy efficient?

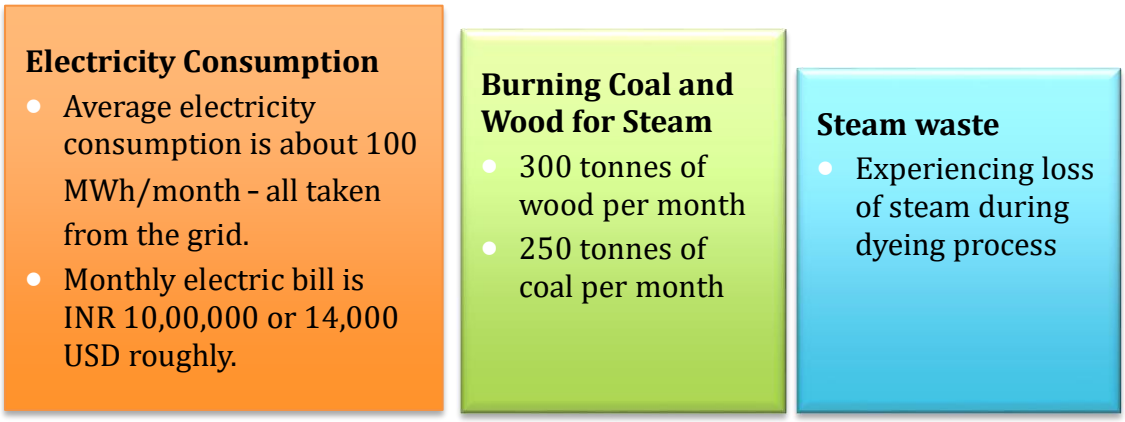
The international clients, especially the leading brands going sustainable ways prefer their suppliers to be sustainable as well (Ravishankar, 2016)**.** The Dyeing industry in Tiruppur is doing well on water conservation after installing ZLD plants. TP Dyeing Unit is connected to the CETP and have extremely efficient (Pillai, 2018)t with their water consumption. The industry dyes only organic grey cotton approved by GOTS (Global Organic Textile Standard). GOTS define requirements to ensure organic status of textiles – from harvesting of raw materials to environmentally, socially responsible manufacturing &

labeling, to provide a credible assurance to the end consumer. In recent years, there has been more attention to business ethics and corporate social responsibility (CSR). CSR has been steadily increasing among consumers, business, trade organization and other stakeholders. In textile industry, buyers in developed countries are questioned for unethical conditions of suppliers in low wage countries. As a result, greater importance is placed on buyers to adopt sustainable supply chain by either choosing suppliers who have adopted sustainable practices or empowering their suppliers to become sustainable.

CLIENT'S REQUIREMENTS

According to the Managing Director of TP Dyeing Unit fashions, dyeing unit is extremely energy intensive and needs help with reducing the energy consumption by suggesting solutions for the same. The energy consumption for TP Dyeing Unit dyeing unit is as follows.

Figure 4 – Client's pain points



- The factory **does not have any renewable energy sources** and consumes all of its electricity from the grid. They would like to understand **energy efficient methods to reduce electricity bills.**
- The other major concern they have with respect to their energy consumption is burning of coal and wood for producing steam for dyeing process and hot air for drying process. In

TP Dyeing Unit, they look forward to having energy efficient options to **avoid burning of tonnes of coal and wood i.e., if there are any alternative methods and materials for producing steam effectively.**

OPPORTUNITIES AND RISKS

Supplier efficiency has become a critical concern both nationally and in global trade operations having supply chain inefficiencies with added effects on the corporate purchaser. Collaborating with suppliers to account for environmental cost can help reduce waste and also cost associated with purchase of raw materials, improve productivity, reduce expenses and increase savings from waste reduction caused by poor practices. As far as textile business is concerned, most buyers want to improve their supplier's environmental performance. Tiruppur is filled with many textiles dyeing industry and is a severe competitive environment. Apart from that, Tiruppur has been lately losing business to countries like Bangladesh and Pakistan. In order to gain competitive advantage, taking an active role in understanding their energy consumption, their greenhouse gas emissions and undertaking strategies to reduce energy consumption, reduce burning of coal and wood, reduce steam waste could present plethora of opportunities for the clients. As suppliers, to have sustainability or green tag on them is going to provide better visibility, as their buyers are moving towards sustainable supply chain.

Intelligent sourcing is taking into consideration all costs related to products and services – purchase price, usage, disposal cost, maintenance etc. The buyers are incorporating additional evaluation metrics like carbon and water footprint, raw material composition, energy intensity, packaging score, transportation etc. The buyers have started monitoring supplier's environmental, social and governance activities to avoid risk and brand damage followed by financial and compliance risk (Oracle, 2015). As TP Dyeing Unit Process was

established with a mission to produce world-class garments, moving towards path of sustainability will give it a better competitive edge. It also simplifies the process for buyers to choose supplier with sustainability and code of conduct already in place.

TP Dyeing Unit Process' energy consumption is derived from electricity, coal and wood. The price volatility of these three can affect the operating process of dyeing industry. There is a considerable risk of losing its revenue to its competitor with less environmental footprint. Apart from that, as mentioned earlier, in the year 2010, many dyeing industries were shut down for polluting surface and ground water resources in Tiruppur. This resulted in establishment of ZLD plants across Tiruppur leading to less pollution and reduction of water consumption. As there is a growing need for reducing greenhouse gas emissions in India, industries might be advised to reduce their GHG emission. This could be supported by stringent regulations and failing to comply the same might lead to consequences similar to that of 2010. So efficient management of energy not only reduces cost, but also reduces environmental risk that the factory can face in the future.

Price volatility of coal, electricity and diesel also presents significant risk to the factory, as they are mainly dependent on these fuels. Global coal prices have been increasing steadily in the last few months resulting in cost pressure for thermal power producers in the country. The price of 4200 kcal/kg grade coal, a popular grade in India and China has surged 33% to $49.25 per tonne since February 2018 compared to the start of 2017 which was around $37 per tonne. As power producers are relying on imported coal for power generation, increase in coal price has put pressure on them (Pillai, 2018). Similar situations in the past have resulted either in power cuts or increase in tariff. Reliance on renewable energy could reduce this risk for TP Dyeing Unit in future. **The buyers will be confident to continue to relationship as the business takes the path of sustainability.**

Opportunities of becoming sustainable business (Rogers, 2016)

Improved brand and better competitive edge	Studies have found that the brand image of a company increases if it is sustainable. People believe in companies
Increase in productivity and reduction in cost	Sustainability can lead to efficient operation that can streamline effort and conserves resources, enhancing employee productivity and cost reduction.
Increasing business ability to comply with legislation	Integrating sustainability into business will enable it to meet changing regulations.
Attract more employees & buyers	Showing respect to the environment and of its employees will tend to attract people whom the company wants to employ and also funds needed for business to expand.
Reduce waste	Engaging in sustainable business practices can reduce waste.
Make stakeholders happy	If your business can become sustainable, morale and productivity is likely to improve with increase in sales as costs decrease. It's a win-win situation the buyers, consumers, and the employees.

Risk involved in not being sustainable business (Deloitte, 2018)

RECOMMENDATIONS

Reducing electricity consumption

As electricity consumption was the most critical problem faced by the client. The first and foremost recommendation is use of solar energy in their facility. The Government of India under Ministry of New and Renewable Energy (MNRE) has launched several schemes since 2014 to support renewable energy generation in the country. Solar capacity in India has increased to 370% in the last three years with strong support from the Government (MNRE,

2018). Benefits of installing solar energy in a facility are as follows (Kenbrook Solar, 2018)

1. Return on Investment

Resident and commercial customers paying more than INR 1,500 monthly as electricity bill should consider installing grid tied solar net metering system. This can result in electricity bill savings by 20%-30%.

A rough estimate of ROI calculation is as follows

Figure 5 – Return on Investment of Solar Plant (Kenbrook Solar, 2018)

Solar Plant	Solar Plant Cost	Govt. Subsidy	Cost After Subsidy	Units Monthly	Savings Monthly	Payback Period
1KW	75,000	20,000	55,000.00	120	960	4.5 Years
2KW	1,40,000	40,000	1,00,000	240	1920	4.5 Years
3KW	2,10,000	60,000	1,50,000.00	360	2880	4.5 Years
4KW-1P	2,50,000	80,000	1,70,000	480	3840	4 Years
5KW-1P	3,20,000	1,00,000	2,50,000	600	4800	4 Years
10KW-3P	5,80,000	1,74,000	4,06,000.00	1440	11,520	3 Years

2. Net Metering Benefits

Net metering was announced in the state of Tamil Nadu through Tamil Nadu Solar Energy Policy 2012, which is an integral part of the policy. Consumers planning to install grid-connected solar PV systems can apply for solar net-metering with consumer guideline for solar net-metering explaining the process. In grid-connected solar PV systems, solar energy produced by solar panels is converted to AC (alternating current) by a solar grid inverter. The output of the solar grid inverter is connected to the distribution board switch-board of the building or facility. The electricity flows to the loads of the building and if solar energy produced is more than what the building load consumes, the surplus energy will automatically be exported to TANGEDCO. If availability of solar energy is less than what

the loads of the building require, the shortfall is withdrawn from grid (in other words energy import) (TEDA, 2018).

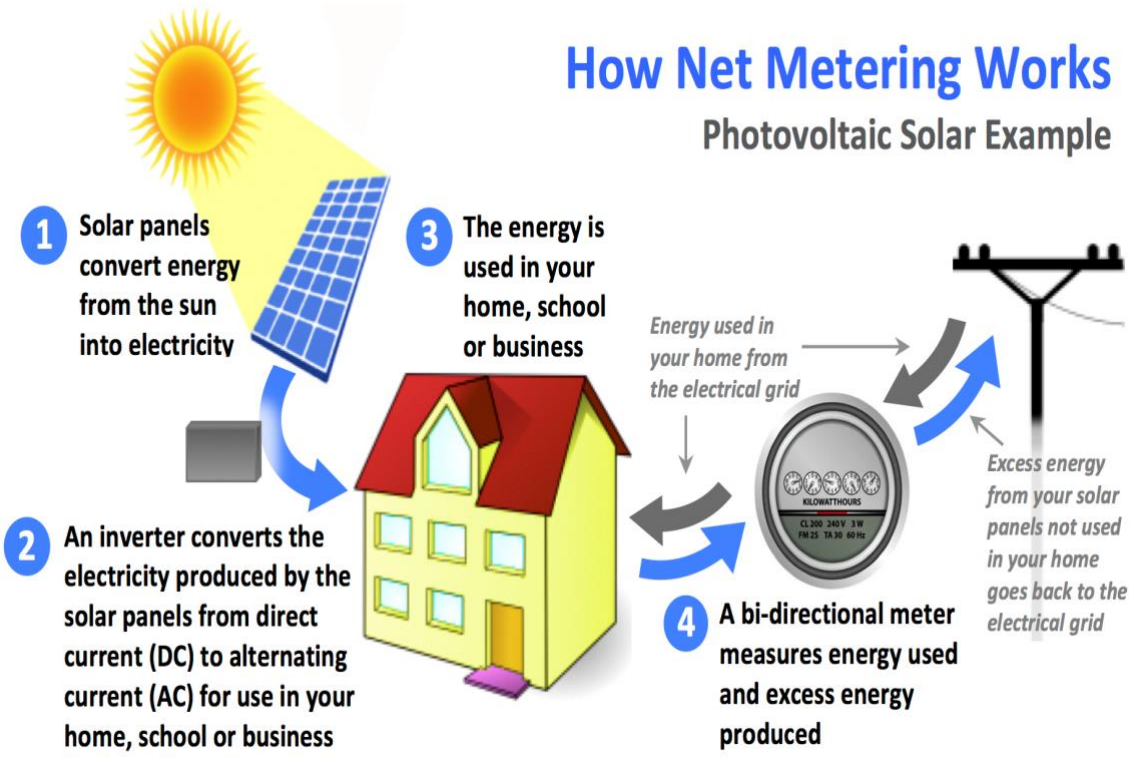


Figure 6 – Solar Net Metering (Renewgreen, 2016)

3. Tax benefits

Commercial, private and industrial customers can leverage on accelerated depreciation benefit. Solar power generation projects also have the option of profiting from accelerated depreciation benefit by the Central Government under section 32 of the Income Tax Act, 1961. Companies make use of the benefit to substantially reduce tax burden in the first few years of the project mostly accounting for 100% of the project cost (80% accelerated depreciation and 20% additional depreciation) (Kenbrook Solar, 2018).

