

ENERGY AUDIT REPORT



PREPARED FOR:

*KANYA MAHA VIDYALAYA, JALANDHAR CITY
(AN AUTONOMOUS COLLEGE)
Pathan Kot By Pass Chowk, Vidyalaya Marg,
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Executive Summary

Based on an inspection of the building plans, measurements and documents, energy auditing includes an evaluation and analysis of the existing situation and the various measures that could be implemented to reduce the energy consumption and improve the indoor environment. The results are presented in the energy analysis report describing the recommended measures with corresponding investments, savings and profit.

The energy analysis is a feasibility study for the building, which not only serves to identify energy use among various services but also identifies opportunities for energy conservation. The study depicts to the owner, manager, or management team of the building, options available for minimizing energy usage, water consumption, waste generation, total costs involved and benefits achievable from implementing proposed energy-conserving opportunities (ECOs). The aim is to minimize energy consumption and cost associated with it, propose context related strategies by considering building functions and occupancy schedules. It establishes and maintains an efficient balance between a building's annual functional energy requirements and its annual actual energy consumption.

Goals and objectives of the Energy Management program

- Continuous monitoring of energy consumption with respect to the users
- Minimize energy use and reduce cost over the year
- Achieve and maintain optimum energy utilization
- Minimize environmental impacts
- Adopt new technology suitable to the institute

Major challenges and goals for the years to come

- Rising costs of grid power are adversely affecting the bottom line
- Provision of Energy Management Info System (EMIS)
- Optimization of lighting fixtures
- Upgradation of other appliances and equipment
- Solar Energy for water heating
- Solar energy for power generation

Major activities to meet challenges and goal.

Implementation of State-of-the-art Energy Management System (EMS) in order to inculcate the knowledge, awareness & responsibility at grass- root level among the students and staff of the KMV College, Jalandhar.

Summary and classification of energy.

- KMV mainly relies on the Punjab State Power Corporation Limited (PSPCL) to meet its Electricity requirements.
- Solar Power, a clean renewable resource of energy for power generation is installed (in pipeline) in KMV on RESCO Model
- In addition of electricity, Diesel Generator (DG) set are operated to meet the Institute emergency requirement. DG Power contribution is approximately less than 1% of the annual energy requirements of the plant.



Introduction

Kanya Maha Vidyalaya, Jalandhar, the First & Only Women College in Punjab with AUTONOMOUS STATUS by UGC, MHRD, Kanya Maha Vidyalaya (Autonomous) has received Top National and State Level Ranking in Times BBA Education Ranking Survey 2022 conducted by prestigious Times of India group. KMV's BBA program has the proud privilege and honour of being ranked among top slot among all the colleges of Punjab & ranked No. 1 in Jalandhar among all the affiliated colleges of Guru Nanak Dev University, Amritsar second time in a row. Heritage is our rich legacy, inherited from the past that we preserve today to bestow to the future generations. With a priceless inheritance of 135 years, Kanya Maha Vidyalaya, Jalandhar, established in 1886, has the proud distinction of being the first educational institution for women in Northern India. Since its inception, it has shaped the destiny of the nation, the society and women through incredible contribution that was not confined only to the sphere of higher education but also encompassed environmental ethics. Kanya Maha Vidyalaya, Jalandhar in its contribution to its mission of clean and green India has taken several initiatives and has adopted numerous green policies. To ensure that the practices followed in the campus are in accordance with the Green Policies adopted by the institution regularly green audit is conducted annually.

The college lays emphasis not only on academic excellence but also on shaping the diverse talents of our students. For this the college provides unusually rich and vibrant cultural life, outreach initiatives and civic engagements. We excel in sports also. The college has a sustained record of excellence in academic, co-curricular and sports activities and is constantly stretching its arms towards new areas of perfection.

The college, which is located in a beautiful 27-acre campus far away from the madding city crowds of Jalandhar, has approximately 2500 students, over 120 faculty, administrative and support staff. The peaceful environment of the college houses an impressive infrastructure consisting of ultra- modern Science Labs, State-of-the Art Computer Labs, and Conference Room with Audio-Visual Aids, Fully Automated Library, Functional Language Lab, Health Club and a Hostel with a fully mechanized Kitchen. K.M.V. with its selfless services towards empowering women continues to lead from the front. It is the only institution from North India to have been selected by the Ministry of HRD for the production of documentary films on leading institutions of women education in India. Lauding the Vidyalaya's effort in imparting quality education, the chairperson of NAAC strongly recommended the elevation of the college to the status of deemed University. The college is poised to fulfill the dreams of its founding father and scale unprecedented heights.