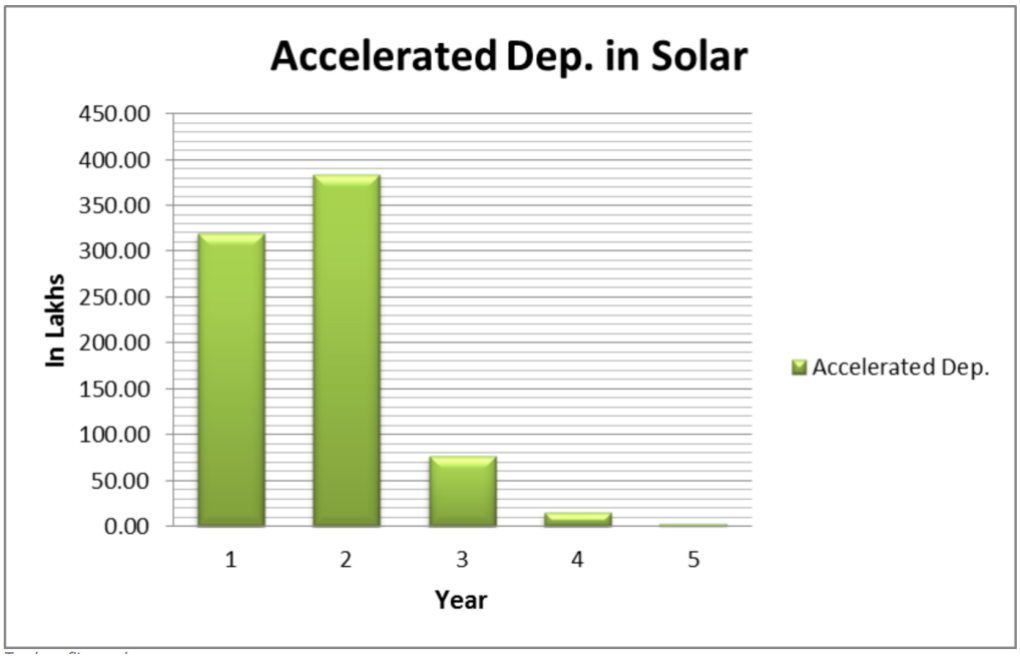
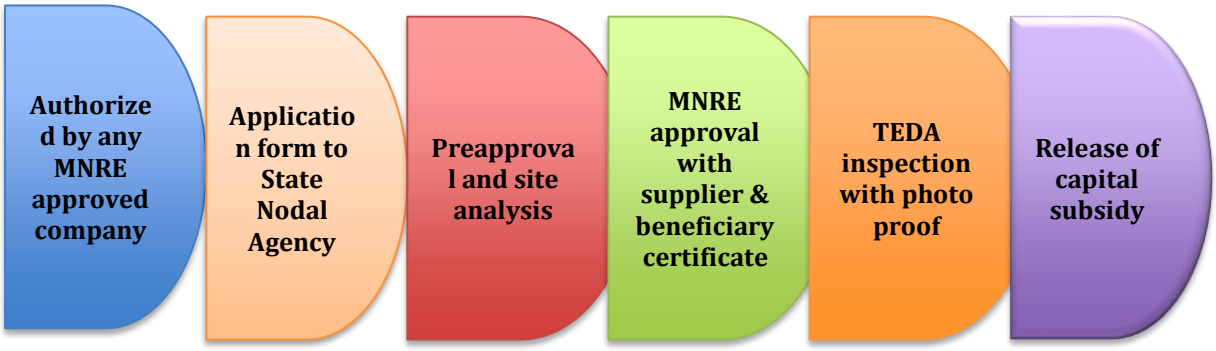


Figure 7 – Tax benefits on solar projects (Kenbrook Solar, 2018)

Under section 80-IA of the Income Tax Act of 1961, the Central Government provides about 10-year tax holiday. The beneficiary has the freedom to choose a ten-year continuous period in the first 15 years of the project life to avail tax benefits. The projects are taxed using the Minimum Alternate Tax (MAT) rate, which is significantly lesser than the corporate tax rate. The Central Government has also mandated concessions and exemptions on specific materials imported that are used in manufacturing of solar products as well as using it in solar power generation projects (Kenbrook Solar, 2018).

Procedure to get MNRE (Ministry of New and Renewable Energy) is as follows



i. The organization has to first submit a project report with technical and financial details,

operations and maintenance plan supported by system monitoring and reporting details to MNRE via district head of the state nodal agency (SNA).

ii. The MNRE evaluates the project on technical and financial details.

iii. SNA inspects the installation to ensure that only MNRE approved components are installed. Followed by this, the subsidy is released to channel partner directly from MNRE.

iv. The organization will be responsible for payment of 70% of the system cost, if the facility chooses to finance its solar plant. The facility can also work with a bank to procure financing 70% of the system cost.

Solar panels for TP Dyeing Unit Process – Capital cost and simple payback period

The simple payback period for solar installation in TP Dyeing Unit process is done based on site survey by a reputed solar panel installer and consultant – **SOLAR TOWN.**

About Solar Town Energy Solutions Private Limited

SOLAR TOWN
Powering Your World

SolarTown Energy Solutions Pvt. Ltd. is a pioneer in India's solar industry specializing in the sale, lease and installation of solar rooftop systems for residential, commercial and industrial customers. SolarTown empowers businesses and homeowners to take control of their electric bills by adopting clean solar power at a fixed cost that is lower than DISCOM rates. Shielding its customers against rising energy costs, SolarTown offers two options: direct purchase of a system with accelerated depreciation tax benefits and payback periods as low as five years, or lease of a system with no upfront costs and a fixed rate going forward. Its confidence in its systems is reflected in a unique 15-year performance guarantee and hassle-

free O&M service. With over 100 installations and an impressive customer base of some of India's top corporates, such as Infosys, Axis Bank, RBL Bank, Renault-Nissan, Plant Engineering and Aachi Group, SolarTown is India's preferred supplier of solar rooftop systems from 1 kW to 500 kW (Solar Town, 2018).

Cost Savings Calculation For TP Dyeing Unit Process for 1000 Kw Solar installation – CAPEX Calculations

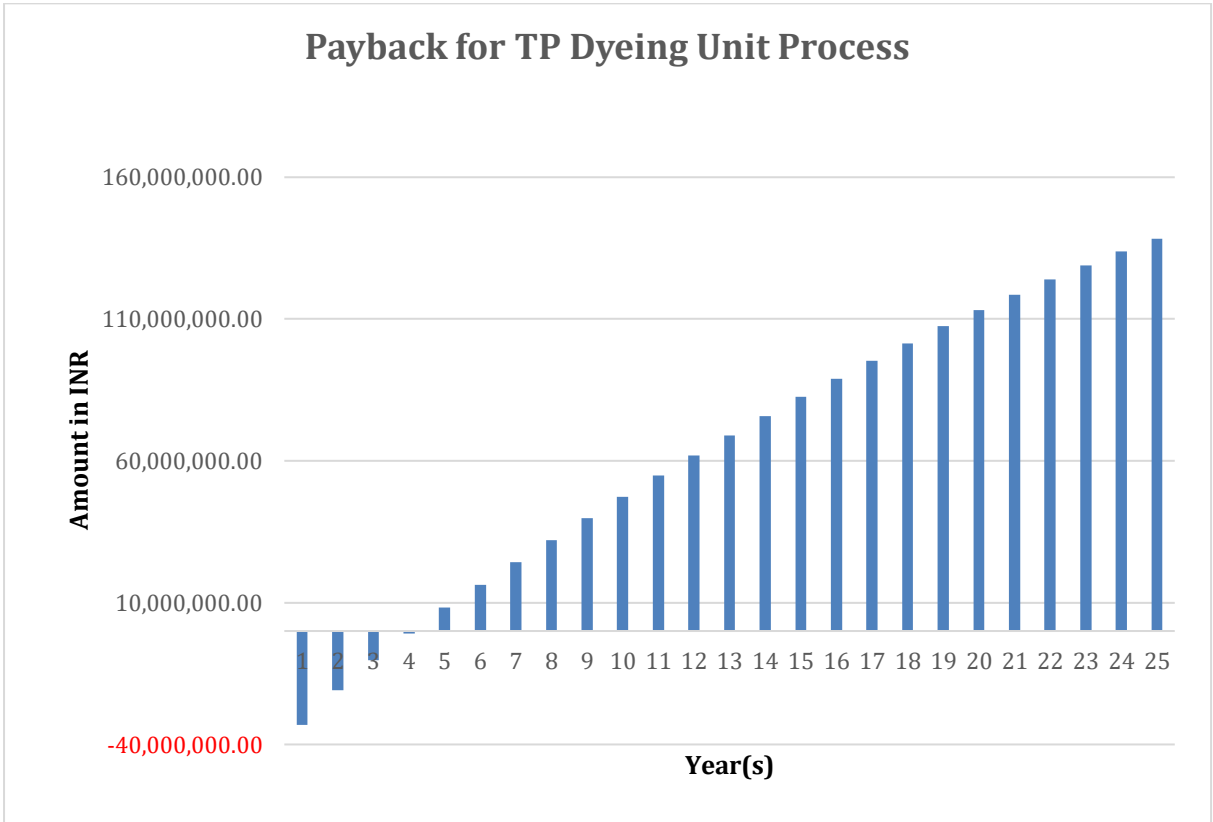
Calculation based on CAPEX

Table 1 – Cost savings for solar panels based on CAPEX model

COST SAVING CALCULATIONS				SOLAR TOWN				
LT III-B other industries		6.35	Rs/KWh			Power Degradation Factor		0.7%
Maintenance Charges		Downpayment	0%					
Maximum Mainteneance charge per year	12,00,000.00	Loan Amount	4,70,00,000.00	Tenure(years)	7	Interest	18%	EB / Diesel Escalation rate
EMI	20000							
Size of system (KWp)	Energy Produced KWh	Cost of System (Rs) A	Capital Subsidy 30% in Rs B			Final cost Rs C=A-B in lacs	Accelerated Depreciation	Effective Investment (net of depreciation)
1,000.00	15,00,000.00	4,70,00,000.00				4,70,00,000.00	1,30,03,584.00	4,70,00,000.00

Year	Generation	Savings (in Rs)	Diesel Savings	Maintenance (In Rs)	EMI per year	Accl Depreciation Benefit	Net Savings (in Rs)	Payback (In Rs)
0							-4,70,00,000.00	
1	15,00,000.00	95,25,000.00	0.00	12,00,000.00	0.00	56,40,000.00	1,39,65,000.00	-3,30,35,000.00
2	14,89,500.00	99,31,241.25	0.00	12,60,000.00	0.00	33,84,000.00	1,20,55,241.25	-2,09,79,758.75
3	14,79,073.50	98,61,722.56	0.00	13,23,000.00	0.00	20,30,400.00	1,05,69,122.56	-1,04,10,636.19
4	14,68,719.99	97,92,690.50	0.00	13,89,150.00	0.00	12,18,240.00	96,21,780.50	-7,88,855.69
5	14,58,438.95	97,24,141.67	0.00	14,58,607.50	0.00	7,30,944.00	89,96,478.17	82,07,622.48
6	14,48,229.87	96,56,072.68	0.00	15,31,537.88	0.00		81,24,534.80	1,63,32,157.29
7	14,38,092.26	95,88,480.17	0.00	16,08,114.77			79,80,365.40	2,43,12,522.69
8	14,28,025.62	95,21,360.81	0.00	16,88,520.51			78,32,840.30	3,21,45,362.99
9	14,18,029.44	94,54,711.28	0.00	17,72,946.53			76,81,764.75	3,98,27,127.74
10	14,08,103.23	93,88,528.30	0.00	18,61,593.86			75,26,934.44	4,73,54,062.18
11	13,98,246.51	93,22,808.61	0.00	19,54,673.55			73,68,135.05	5,47,22,197.24
12	13,88,458.78	92,57,548.95	0.00	20,52,407.23			72,05,141.72	6,19,27,338.95
13	13,78,739.57	91,92,746.10	0.00	21,55,027.59			70,37,718.51	6,89,65,057.46
14	13,69,088.40	91,28,396.88	0.00	22,62,778.97			68,65,617.91	7,58,30,675.37
15	13,59,504.78	90,64,498.10	0.00	23,75,917.92			66,88,580.18	8,25,19,255.55
16	13,49,988.24	90,01,046.61	0.00	24,94,713.82			65,06,332.80	8,90,25,588.35
17	13,40,538.33	89,38,039.29	0.00	26,19,449.51			63,18,589.78	9,53,44,178.14
18	13,31,154.56	88,75,473.01	0.00	27,50,421.98			61,25,051.03	10,14,69,229.17
19	13,21,836.48	88,13,344.70	0.00	28,87,943.08			59,25,401.62	10,73,94,630.79
20	13,12,583.62	87,51,651.29	0.00	30,32,340.23			57,19,311.06	11,31,13,941.85
21	13,03,395.54	86,90,389.73	0.00	31,83,957.25			55,06,432.48	11,86,20,374.33
22	12,94,271.77	86,29,557.00	0.00	33,43,155.11			52,86,401.89	12,39,06,776.23
23	12,85,211.86	85,69,150.10	0.00	35,10,312.86			50,58,837.24	12,89,65,613.46
24	12,76,215.38	85,09,166.05	0.00	36,85,828.51			48,23,337.55	13,37,88,951.01
25	12,67,281.87	84,49,601.89	0.00	38,70,119.93			45,79,481.96	13,83,68,432.97

Chart 1 - Payback chart for TP Dyeing Unit Process



Electricity savings and Net savings

CAPEX Investment – Electricity and Net savings

Chart 2 - Electricity and net savings from installing solar panels

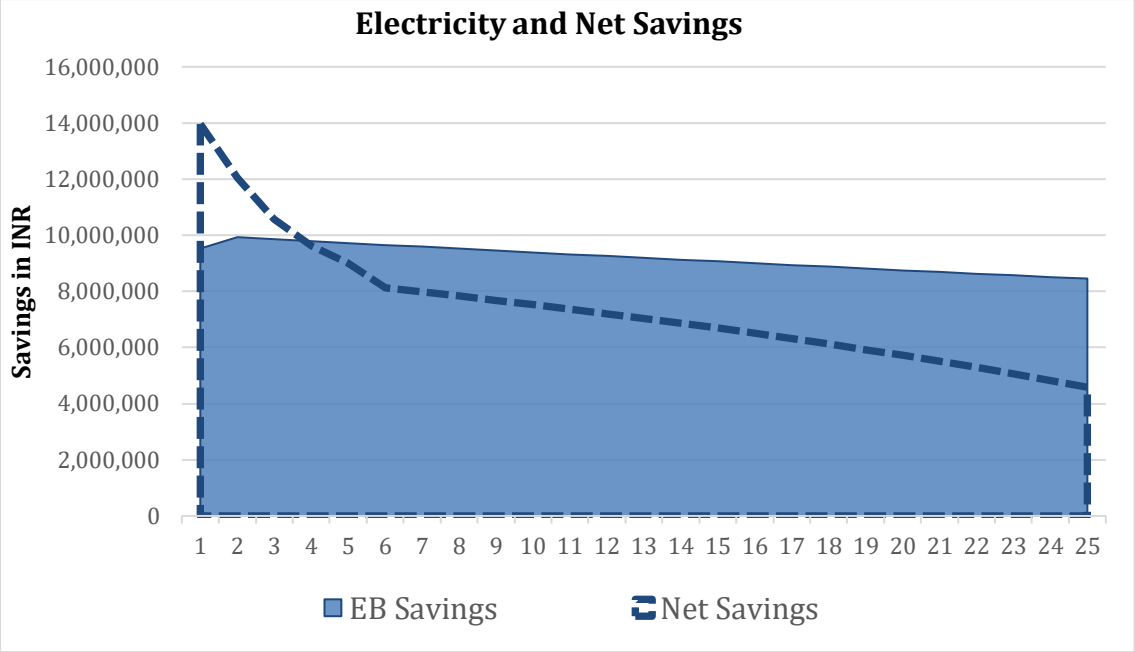


Table 2 – Payback period after factoring electricity bill savings and tax savings

CAPEX Investment							
Year	Solar Generation (Units)	EB Savings (in Rs)	Diesel Savings	Maintenance (In Rs)	Tax Saving (Depreciation)	Net Savings (in Rs)	Payback (In Rs)
1	15,00,000	95,25,000	0	12,00,000	56,40,000	1,39,65,000	3,30,35,000
2	14,89,500	99,31,241	0	12,60,000	33,84,000	1,20,55,241	2,09,79,759
3	14,79,074	98,61,723	0	13,23,000	20,30,400	1,05,69,123	1,04,10,636
4	14,68,720	97,92,691	0	13,89,150	12,18,240	96,21,781	7,88,856
5	14,58,439	97,24,142	0	14,58,608	7,30,944	89,96,478	82,07,622
6	14,48,230	96,56,073	0	15,31,538	0	81,24,535	1,63,32,157
7	14,38,092	95,88,480	0	16,08,115	0	79,80,365	2,43,12,523
8	14,28,026	95,21,361	0	16,88,521	0	78,32,840	3,21,45,363
9	14,18,029	94,54,711	0	17,72,947	0	76,81,765	3,98,27,128
10	14,08,103	93,88,528	0	18,61,594	0	75,26,934	4,73,54,062
11	13,98,247	93,22,809	0	19,54,674	0	73,68,135	5,47,22,197
12	13,88,459	92,57,549	0	20,52,407	0	72,05,142	6,19,27,339
13	13,78,740	91,92,746	0	21,55,028	0	70,37,719	6,89,65,057
14	13,69,088	91,28,397	0	22,62,779	0	68,65,618	7,58,30,675
15	13,59,505	90,64,498	0	23,75,918	0	66,88,580	8,25,19,256
16	13,49,988	90,01,047	0	24,94,714	0	65,06,333	8,90,25,588
17	13,40,538	89,38,039	0	26,19,450	0	63,18,590	9,53,44,178
18	13,31,155	88,75,473	0	27,50,422	0	61,25,051	10,14,69,229
19	13,21,836	88,13,345	0	28,87,943	0	59,25,402	10,73,94,631
20	13,12,584	87,51,651	0	30,32,340	0	57,19,311	11,31,13,942
21	13,03,396	86,90,390	0	31,83,957	0	55,06,432	11,86,20,374
22	12,94,272	86,29,557	0	33,43,155	0	52,86,402	12,39,06,776
23	12,85,212	85,69,150	0	35,10,313	0	50,58,837	12,89,65,613
24	12,76,215	85,09,166	0	36,85,829	0	48,23,338	13,37,88,951
25	12,67,282	84,49,602	0	38,70,120	0	45,79,482	13,83,68,433
IRR	21.0%						

Table 3 – Net Savings Calculation for CAPEX and Loan

Loan and CAPEX							
Year	Generation	Savings (in Rs)	Diesel Savings	Maintenance (In Rs)	EMI per year	Tax Saving (Depreciation)	Net Cashflow
1	14,50,000	92,07,500	0	0	0	1,12,80,000	2,04,87,500
2	14,39,850	91,43,048	0	0	0	22,56,000	1,13,99,048
3	14,29,771	90,79,046	0	4,70,000	0	4,51,200	90,60,246
4	14,19,763	90,15,493	0	4,70,000	0	90,240	86,35,733
5	14,09,824	89,52,384	0	4,70,000	0	18,048	85,00,432
6	13,99,956	88,89,718	0	4,70,000	0		84,19,718
7	13,90,156	88,27,490	0	4,70,000	0		83,57,490
8	13,80,425	87,65,697	0	4,70,000	0		82,95,697
9	13,70,762	87,04,337	0	4,70,000	0		82,34,337
10	13,61,166	86,43,407	0	4,70,000	0		81,73,407
11	13,51,638	85,82,903	0	4,70,000	0		81,12,903
12	13,42,177	85,22,823	0	4,70,000	0		80,52,823
13 - 25	13,32,782	84,63,163	0	4,70,000	0		79,93,163

Cost Savings Calculation For TP Dyeing Unit Process for 1000 Kw Solar installation – Power Purchase Agreement (Leasing)

What is Power Purchase Agreement (PPA)?

Power Purchase Agreement (PPA) is a legal contract document between a power producing company and a power purchase agency. Central Government is offering good rate under PPA for ground mounted and as well as roof mounted projects from 1 MW to 1000 MW. PPA is signed with government with power tariff @ 3-5 Rs / unit, depending on the size of the project. A lot of private companies are also participating in this scheme. Under "Open Access Power Policy" industries are getting direct power from independent power producers, within state and interstate (Greentech India, 2018). In general, government PPAs are regarded as low risk as they are supported by the government and the agreement is signed for the duration of plant life, which approximately is 25 years (Solar Mango, 2018).

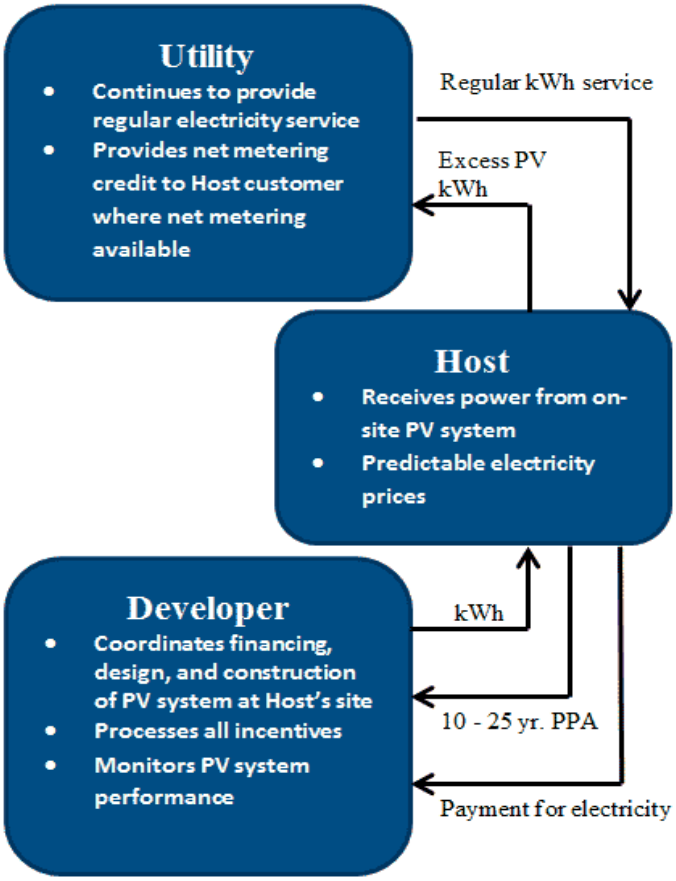


Figure 8 – Explanation of Power Purchase Agreement (Solar Energy Industries Association, Solar Power Purchase Agreements, 2018)

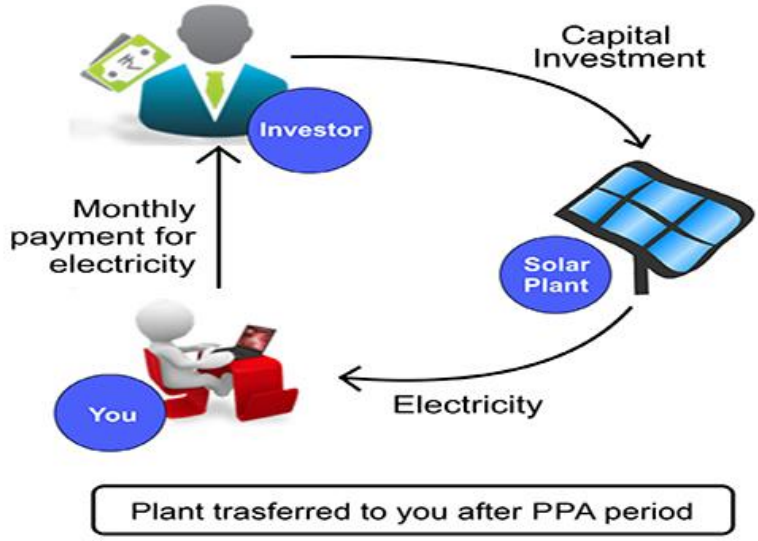


Figure 9 – Working model of PPA in India (Sologix, 2018)

Pros of PPA include (Solar Mango, 2018),

- No to low upfront cost.
- Predictable cost of electricity up to 25 years.
- No need to deal with complex design and permitting process & no operating and maintenance responsibilities.
- Customer enjoys marketing benefits of green energy
- Price of electricity is indexed to inflation and hence increasingly cost effective when compared to fossil fuel based electricity.

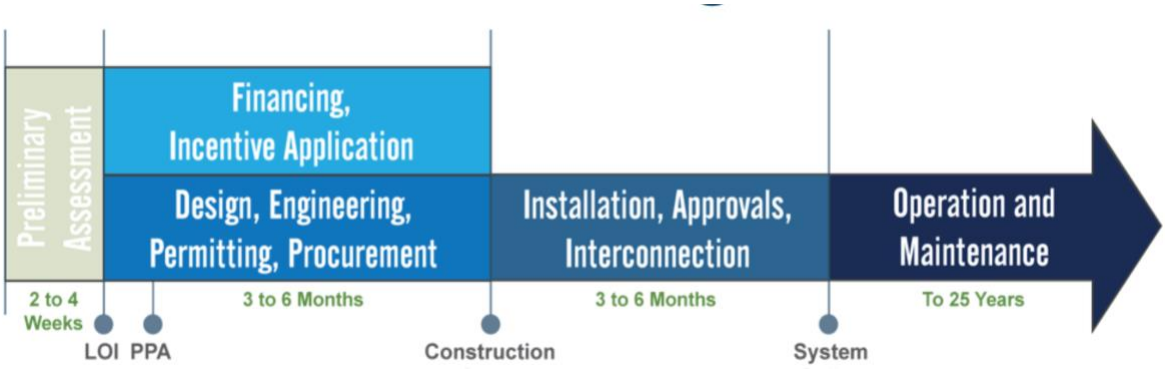


Figure 10 - Power Purchase Agreement Process in India (Greentech India, 2018)

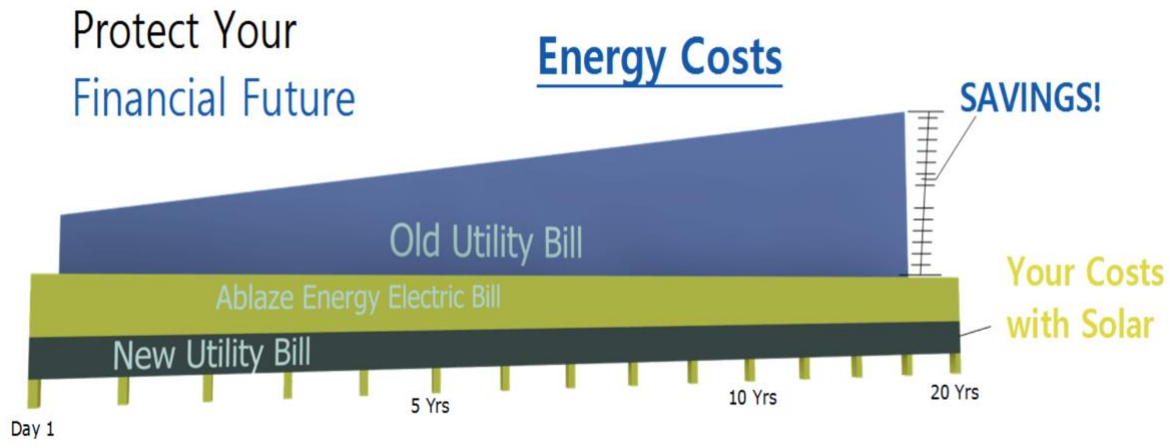


Figure 11 - Energy savings from PPA (Greentech India, 2018)