Autonomous Status: Under Autonomous status, KMV has taken a giant leap by placing itself into a higher league of colleges that enjoy the honor of uplifting academic standards towards excellence by developing new age innovative programs, value-added courses, developing curriculum and bringing about educational reforms through conduct of examinations, evaluation and declaration of results. The college has earned this functional status only after having been accredited by National Assessment and Accreditation Council of India (NAAC) with a higher grade for three times, under which degrees will continue to be awarded by the parent university, Guru Nanak Dev University, Amritsar. Detailed Marks Certificates containing marks of students in various subjects will be awarded by the college.



Occupancy Details

The number of occupants is also important to define the amount of water and energy used in the building; therefore, the following details of the occupants have been considered during the calculation and report preparation. The total occupancy of the campus is approx. 2500.

Brief

The Energy analysis was conducted by NITTTR team for a period, at the Institute premises to study the existing practices of energy consumption and seek possible ways to conserve energy. Solar rooftop Power Plant of 260 KW under operational expenses (RESCO MODEL).

Energy Analysis Definition & Procedure

Definition

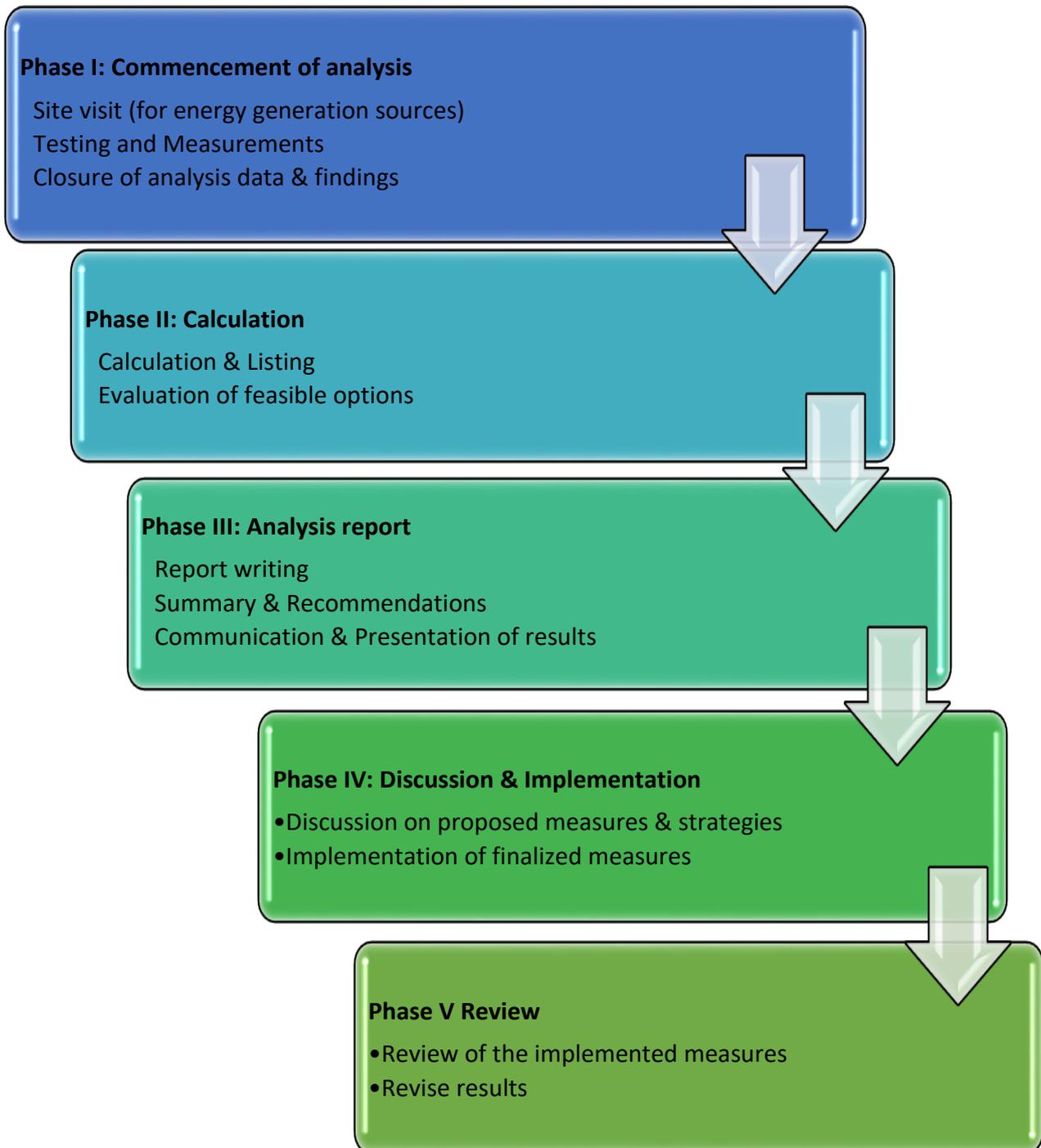
This report elaborates the current actual energy performance of the building and real-time performance of all the energy intensive systems installed in the facility. Detailed survey and testing of the energy intensive systems has been performed in order to arrive at the present performance of each equipment. The test results have been carefully analyzed and presented along with improvement measures and general recommendations for each of the systems. The suggested Energy Efficiency Measures (EEMs) presented in the report are mainly of three types depending on their initial cost implications – No cost, Low cost and Medium cost measures. The measures, if implemented, will help the facility team in optimizing the building operations and will result in comprehensive energy and cost savings in the long run.