Chart 3 - Expected Electricity Board Tariff vs. Proposed Solar Tariff

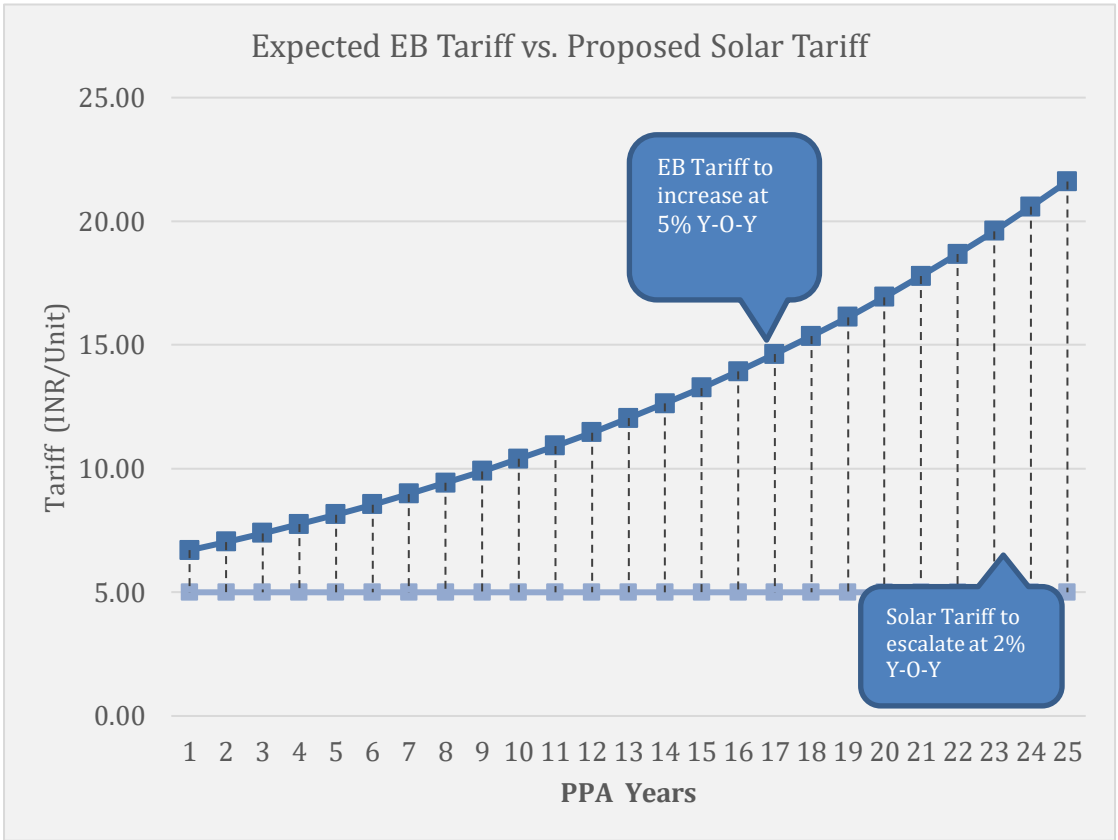


Chart 4 - Solar Cost Vs. Electricity Bills Cost in PPA

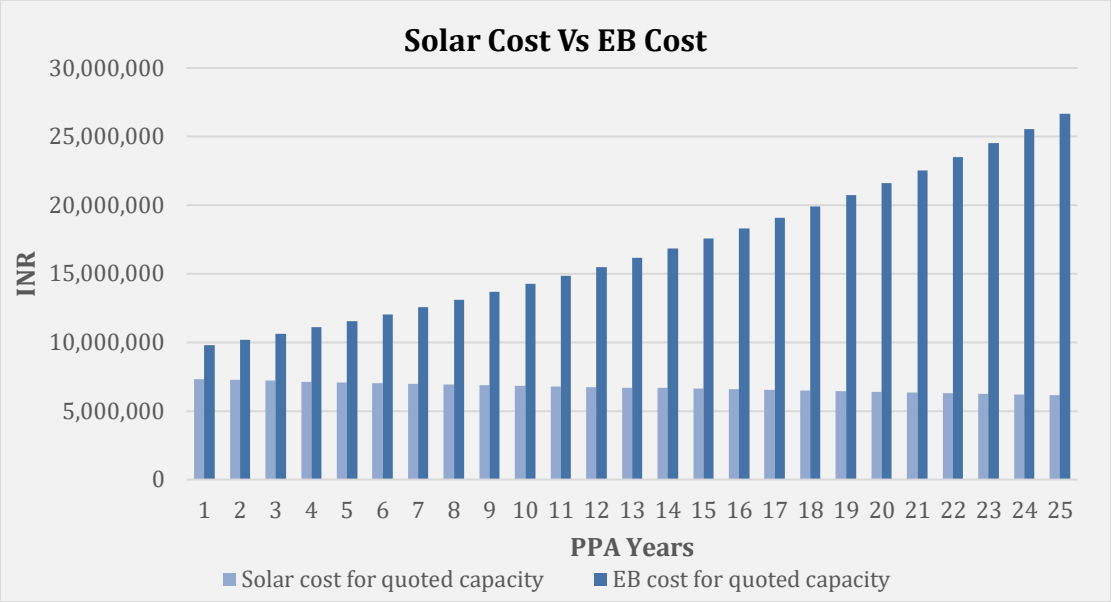


Table 4 - Customer savings from PPA method

SolarTown BOOT Model Customer Savings							
Solar Plant Capacity in kW		1000		PPA Tenure (Years)		25	
EB Unit Rate	6.7	Rate of Increase of EB	5%	Power Degradation		0.7%	
SolarTown Unit Rate	5	Rate of Increase of SolarTown	0%	Yearly Generation		1460000	
All in INR, except Solar Generation Units				CUF		17.00%	
Year	EB cost for quoted capacity	Solar Generation Units	Solar cost for quoted capacity	Savings from Solar	Cumulative Savings	SolarTown Tariff	EB Tariff
1	97,82,000	14,60,000	73,00,000	24,82,000	24,82,000	5.00	6.70
2	1,01,99,202	14,49,780	72,48,900	29,50,302	54,32,302	5.00	7.04
3	1,06,34,198	14,39,632	71,98,158	34,36,041	88,68,343	5.00	7.39
4	1,10,87,747	14,29,554	71,47,771	39,39,976	1,28,08,319	5.00	7.76
5	1,15,60,639	14,19,547	70,97,736	44,62,903	1,72,71,222	5.00	8.14
6	1,20,53,701	14,09,610	70,48,052	50,05,648	2,22,76,871	5.00	8.55
7	1,25,67,791	13,99,743	69,98,716	55,69,075	2,78,45,946	5.00	8.98
8	1,31,03,807	13,89,945	69,49,725	61,54,082	3,40,00,028	5.00	9.43
9	1,36,62,684	13,80,215	69,01,077	67,61,608	4,07,61,636	5.00	9.90
10	1,42,45,398	13,70,554	68,52,769	73,92,629	4,81,54,265	5.00	10.39
11	1,48,52,964	13,60,960	68,04,800	80,48,165	5,62,02,429	5.00	10.91
12	1,54,86,443	13,51,433	67,57,166	87,29,277	6,49,31,707	5.00	11.46
13	1,61,46,940	13,41,973	67,09,866	94,37,074	7,43,68,781	5.00	12.03
14	1,68,35,607	13,32,579	66,62,897	1,01,72,710	8,45,41,491	5.00	12.63
15	1,75,53,646	13,23,251	66,16,257	1,09,37,389	9,54,78,880	5.00	13.27
16	1,83,02,309	13,13,989	65,69,943	1,17,32,366	10,72,11,245	5.00	13.93
17	1,90,82,902	13,04,791	65,23,953	1,25,58,949	11,97,70,194	5.00	14.63
18	1,98,96,788	12,95,657	64,78,286	1,34,18,502	13,31,88,696	5.00	15.36
19	2,07,45,386	12,86,588	64,32,938	1,43,12,448	14,75,01,145	5.00	16.12
20	2,16,30,176	12,77,581	63,87,907	1,52,42,269	16,27,43,414	5.00	16.93
21	2,25,52,703	12,68,638	63,43,192	1,62,09,512	17,89,52,926	5.00	17.78
22	2,35,14,576	12,59,758	62,98,789	1,72,15,787	19,61,68,713	5.00	18.67
23	2,45,17,473	12,50,940	62,54,698	1,82,62,775	21,44,31,488	5.00	19.60
24	2,55,63,143	12,42,183	62,10,915	1,93,52,228	23,37,83,716	5.00	20.58
25	2,66,53,411	12,33,488	61,67,438	2,04,85,973	25,42,69,689	5.00	21.61

What is the best solution for TP Dyeing Unit Process

The difference between CAPEX and OPEX is that in CAPEX, the real savings start from payback period whereas in OPEX the savings start from day 1. However, the savings and free electricity in CAPEX is always higher than savings in OPEX. To sum up, the choice between CAPEX or OPEX is decided by the financial goal and the amount of money available for CAPEX.

If there is enough cash available for CAPEX

- Then invest in solar, which has a quick payback of 3–5 years & free electricity for almost 25–30 years after it.
- Or it can be partially invested in other financial or core business assets to generate greater returns after which the business can pay 30% as down payment and 70% can be loan.

OPEX model will work if there is spare cash or the business can generate cash regularly over the contract period, which

- Can be invested in other financial or other core business assets that generate more returns than savings through solar. The business can pay monthly in PPA mode against actual generation at pre-determined unit rate for a long period of time.
- If the business is comfortable with long contract period of 15-20 years.

Coal and Wood fuel savings through use of Heat Pumps

After thorough understanding and analysis of alternatives that can be proposed to reduce coal and wood burning to produce electricity, heat pumps were determined to be one of the most plausible solutions. Heat pumps use renewable energy heat sources from the ambient air to heat water. It can produce hot water round the clock and throughout the year. An energy

efficient and affordable solution can be used for both domestic and commercial purposes. It uses heat from the air to heat water and can achieve savings up to 80% when compared to oil fired boilers, coal powered boilers and electric water heaters. It is one of the most ideal solutions for commercial applications where hot water is needed 24x7. It saves operating costs by tapping into heat from air while saving customers from paying huge energy bills (Venus, 2018). The key components needed for heat pumps include

i) Compressor

ii) Condenser

iii) Evaporator

iv) Expansion valve

v) Electronic control

Working of a heat pump

The process begins with air being forced through an evaporator that contains the refrigerant with help of a fan after which the refrigerant evaporates to gas and extracts heat from ambient air. The refrigerant passes through the compressor and the compressor pressurizes the refrigerant to a high temperature gas. R407C is the refrigerant used in the process. The hot refrigerant loses its heat to water flowing from storage tank. The refrigerant absorbs heat from the ambient air and boils the gas and refrigerant returns to the compressor and the cycle repeats (Venus, 2018).

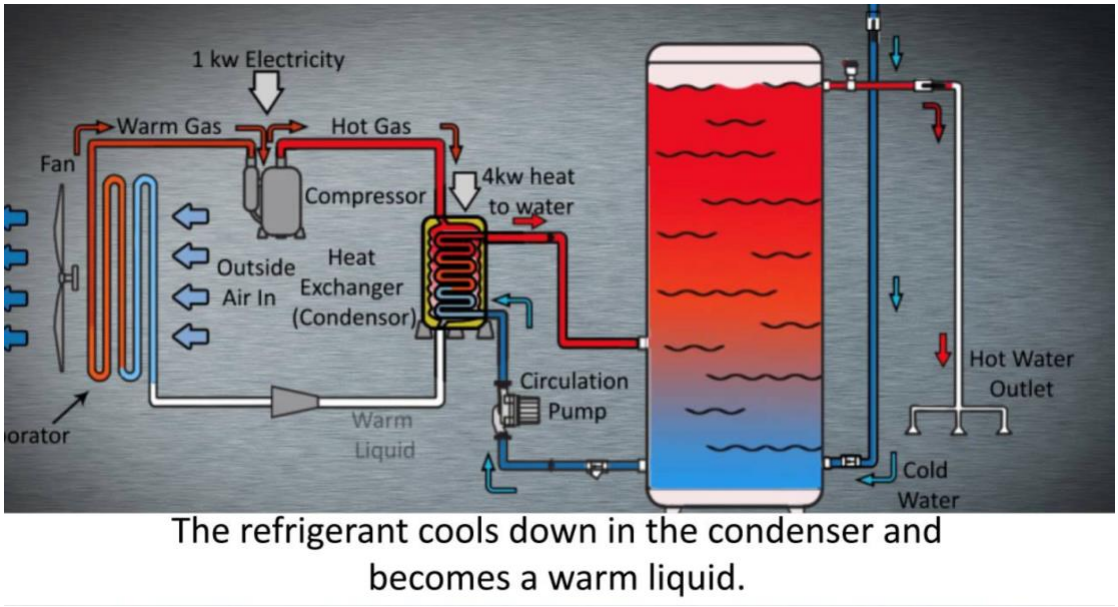


Figure 12 – Working of heat pump water heater (Venus, 2018)

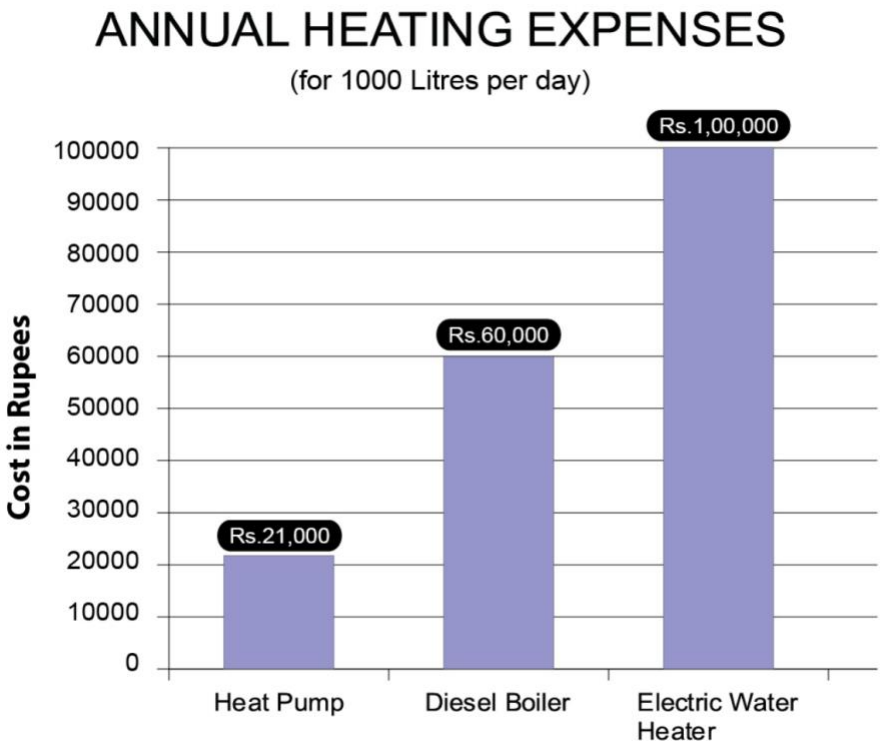


Figure 13 - Cost savings achieved through heat pumps (Venus, 2018)

Heat pump simple payback period for TP Dyeing Unit Process

Based on the fuel consumed, capacity of the boiler and working hours of the boiler, a simple payback period is calculated by Solar Town.