Objective

The objective of Energy Analysis is to assess the following:

- Understand the energy consumption scenario
- Survey the energy generation systems
- Suggest potential energy conservation measures based on end users
- Support with implementation and maintenance

Procedure



Energy Analysis Procedure

Energy Consumption Scenario

The electric power for the entire facility is maintained by grid power supply by PSPCL. In case of loss of grid power, diesel generator sets are installed at the Campus for power backup.

Energy Consumption FY (2022-23)

Source	Unit (kWh)
Grid Power purchased from (PSPCL), kWh	
Gross Generation Solar Rooftop (kWh)	
Gross Generation through DG set (kWh)	
Total kWh	

Inventory / Connected Details of KMV

Lighting

The Institute has various lighting fixtures to provide the required illumination level, the lighting details are listed in the below table

S. No	Types of Light	Wattage	Quantity
1.	CFL (24)	24W	0
2.	TUBE LIGHT	28 w	797+ 406 = 1203
3.	TUBE FITTING	20W	26
4.	TUBE LIGHT LED	36W	87
5.	TUBE LIGHT	18 W	61
6.	CONSEALED LIGHT LED	36W	-
7.	DOWN CEILING LIGHT	15 W	145
8.	LED BULB	3W	131
9.	SENSOR LIGHT	6W	25
10.	LIGHT WATT	150W	14
11.	LIGHT 400W	400W	3
12.	STREET LIGHT	40W	20
13.	REFRIGERATOR	1 kW	8
14.	FLOOD LIGHT	40W	8

Comfort Systems and Controls (HVAC)

Air Conditioner

The Institute has 57 nos. of air conditioning system installed in different location. The air conditioning details are listed in the below table:

	Block no./location	No of ACs
1	ADMINISTRATION BLOCK	15
2	IT BLOCK	4
3	AUDITORIUM	5
4	Science Block	4
5	Commerce Block	1
6	Arts Block	0
	Total	29
	Hostel	25
	Staff Residence	3
	Hostel Total	
	GRAND TOTAL	57

Air Conditioner Details

Fan & Cooler

The Institute has fitted different types of fans in the campus building. Fan details are listed in the below table

S. No	Types of Fans	Wattage	Quantity
1	FAN CEILING 60w	60	1093
2	WALL FANS 100watt	50	40
3	EXHAUST FANS	30	38
4	HVLs Fan	No	NO
5	Wall Fan 150	150	NO
6	DESERT COOLERS	70	130
Total			

Water Heater & Water Cooler

Water heating and cooling is a process that uses an energy source to heat and cool water from its initial temperature. Institute is using water for cooking, cleaning and bathing purposes.

S. No	Miscellaneous Appliances	Wattage	Quantity
1	GEYSER ELECTRIC (50 LTR)	NO	NO
2	GEYSER ELECTRIC (25 LTR)	2kW	25
3	WATER COOLERS	3kW	10
Total			35

Electricity Bill Analysis of KMV

The efficacy of the electrical distribution system is evaluated through the study of the electricity bill.