Table 5 – Heat pump calculations and payback period

Customer: Thangamman Process

Heat Pump Calculations:

Capacity in liters	Temp. raise from 25 C to 80 C	Energy required to heat	
		Kcal	KW
800	55	44000	51

Heat Pump			Time to heat /hours	Unit Consumed	Per Day Cost (units*Rs.8)	Remarks
Model	Input KW	Output KW				
20i+20i	9	27	1.89	17	108	Per unit cost taken as Rs 6.35

Running Time of Heatpump	24	
Total Electricity Consumed	409.3	
Per day cost	2599.07	
Coal Consumption in 24hrs	10 tonnes	
Savings in Coal	35000	
Coal Consumed for increase in temp from 80C to 100C	10500	3tonnnes(Assumed)
Net Savings per day	-21900.93	
Investment	3600000	
Payback in days	-164.3765795	

Payback period in days – 164 days

In this case, 80% savings on coal is achieved as the heat pump is used in raising the water temperature to 80 degC and coal is used for only the remaining portion of raising the temperature from 80 deg C to 100 deg C. This results in less burning of coal thus reducing environmental impact and greenhouse gas emissions. Also, price volatility of coal poses a huge risk to the client. Heat pumps eliminate this risk of price volatility and can run the plant without interruption.

Carbon footprint of burning coal vs using heat pump

According to EPA, the carbon footprint of burning coal is calculated using the following formula (EPA, 2018) (IndiaMart, 2018)

21.10 mmbtu/metric ton coal × 26.05 kg C/mmbtu × 44 kg CO_2/12 kg C × 1 metric ton coal/2,204.6 pound of coal x 1 metric ton/1,000 kg = 9.14 x 10^{-4} metric tons CO_2/pound of coal.

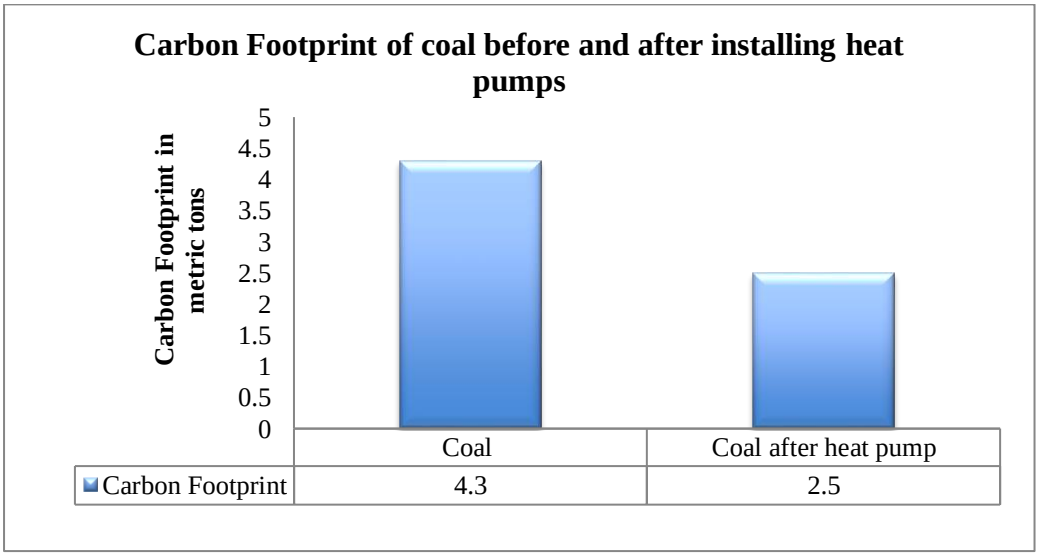
Carbon footprint per metric tonne of coal = 2.01 metric tons of CO2/tonne of coal

Coal consumption per month = 230 metric tonnes

Coal consumption per year = 230 x 12 = 2760 metric tonnes

Coal consumption per year after installing heat pumps = 823 metric tonnes

Chart 5 - Carbon footprint coal before and after installing heat pumps



Environmentally friendly alternative to coal and firewood

Briquettes are environmentally friendly alternatives to coal and firewood for producing steam.

Figure 14 – Biomass Briquettes (IndiaMart, 2018)

Figure 15 – Briquettes end-user applications (Base Chemicals India Co., 2017)

Different kinds of Briquettes include,

1. Biomass Briquettes
2. Agrowaste Briquettes
3. White coal Briquettes
4. Wood and Sawdust Briquettes
5. Recycled Briquettes

Biomass briquettes are a good substitute to coal and charcoal. It is made from agricultural and forestry waste and low-density biomass is converted into high-density biomass briquettes using briquetting machine. It seldom uses any chemical and serves to be 100% natural. Few

key ingredients or materials for briquettes are mustard stalks, sawdust, coffee and rice rusk, jute sticks, sugarcane bagasse, groundnut shell, cotton stalks, caster seed shells, tobacco waste, maize stalks etc. Biomass Briquettes are widely used for many thermal application like steam generations in boilers, furnace and foundries (3e Energy Efficiency Environment, 2018).

Agro Waste Briquettes are predominantly made from agro-residues like rice husk, arhar stalks, groundnut shells, pine needles, sugarcane bagasse, cotton stalks, sunflower & waste, leaves and trash, maize stalks, bajra cobs, coir dust etc.

White coal or White coal Briquettes is made from drying chopped wood over fire. It differs from charcoal, which is mainly carbonized wood. It produces more heat than green and white coal are made from groundnut shells, cotton hulls and salks, castor seed shells, forest leaves, wood chips and shavings, paddy straw, coir dust, sesame seed oil cakes etc. India is becoming a major manufacturer and consumer of white coal. Many facilities in the country have switched to white coal instead of fossil fuel.

Wood briquettes are made using dry, untreated wood chips or wood shavings. Wood briquettes are made from pressing raw materials with high pressure without any binder. By compacting wood at high temperature, it turns into a fuel called brown coal. Advantages of wood briquettes include lower ash and sulphur content when compared to fossil fuels. In addition to this, briquettes have higher BTU value per cubic foot due to its high density implying less storage space and more heat released per kilograms. The low moisture content of 10% leads to energy content around 5.0 KWh per kilograms. Green fire logs have high water content and hence can produce only energy of 2.5 KWh/kg. **Sawdust Briquettes** is another form of briquette is made using waste by-product of sawmills such as sawdust. The sawdust is compressed and made into a reconstituted log that can replace firewood. This does not have binders and natural lignin in the wood binds the particles of the wood together

to form a solid. Burning Sawdust Briquettes are more efficient more than burning firewood with a moisture content as low as 4% while moisture content in firewood is as high as 60%. **Recycled Briquettes or refuse-derived fuel (RDF)** or solid recovered fuel (SRF) are produced by shredding and dehydrating municipal solid waste (MSW). RDF consist mainly of combustible components of municipal waste like plastic, textile, leather, corrugated box, biomass etc. The RDF is recovered by subjecting mixed municipal solid waste through a series of electro-mechanical operations which includes – presorting of pre-defined waste components, shredding of waste into defined sizes, removal of inert materials through air-density separator, using ferrous materials using magnetic separator followed by subjecting it to secondary shredding and formation of bales/briquettes. Environmental benefits of using RDF include offering an environmentally sustainable solution to industries, which are concerned about greenhouse gas (GHG) emissions. RDF is recommended for industries with stringent air pollution control systems (3e Energy Efficiency Environment, 2018).

Table 6 – Firewood, briquettes, coal B comparison (IndiaMart, 2018)

Content	Firewood	Briquettes	Coal B
Calorific value	2500 to 3000	4200 to 4500	4500 to 6000
Ash	20 to 28 %	0.5 to 6 %	25 to 50%
Pollution,Poisonous Effluent Smoke	Smoke	No Smoke No Sulphur	Sulphur, Co2, phosphoro fumes
Moisture	25 to 35 %	8%	10%
Cost	Rs. 3.5 /kg	Rs.5.5 /Kg	Rs. 7 /kg
Efficiency	50%	75%	70%
Wastages	20%	10%	15%

Labour usage	Require maximum persons in handling and cutting	Single person is enough	Require tw persons
Boiler efficiency	Require regular maintenance	normal Fly ash deposit on tubes	high wear & tear
Handling	Tough require more areas	Easy because of packed material	Tough

Additional benefits of becoming Environmentally Sustainable

Certified Emission Reductions (CERs), a contract to trade offsets generated by CDM carbon project was planned by NASDAQ OMX Commodities Europe. As a result, many organizations engage in emission reduction, offsetting and also sequestration programs to generate credits that can be sold on one of the exchanges. Emissions of the carbon will be the fastest growing services sector with an estimated market size of €30 billion in 2007 and it would have increased by now. According to Louid Reds Haw, head of environmental markets at Barclays Capital – Carbon will be the world's largest commodity market and could also become the world's biggest market overall.

Most of the "Green Projects" that use "Renewable Energy" sources or energy efficient systems contain emission of greenhouse gases. These green projects earn CER whose present market rate is estimated at INR 1,200 per CER when the same is sold to developed countries in order to "offset" the emissions generated.

TP Dyeing Unit Process can also qualify to earn carbon credits by replacing traditional fossil fuels by green fuels like briquettes or use of solar energy or use of heat pumps. There many organizations that are working together with some of the dealing CC agencies to assist organizations qualify for these credits. Carbon Credits (CC) can become an important revenue generation source for the company in the long run. The company will not only go green but make money out of it and also can achieve a sense of pride by participating in the movement to save the environment (Jay Khodiyar Machine Tools, 2018).

Also, UNFCCC acknowledges and validates international transfer of carbon credits. There are many carbon credits selling companies that provide carbon credit to commercial and industrial customers aiming at lowering carbon footprint on a voluntary basis. Recently, Government of India (GOI) in the budget 2018, it proposed to reduce the tax on income from carbon credits to 10% from 30%. The initiative is an incentive to industries to reduce emissions and also make income out of it (The Economic Times, 2018).

Profile of registered CDM projects from India

	No of Projects	Annual Emission Reduction (tCO2/y)	Total ERs by 2012 (tCO2)
Biomass	119	4,164,842	29,753,919
Wind Power	56	2,122,814	17,673,572
Hydro Power	43	3,271,569	12,817,102
Energy Efficiency	42	1,005,127	7,529,638
Fuel Switch	10	4,136,607	21,002,502
Methane Avoidance	3	368,893	1,282,448
Methane Recovery	1	64,599	569,990
Waste Heat Utilization	50	4,816,998	31,796,172

Figure 16 – Profile of registered CDM projects from India (Small Industries Development Bank Of India, 2018a)

Indian SMEs can find out their carbon footprint of their facility or product and can also offset any carbon emissions with local carbon credits or by implementing renewable energy at their facility (wind, solar etc). Consumer products have started to display details about their environment footprint like GHG gas produced in making, transporting and as well as selling of the same. By doing so, SMEs can prepare themselves for carbon market and beat the carbon tax, which could soon be implemented on Indian exporters. TP Dyeing Unit Process can be well prepared in advance than wait till the measures become mandatory. This proactive measure can also provide them a competitive advantage.

By offsetting business's carbon footprint, the organization creates a good will and positive, tangible statement to employees, customers, suppliers and other stakeholders. Since all of them are affected by climate change and other environmental risks, they will more attracted and loyal to businesses that care for the environment. Companies that take green initiatives are better managed, efficient and profitable than their rivals. Many of the successful organizations have realized he importance and benefits of addressing environmental issues.

If TP Dyeing Unit Process is interested in knowing its carbon footprint, it can use Carbon Yatra's help in assessing ideal carbon program, prepare documentation and also selling of voluntary carbon credits. Carbon Yatra can assess which program is ideal for the project based on the size, buyer requirements, cost and amount of carbon credits that can be generated to benefit the organization (smallB, 2018).

Examples of Carbon Credits and how to earn them (smallB, 2018)

A windmill with a capacity of 1 MWh would roughly generate about 1800-carbon credit per annum as it uses wind energy to generate power and supplies the same to the grid. To sum up, the grid would have burnt either coal or any kind of fossil fuel to generate that 1 MWh of electricity, but now the same is supplied by the wind project. Hence the owner can apply for carbon benefits and is entitled to carbon savings on account of reduction in fossil fuel. As a

result, this translates into carbon credits and is calculated on the number of power units supplied per annum to the grid.

For the owner to calculate the carbon credits, power generated via meter readings, commissioning certifications, meter calibration reports and monthly invoices billed to the State Electricity Board (SEB) has to be furnished.