S. No	Billing Month	Contract Demand (KVA)	M DI	KVAH	KWH	Bill Period (Days)	Energy Charge	Fixed Charges	Unit rate
1.	June, 2021	389.889	32.48	24971 77	24020 82	30	112434	33840	6.53
2.	July, 2021	389.889	38.68	25070 52	24117 24	21	89943	26918	6.63
3.	August, 2021	389.889	38.68	25179 75	24224 73	30	144839	38455	6.63
4.	September, 2021	389.889	19.15	25338 69	24380 97	37	210754	47428	6.63
5.	October, 2021	389.889	85.0	25509 92	24547 77	28	227051	35891	6.63
6.	November, 2021	389.889	94.66	25693 48	24725 16	21	217597	26918	6.63
7.	December, 2021	389.889	42.4	25903 27	24929 62	39	278182	49991	6.63
8.	January, 2022	389.889	67.1	26062 85	25078 84	28	211603	35891	6.63
9.	February, 2022	389.889	50.2	26199 53	25213 09	25	181238	32046	6.63
10.	March, 2022	389.889	50.5	26364 90	25376 37	34	812192	43582	6.63
11.	April, 2022	389.889	66.04	26475 11	25483 83	25	146138	32046	6.63
12.	May, 2022	389.889	105.2	26756 77	25757 46	36	373481	46146	6.63
13.	June, 2022	389.889	127.5	27131 95	26119 02	31	497489	39737	6.63



14.	July, 2022	389.889	139.32	27428 22	26403 84	20	392854	25637	6.6 3
15.	August, 2022	389.889	73.72	27621 03	26590 70	35	255666	44864	6.6 3
16.	September , 2022	389.889	126.62	27916 95	26876 87	31	392390	39737	6.6 3
17.	October, 2022	389.889	143.48	28286 60	27234 09	31	490156	39737	6.6 3
18.	November , 2022	389.889	96.72	28532 89	27472 61	30	326581	38455	6.6 3
19.	December , 2022	389.889	60.88	28682 34	27618 10	31	198171	39737	6.6 3
20.	January, 2023	389.889	55.5	28836 12	27768 90	36	203912	46146	6.6 3
21.	February, 2023	389.889	52.3	28988 06	27919 42	31	201472	39737	6.6 3
22.	March, 2023	389.889	54.3	29161 46	28038 894	25	229928	32046	6.6 3
23.	April, 2023	389.889	55.24	29316 23	28238 26	28	205225	35891	6.6 3
24.	May, 2023	389.889	50.14	29389 51	28391 89	31	97169	39737	6.6 3

Observation on Electricity Bill analysis

The Present Electricity consumption does not clearly reflect any pattern. The reason being:

- The Institute has been running on partial strength since last 2 years due to COVID regulation.
- The present bill only captures the consumption of essential equipment's such as servers, air conditioner dedicated for maintaining ventilation in server room and other essential load such as essential lights, facility staff energy usage.
- The seasonal variation can be captured, and suitable analysis can be done in case the office is running on optimum load (80% or more).

Renewable Energy

Roof Top Solar

KMV has signed Agreement between KMV and Renewable Energy and Service Company (RESCO). Solar rooftop Power Plant of 260 KW under operational expenses (RESCO MODEL). This provides an alternate clean source of energy. It also provides shade on roof hence minimizing the heat gain.

Energy efficient measures

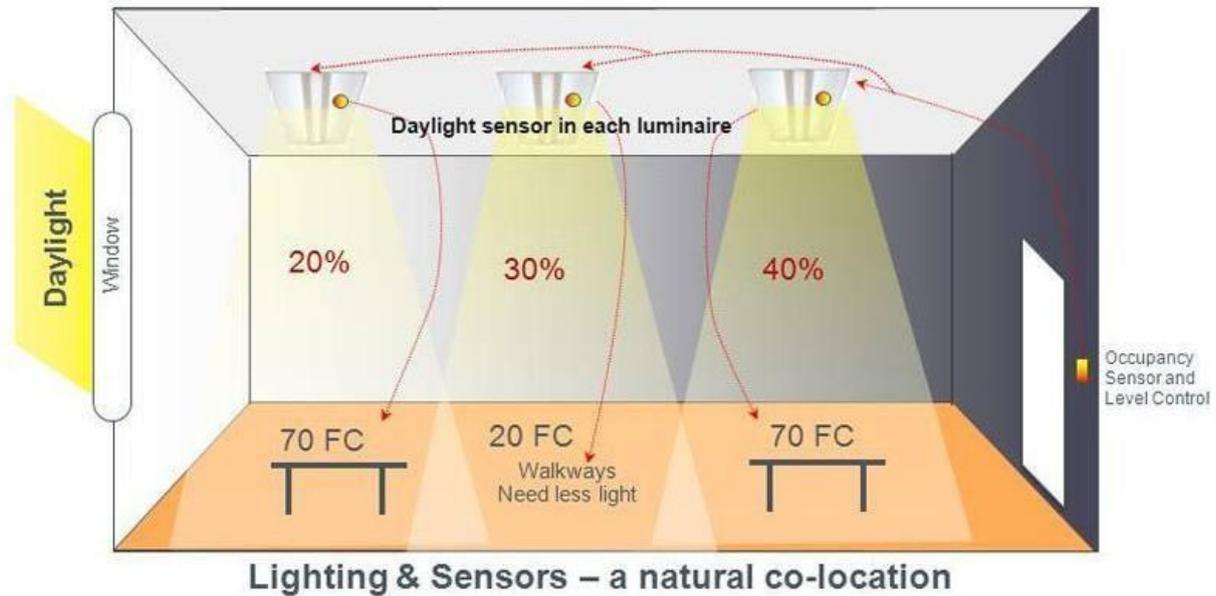
The KMV Campus has set a high standard by being the first green campus with 1.1 MW Solar Power Plant. The solar power generation will annually generate nearly 11 lakh units of electricity.