Click here to get the list of small-scale projects eligible for carbon credits.

Compliance Emission Rights (CER) is generated only under the CDM (Clean Development Mechanism) within United Nations Framework Convention on Climate Change (UNFCCC) program. This can be used currently in the European compliance market i.e., industries in EU have a compliance obligation to purchase CER.

The non-compliance market is where the voluntary emission rights or VER credits are generated. These can be used worldwide but only for non-compliance purposes i.e., CSR, carbon footprint purpose etc. As the process of earning CER is more complicated, stringent and time consuming, CERs generate better price than VERs. However, VERs serve the voluntary market better as they are priced lower than CERs.

The other carbons programs for Indian SMEs include the Voluntary Carbon Standard (VCS) and Carbon Offsets (ISO14064) Program. Carbon prices in the voluntary market are low and there is a growing demand for voluntary credits and the market is expected to grow moving forward. Although the carbon prices are incomparable to the Kyoto CDM process, voluntary carbon standard is cost effective and quicker option for projects commissioned after 2004. Also, SMEs can monetize their carbon credits in the non-Kyoto sectors where the prices for credit range from $1.00-$3.00.

Typical timelines for the carbon market process are:

- Clean Development Mechanism (CDM): 1.8 years
- Verified Carbon Standard (VCS): 6-8 months
- Carbon Offsets (ISO 14064): 2 months

Eligibility conditions for the VCS market

The Verified Carbon Standard (VCS) is one of the many voluntary programs available in the market. To be eligible for the program, the project should have been commissioned within two years from the date of application. For instance, if the business plans to enter market in August 2020, the project should have been commissioned on or after August 2018 only. When it comes to commissioning, certificates of installation of boilers or windmills or solar PVs from official certifying agencies are accepted. The VCS follows the same set of guidelines as that of CDM market and one can follow any method to a carbon project listed under UNFCCC CDM guidelines. For more information on VCS process, click here. For knowing about statistics pertaining to global VCS market Click here .

FOSTERING SUSTAINABLE BEHAVIOR

After suggesting many initiatives for TP Dyeing Unit Process to improve its energy efficiency, it is high time to suggest or encourage implementing sustainability initiatives in its factory. Based on the information provided in the recommendation, the factory facility can identify short-term and long-term sustainability goals. These initiatives could improve efficiency and also reduce carbon footprint thereby increasing its presence in front of its buyers and as well as create a competitive edge. Kotter's eight steps have been used for the client to change required behaviors (Kotter, 2012).

Figure 17 represents Kotter's eight steps model for change behavior, which will be explained in detail with context to TP Dyeing Unit Process.

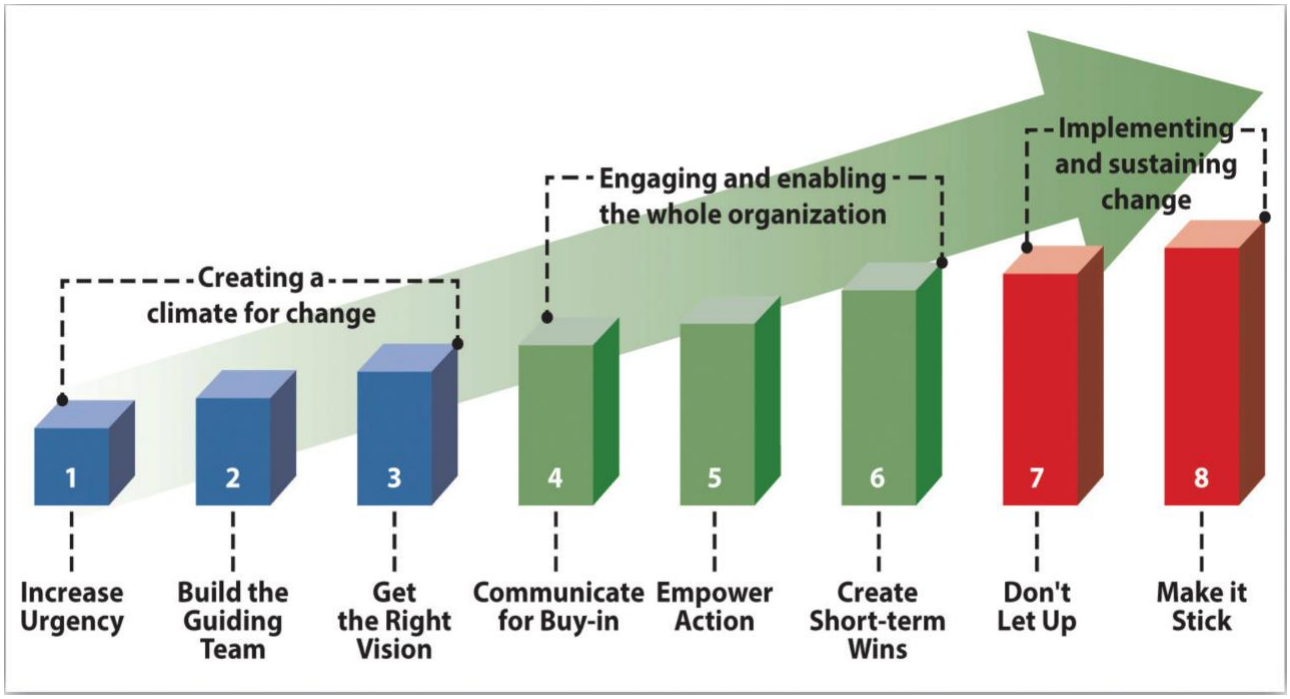


Figure 17 – Kotter's eight step model for change (Flatworld Knowledge, 2018)

Table 7 – Kotter's eight steps in context of TP Dyeing Unit Process

Kotter's eight steps	Actions
Step 1 - Increase Sense of Urgency – Don't lose to competitors	Explain the context of losing to competitors if the organization is not sustainable enough as many buyers prefer to maintain relationship with sustainable buyers to improve their CSR image. It is extremely critical for the organization to identify primary sustainability goals that can be achieved at a faster pace.

Step 2 - Build the Guiding Team	Assemble a group with powerful people to lead the change effort. These powerful people can select volunteers to participate in bringing the change in the organization. Volunteers' contribution can be highlighted on a company notice board by announcing sustainability champion every month or every quarter.
Step 3 – Get the Right Vision	Create a compelling vision for the future on which the guiding team can build on. Project how the future of the organization will be if sustainability is a part of the company's vision. Provide a vision that can bring in a sense of security and reduce any environmental, social governance based threats in the future. A classic example is how the factories in Tiruppur were shutdown due to ZLD non-compliance and which forced many factories to have effluent treatment plant later. Such situations can be avoided in the future if the factory can integrate sustainability to its vision.
Step 4 – Communicate for Buy-in	Communicate the vision to the employees and increase the volunteer base. Communicate from day 1 so that every employee is

	responsible, takes ownership for lasting cultural change.
Step 5 – Empower Action	The key element to succeed is first to remove the obstacles to change. Think out of the box so that TP Dyeing Unit secures a special spot amongst its competitors. Change systems or structures that obstruct the vision of the company and encourage any ideas that improves sustainability even if its non-traditional.
Step 6 – Create Short-term Wins	Project achievements that are achievable in short term. For instance, energy savings and decreased carbon footprint through implementation of solar, heat pumps and use of biofuel briquettes are short-term wins that can be projected well. This improves the brand image of TP Dyeing Unit Process. Encourage volunteers by recognizing them as sustainability champions thereby pulling more volunteers into these initiatives.
Step 7 – Don't Let up – Leverage on the short term wins to drive change	Use benefits gained out of the short-term wins and continue to drive change in the organization. Reinvigorate the process with new themes, more volunteers etc. Do not stop improving after getting satisfying results

	from short-term wins. Set up more future goals. TP Dyeing Unit Process should let volunteers to remain engaged in the effort while performing their regular duties.
Step 8 – Make it Stick	Promote the organization success achieved because of new behavior. Develop a means to ensure there is development and succession.

First step in change behavior is having a mission statement for company with sustainability incorporated in it. The client has a very strong mission statement in the website however, modifying to the following can be a differentiating factor.

"Our mission is to supply garments worldwide to fashion market, where the garments supplied provide better value in quality, price, and service using sustainable business practices so that our earth, environment and the whole chain is benefited"

Such a mission statement is likely to improve corporate image and gain an edge over the competitors.

SUSTAINABILITY CAPITAL RESERVE

The sustainability action plan for TP Dyeing Unit Process have been primarily focused on energy efficiency and cost savings related to that. With solar panels installed in the factory, expenses on energy will decrease drastically. TP Dyeing Unit Process can create a sustainability capital reserve from savings achieved through energy efficiency after installing solar panels. As far as TP Dyeing Unit Process is concerned, for the CAPEX model, the payback period is 4 years. As a result, it can start to have a sustainability capital reserve from

the 5th year. This will enable TP Dyeing Unit to self-fund other sustainability projects through savings generated from use of solar panels. In short, it can peel off some of the savings from energy and set them up as Sustainability Capital Reserve. This rotating pool of capital can be used in the future to fund or invest on any other sustainability projects. Despite the fact that the projects are self-funded, the return on investment (ROI) can assure the stakeholders that the funds are profitably invested back in to the company. Sustainability Advantage website has a quick tool for calculating sustainability ROI for building a compelling business case for sustainability initiatives and also calculate sustainability capital reserve based on the revenue of the company, profits, employee salary and benefits, energy expenses, material expenses etc. This simple tool provides details on how of Sustainability Capital Reserve is achievable depending on the parameters mentioned above. Following is an example of sustainability capital reserve is calculated based on the details furnished by an organization (Sustainability Advantage, 2018a)

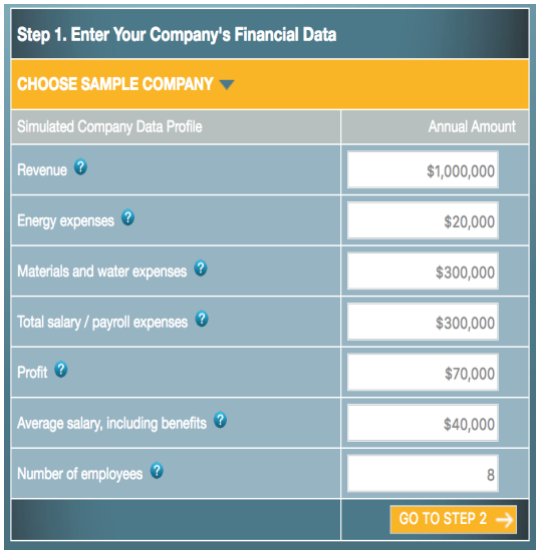


Figure 18 - Columns to enter company's financial details (Sustainability Advantage, 2018b)

Figure 19 - Selection of type of company (Sustainability Advantage, 2018b)

Figure 20 - Simulator tool for presenting profits improvement and also Sustainability Capital Reserve for more projects (Sustainability Advantage, 2018b).

PERFORMANCE AND METRICS

Scope 3 emissions are emissions that are outside direct operations, which include emissions from suppliers, employees, customers etc. For many companies, scope 3 emissions can be indicators of climate risk, carbon and energy hotspots in the supply chain side or use of products. Scope 3 aids in many companies identifying opportunities to create greater efficiencies along their value chain. For example, Walmart is a great example of being the most aggressive companies to tackle carbon and GHG emission. It committed to reducing 20 million metric tons of emissions from its supply chain back in 2015. Such an ambitious goal cannot be achieved without suppliers not committing to support the same. By the end of 2011, almost 148 Chinese supplier factories with which Walmart associated with had achieved a 20% reduction in energy consumption per unit (Greenbiz, 2013). In order to reduce environmental risks, many companies in India are also becoming more sustainable and are adopting strategies to reduce their emissions. Not only is the environmental impact of GHG gases visible to the public; it carries a high value for the future regulations. Lowering carbon emissions also goes in parallel with energy cost cutting providing critical business advantage over competitors.

According Sonya Bhonsle, Head of Supply Chain at CDP, "With emissions in the supply chain on average around four times greater than those from a company's direct operations – and rising to up to seven times greater for retailers and consumer-facing companies – large multinational corporations cannot comprehensively address their environmental impact without looking to their supply chains" (Scott, 2018).

TP Dyeing Unit Process supplies dyed and finished garments to many leading cloth retailers in India. They supply to one of the leading retailers, Aditya Birla Group under the brand name Lifestyle. The company has strong Procurement and Supply Chain Policy, which can be reviewed in the following link – click here. (Aditya Birla Group, 2018)

Based on the above reasons, to support their buyer's sustainability initiatives, to create better visibility amidst competitors etc., following performance metrics can be reported.

Key Performance Indicators that can be measured and reported in TP Dyeing Unit Process

Table 8 - KPIs related to TP Dyeing Unit Process and Indications

Key Performance Indicator	Indications
Total electricity consumption	Energy consumption
Total coal consumption	Energy consumption
Total wood consumption	Energy consumption
Renewable energy consumption	Source of energy and energy consumption reduction
Scope 1, 2 emissions	Greenhouse gas emissions
Total water consumed	Water consumption
Total water reused	Water conservation
Steam consumption to generation	Understand steam waste and fixing of the same
Employee satisfaction	Employee experience and retention

Notes:

1. Submit a short annual report on sustainability initiatives taken by TP Dyeing Unit Process. Since water conservation measures have already been implemented, it can be combined with energy efficiency strategies to be presented to the buyers or its clients. The data should be transparent in such a way that the client/buyer can directly make use of it in reporting their scope 3 emissions.

2. The client had issues about steam leaks and waste. The client can audit the equipment and facility twice annually to make sure the leaks are sealed. The client can check if saving steam can result in reduction in energy consumption and the same can be reported.

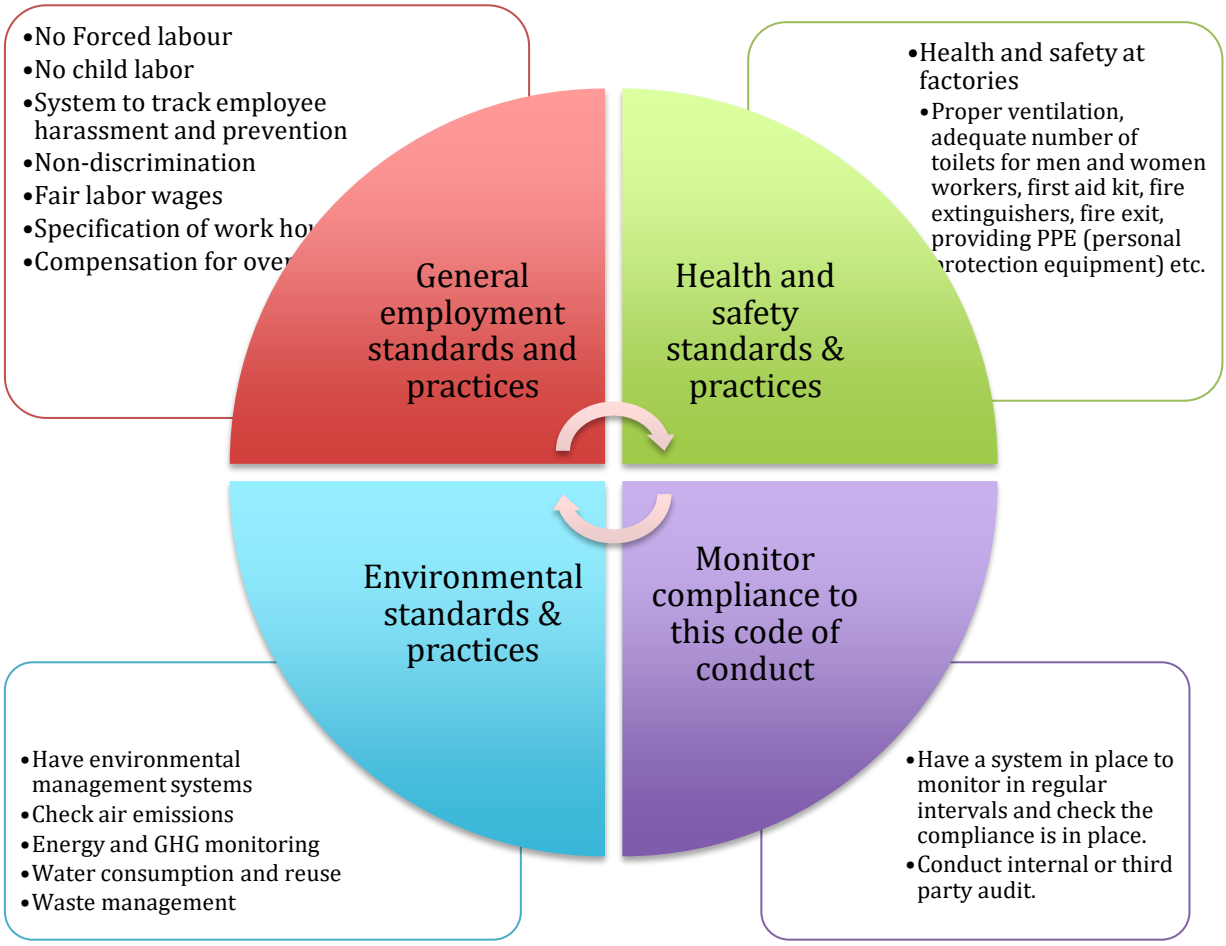
As the key performance indicators are measured at TP Dyeing Unit Process, it can be submitted as a sustainability report annually or newsletter or can be included in the website as a webpage so that the buyers can get an access to it. It will enable the buyers to use some of the information and data from the report. Sustainability report is an essential tool for communicating its environmental performance and social benefit it creates to its internal and external stakeholders. The goal of this report is to identify the priorities of the factory with factors that matter to the company and its stakeholders, report the work it carries out in view of its key performance indicators (KPIs). A sample sustainability report is available as Addendum A in this report.

Relationship between Paris Climate and Agreement and Textile Industry

- Textile is among the sectors identified by Technology Information Forecasting and Assessment Council (TIFAC) for emission control using improved technologies. TIFAC has identified Tiruppur cluster as an important area to bring energy efficiency and reduction in water consumption (Soundariya Preetha, 2017).
- India has agreed to reduce emissions by 30 to 35%. TIFAC is already preparing a report on available & required technologies, technologies that need to be borrowed and how to avail Green Fund (Soundariya Preetha, 2017).
- The Green Climate Fund has been designated as an operating entity of the financial mechanism of UNFCCC aimed at supporting developing countries to reduce greenhouse gas emissions and reduce climate change risks (Nambiar, 2018).

FUTURE RECOMMENDATIONS

1. As many buyers expect their supplier to be socially responsible as it has an effect on the buyer's corporate social responsibility. TP Dyeing Unit Process as a supplier can have basic code of conduct depending on the requirements of the supplier. If the code of conduct is already in place, then it is high time to display in its website for more credibility and visibility.
2. The code of conduct can be devised based on the four main contents.



It can even be as simple as following having following clauses and reporting the status on the same and can be slowly expanded in the future (NIBE, 2018)

Figure 21 - Supplier Conduct of Conduct (NIBE, 2018)

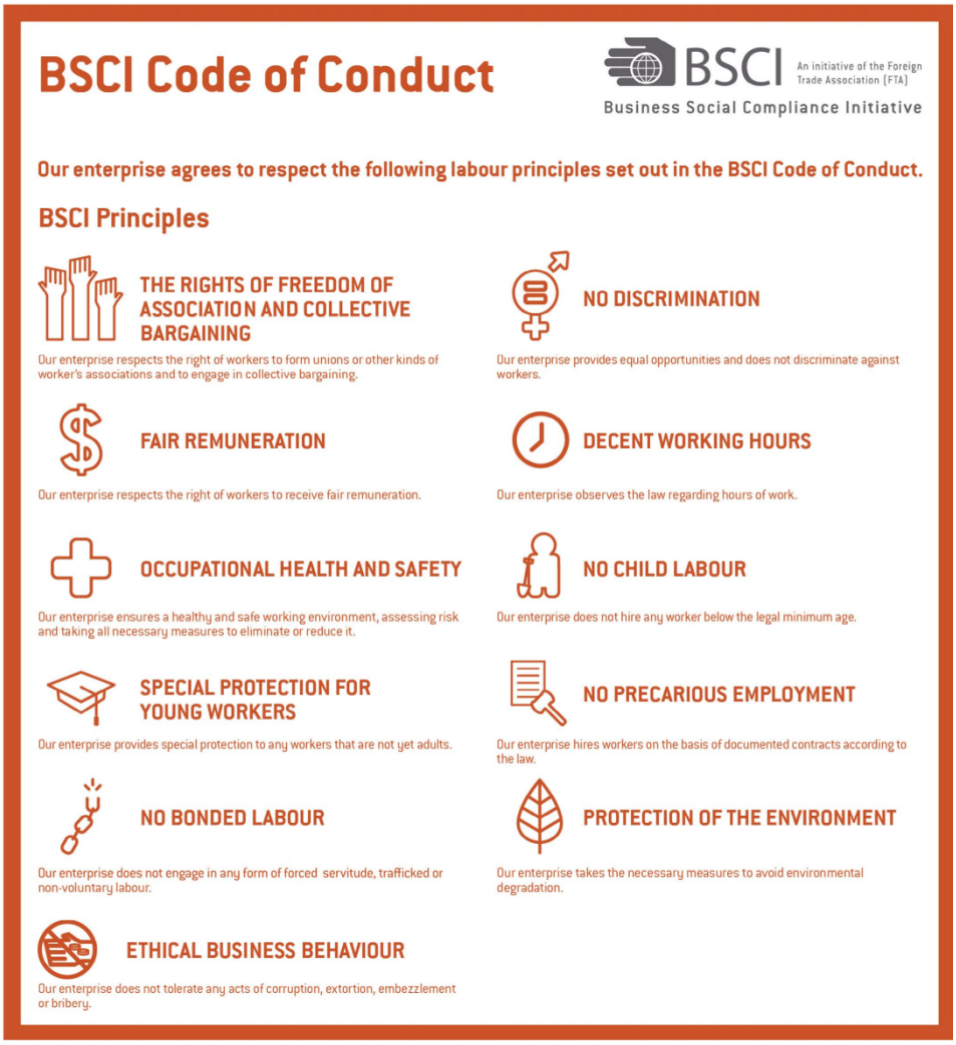


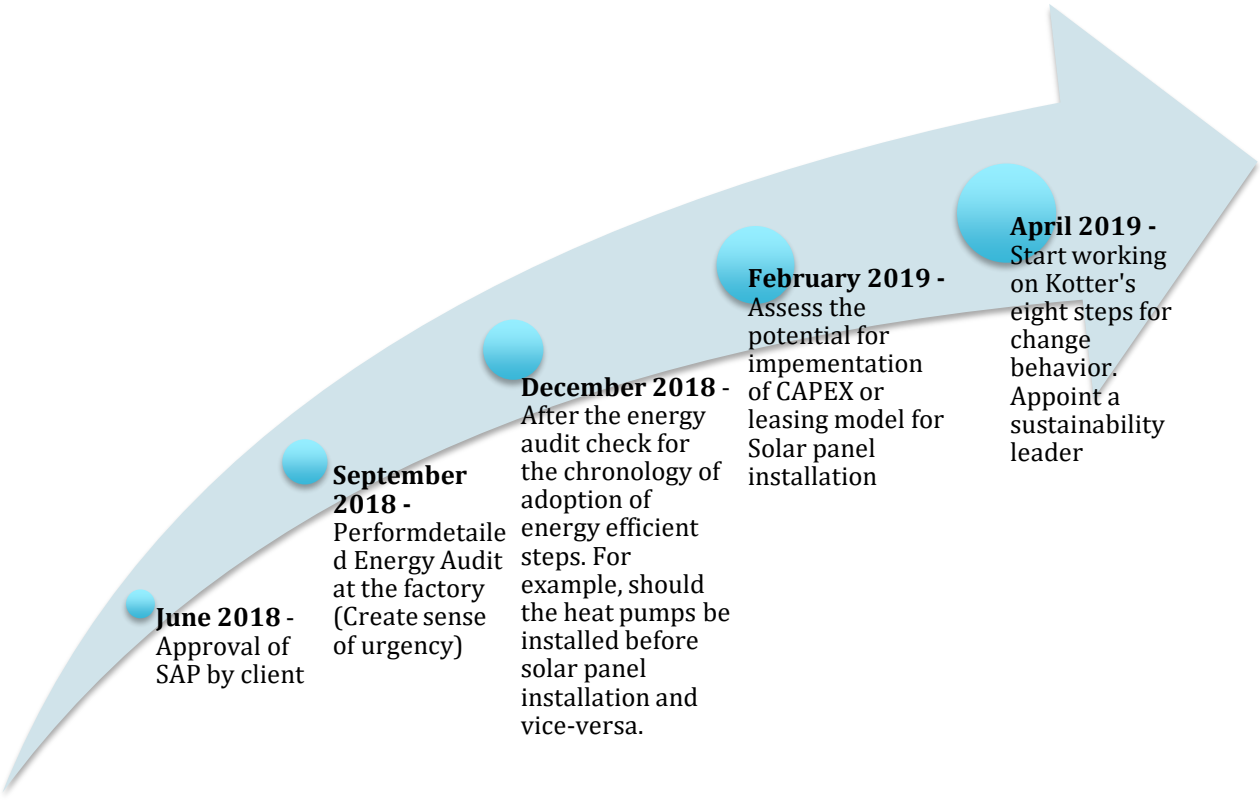
Figure 22 - BSCI Principles for Code of Conduct, (BSCI, 2015)

Table 9 - Few other KPTs that can be measured by TP Dyeing Unit Process in the future include

Metrics	Description
Materials	• Quantity of Materials per product • Quantity of water used per product

	• Quantity of Material recycled • Quantity of water reused for production of a product • Quantity of Hazardous material used
Products	• Number of finished products that use the organic cotton
Wastes	• Waste generated and disposed • Waste recycled at the factory unit
Emissions	• Quantity of specific emissions per year • Quantity of emissions reduced per year

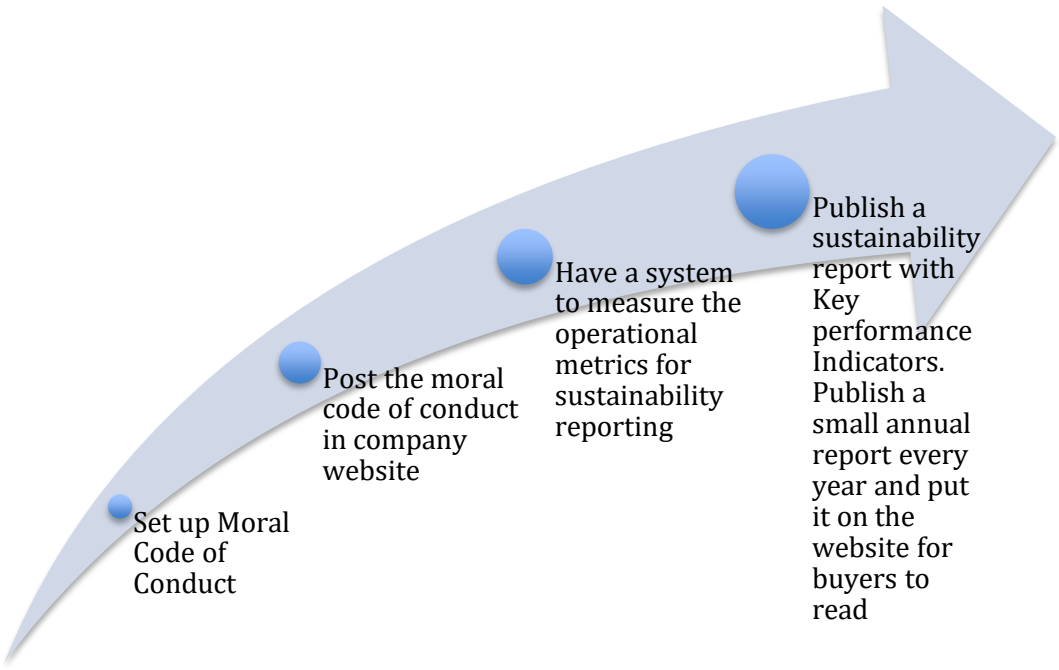
Roadmap for Implementation of Sustainability Action



As the client pointed out that it is extremely critical for them to reduce their energy bills, the prime focus would be on increasing energy efficiency. According to Kotter's eight step model, creating sense of urgency is needed during this situation. It is recommended the client perform an energy audit initially. This gives an insight on chronology of events. For

instance, should the heat pumps be based replaced before installation of solar panels? Or should the steam leaks be sealed and fixed before going to installation solar panels. It is also crucial the client assess the potential of whether the solar panels have to be installed through CAPEX or PPA model. According to Solar Town experts, it is better to go by the CAPEX model because the client will start reaping benefits for the 5th or 6th year of installation. With PPA model, the risk of fossil fuel price volatility is only avoided. After all of these decisions are made, then change behavior can be brought into place before implementing or installing CAPEX intensive systems in the factory.

Long term Sustainability Action Plan



Addendum A – Sample Sustainability Report

SUSTAINABILITY REPORT 2019-2020

MOVING TOWARDS GREENER GARMENTS

EXECUTIVE SUMMARY

TP Dyeing Unit Process believes in providing cotton garments in a sustainable way without compromising on the quality of the finished garments and as well as on our planet Earth.

SUSTAINABILITY VISION

At TP Dyeing Unit Process, sustainability is reflected in our products and manufacturing process that will benefit our future generations. We owe to achieve sustainable growth – profitable and responsible, while leaving minimal footprint on the planet Earth.

Benefits

Our commitment to sustainability has enhanced our business opportunities by creating an edge for us amidst our competitors. We have implemented various initiatives to lower our energy consumption and operating expenses, which has reduced our environmental risk and increased resiliency. Savings from these initiatives have enabled us to do more to the environment by participating in many environmental and social issues. Our sustainability initiatives goes beyond energy efficiency and cost reduction – we are also challenging other dyeing industries in Tiruppur to think about the implications of sustainability and spreading the benefits to make our dyeing community in Tiruppur environmentally committed.

Achievements

TP Dyeing Unit Process takes pride to announce its achievements and here is what we have been doing for the past one year

Installation of solar panels in the factory –to improve energy efficiency in our factory facility, a bold and huge step towards sustainability. We generate about 1 MW of electricity from our solar panels. We let the nature to more work for us than fossil fuels.

Reduction in coal consumption – We wanted to reduce consumption of fossil fuel and owed to find an alternative to burning coal. We installed heat pumps, which has reduced our coal consumption by about 80%. A huge savings on coal consumption and greenhouse gas emissions as well.

Reduction of steam waste – We constantly monitored steam leaks resulting in burning of more fossil fuel for dyeing process. We took measures to fix leaks and recover steam thereby increasing the efficiency of the boilers and reducing energy consumption by 10%.

Establish baseline for energy consumption and greenhouse gas emissions – We have established a baseline for energy consumption and greenhouse gas emissions. This is the starting point for energy efficiency improvement goals and GHG emission reduction goals.

Green vault – name given to our Sustainability Capital Reserve. Green vault is an accounting tool to track cost reduction from sustainability initiatives and projects. These savings will be used to finance future sustainability improvements and projects.

INTIATIVES

Initiative Criteria

We have selected few initiatives to implement that aim at reducing waste, conserving energy, minimizing impact on our surroundings. Our environmentally preferable purchasing policy i.e., dyeing of only GOTS approved organic cotton in our facility is our commitment to minimize negative social and environmental impacts of sourcing.

	Initiative	**Impact**
Waste Reduction	Efficient dyeing process	Reduced grey cotton waste
	Recycling	Upcycle left over cloth from finished garments
	Recover brine solution from reverse osmosis process	Use of the same brine solution for dyeing process enabling reduction of water consumption and reduction waste water getting into the environment
	Sludge recovery from RO for cement industry	Waste reduction and divert waste to make useful products

Water Conservation	Use of Reverse osmosis	Reduced water usage
	Prevent steam leaks	Reduced water usage
Energy Conservation	Renewable energy source	Reduction of electricity taken from the grid.
	Energy efficient lighting	Reduced energy consumption
	Use of less fossil fuel	Reduced consumption of fossil fuel and reduced GHG gas.

ACCOUNTING

GOALS

40% *Reduction of energy bills by 2021*

20% *Reduction in greenhouse gas emissions by 2030*

50% *Energy from renewable sources by 2025*

98% *Water reused in factory 2020*

100% *Waste reduction and recycling by 2025*

Performance Summary

We have set some ambitious goals for us to work hard from day one. We are tracking our progress with 2018 as our baseline year, and the key performance indicators (KPI) summarized below.

Total electricity consumption per annum - 100,000 KWh

Total coal consumption – 250 tonnes

Total biomass consumption – 300 tonnes

Total GHG emissions in tonnes per annum = 45 tCO2eq

Our future initiatives

TP Dyeing Unit Process has plans for implementing many initiatives that will help us reach our sustainability goals. We will have a process to verify and monitor the working progress of these initiatives, using KPIs. We develop mechanism to track the progress.

	Initiative	Impact	Key performance

			indicator
Waste Reduction			
Water Conservation			
Energy Conservation			

We are looking for waste auditing protocols to provide a reliable system to track waste generation and reuse. We look forward to sharing our progress, and progress made in the next 2020 Sustainability Report.

To learn more about our initiatives, feedback and ideas, please write to
Sustainability@TP Dyeing Unit.in

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Reference

Ravishankar, S. (2016, January 17). Tirupur's textile industry struggling to stay afloat. *The Economic Times* .
Oracle. (2015). *Embedding Sustainability in the Sourcing and Procurement Process.* Retrieved August 16, 2018, from Oracle Corporation: http://www.oracle.com/us/products/applications/green/wp-sustainability-procurement-2525294.pdf
Pillai, A. (2018, Febrauary 2018). As coal prices rise, power cos feel the heat with higher cost pressure. *Business Standard* .
Rogers, M. (2016, March 29). *6 Benefits of Becoming a Sustainable Business*. Retrieved August 16, 2016, from Environmental Leader: https://www.environmentalleader.com/2016/03/6-benefits-of-becoming-a-sustainable-business/

Deloitte. (2018). *Sustaiability Risk and Opportunities Report.* Retrieved from https://www2.deloitte.com/content/dam/Deloitte/in/Documents/risk/Board%20of%20Directors/in-gc-sustainability-risks-and-opportunities-report-noexp.pdf
MNRE. (2018). *Initiatives and Achievements*. Retrieved August 16, 2018, from Ministry of New and Renewable Energy: https://mnre.gov.in/sites/default/files/uploads/MNRE-4-Year-Achievement-Booklet.pdf
Kenbrook Solar. (2018). *Solar Benefits, Subsidy, income Tax, Depreciation*. Retrieved August 16, 2018, from Kenbrook Solar: https://solarenergypanels.in/solar-guide/solar-benefits-mnre-govt-subsidy
TEDA. (2018). *TamilNadu Solar Net-Metering.* Retrieved August 16, 2018, from TamilNadu Energy Development Agency.
Renewgreen. (2016, January 1). *Solar Net Metering*. Retrieved August 16, 2018, from Renewgreen: http://www.renewgreen.in/blog/tag/solar-net-metering/
Solar Town. (2018). *About Us*. Retrieved from Solar Town: http://www.solartown.in/about-us/
Greentech India. (2018). *What is a PPA, Power Purchase Agreement?* Retrieved August 16, 2018, from Greentech India: https://www.greentechindia.co.in/ppa-power-purchase-agreement/
Solar Mango. (2018). *Getting a Power Purchase Agreement for a Solar Power Plant in India*. Retrieved August 16, 2018, from Solar Mango: http://www.solarmango.com/2015/12/14/getting-a-power-purchase-agreement-ppa-for-solar-power-plants-in-india/
Solar Energy Industries Association. (2018). *Solar Power Purchase Agreements*. Retrieved August 16, 2018, from Solar Energy Industries Association: https://www.seia.org/research-resources/solar-power-purchase-agreements
Sologix. (2018). *Solar Roof-top Solutions- CAPEX & OPEX*. Retrieved August 16, 2018, from Sologix - Energizing Naturally.
Venus. (2018). *Venus Heat Pumps Water Heaters*. Retrieved August 2018, 2018, from Venus: http://www.heatpumpwaterheaters.co.in/commercial.html
EPA. (2018). *Energy and the Environment* . Retrieved August 16, 2018, from Environment Protection Agency: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
IndiaMart. (2018). *Biomass Briquettes (White Bio Coal)*. Retrieved August 16, 2018, from IndiaMart: https://www.indiamart.com/proddetail/biomass-briquettes-white-bio-coal-11096236548.html
Base Chemicals India Co. (2017). *Biomass Briquettes Manufacturer*. Retrieved August 16, 2018, from Base Chemicals India Co.: http://basechemicalsindia.blogspot.com/2017/02/chemicals.html
3e Energy Efficiency Environment. (2018). *3e Savers India LLP - About us*. Retrieved August 16, 2018, from 3e Energy Efficiency Environment: http://www.3esavers.com/about-us.html
Jay Khodiyar Machine Tools. (2018). *Benefits of Briquettes User Carbon Credit*. Retrieved August 16, 2018, from Jay Khodiyar Machine Tools: http://jaykhodiyar.com/benefits-of-briquettes-user-carbon-credit/
The Economic Times. (2018, Febrauary 2018). Budget proposes less tax on income from carbon credits. *The Economic Times* .
Small Industries Development Bank Of India. (2018a). *CMD Potential in SMEs*. Retrieved from Small Industries Development Bank Of India: https://smallb.sidbi.in/sites/default/files/knowledge_base/presentation_cdm.pdf
smallB. (2018). *Carbon Market*. Retrieved August 16, 2018, from smallB - a SIDBI Initiative: https://smallb.sidbi.in/%20/environment%20/carbon-market
Kotter, J. (2012, November). Accelerate! . *Harvard Business Review* .
Flatworld Knowledge. (2018). *Kotter's eight step model*. Retrieved August 16, 2018, from Flatworld Knowledge: https://images.flatworldknowledge.com/portolesediasleadsup/portolesediasleadsup-fig12_006.jpg
Sustainability Advantage. (2018a). *Sustainability Advantage - About Us*. Retrieved August 16, 2018, from Sustainability Advantage: https://sustainabilityadvantage.com/
Sustainability Advantage. (2018b). *Sustainability Advantage Dashboard*. Retrieved from Sustainability Advantage: https://sustainabilityadvantage.com/sustainability_dashboard/dashboard-3-2.php?s=4
Greenbiz. (2013). *3 ways business can benefit from Scope 3 emissions reductions*. Retrieved from Greenbiz: https://www.greenbiz.com/blog/2013/05/10/3-ways-business-can-benefit-scope-3-emissions-reductions
Scott, M. (2018, June 29). *Here's Why Companies Are Looking To Their Suppliers To Cut Carbon Footprints*. Retrieved August 16, 2018, from Forbes: https://www.forbes.com/sites/mikescott/2018/06/29/heres-why-companies-are-looking-to-their-suppliers-to-cut-carbon-footprints/#351cd07695c0
Soundariya Preetha. (2017, December 17). Efforts to prioritise textile technologies. *The Hindu* .
Nambiar, N. (2018, March 10). NABARD signs project agreement with Green Climate Fund . *The Times of India* .
NIBE. (2018). *Supplier Code of Conduct*. Retrieved August 16, 2018, from NIBE: https://www.nibe.eu/For-partners/For-suppliers/supplier-code-of-conduct/
BSCI. (2015). *Easy Guide to BSCI 2.0*. Retrieved August 16, 2018, from Business Social Compliance Initiative: https://ch.amfori.org/sites/ch.fta-intl.org/files/BSCI-2015-12-14-EasyGuide_final_0.pdf

Solar Energy Industries Association. (2018). *Solar Power Purchase Agreements*. Retrieved 16 August, 2018, from Solar Energy Industries Association: https://www.seia.org/research-resources/solar-power-purchase-agreements
Google. (2018). *Google Maps of TP Dyeing Unit Process*. Retrieved August 18, 2018, from Google : https://www.google.co.in/maps/place/TP Dyeing Unit+Process/@11.1160252,77.3968566,1791m/data=!3m1!1e3!4m5!3m4!1s0x0:0xa5002c96b426003f!8m2!3d11.1139691!4d77.3954948
Aditya Birla Group. (2018). *BUILDING SUSTAINABLE BUSINESSES*. Retrieved August 18, 2018, from The Aditya Birla Group: http://sustainability.adityabirla.com/
Sangameswaran. (2011, JANUARY 29). Effluent treatment plants in Tirupur ordered closed. *The Hindu* .