Further, it as an opportunity to raise the bar by amending the following energy efficient measures in the facility to achieve more savings in electricity.

ECM-1 Occupancy and Daylighting Sensors

Occupancy Sensors provide automatic ON/OFF switching of lighting loads to enhance convenience, security and long-term energy savings. Daylight sensors are battery-powered sensors that save energy by dimming or turning off electric lighting when sufficient daylight is available. The sensor detects light in the space and then adjusts the lights to take advantage of daylight, thus conserving

energy. These sensors are being incorporated into most projects and as many retrofit/retro commissioning projects as possible, with funding and electrical/mechanical application being key factors.



ECM-2 Sub Metering

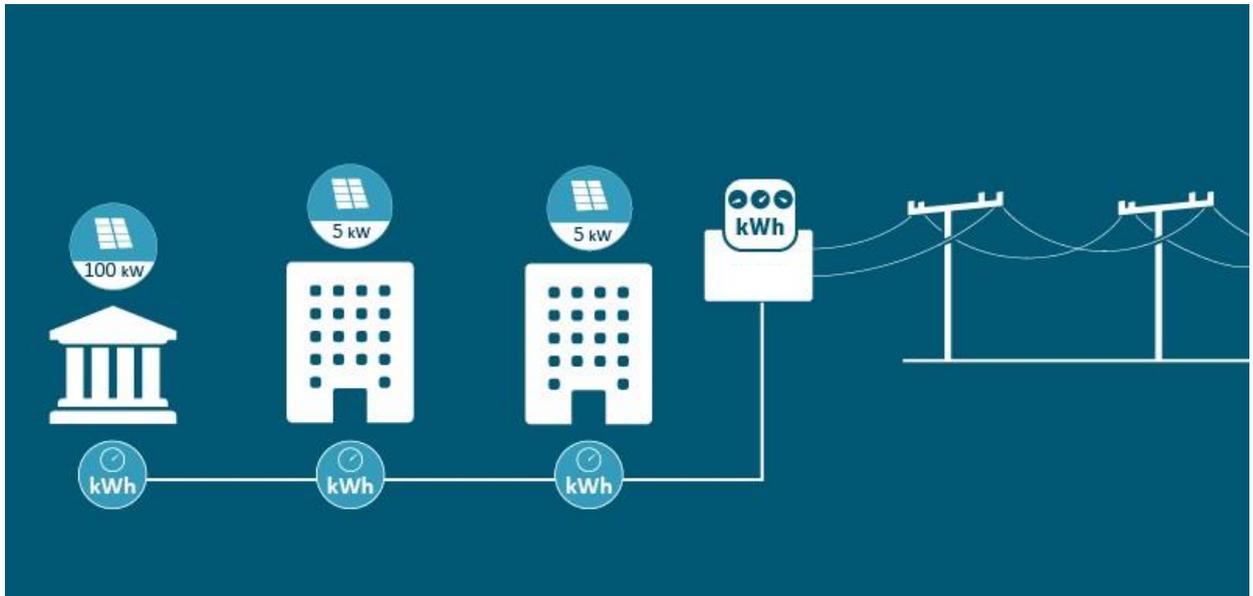
Energy efficiency is the first step in achieving sustainability in buildings and helps to control increasing their energy costs while reducing their environmental footprint. An Energy Management System (EMS) or Building Automation System (BAS) can provide metering, sub metering and monitoring functions that allow facility managers to gather data that allows them to make more informed decisions about energy use.

Electrical sub metering involves the installation power meters (also called power monitors, electrical meters, or energy monitors) that can measure energy usage after it reaches the primary utility meter. Sub metering offers the ability to monitor energy usage for individual tenants, departments, pieces of equipment or other loads to account for their actual energy usage.

There are various Benefits of Sub metering, some are as follows:

1. Accurate energy monitoring, real-time energy consumption
2. Granular in-depth review of facility energy data
3. Better informed to make decisions that can help optimize energy performance
4. Ability to record actual energy usage (no estimates)
5. Comparison of usage across similar facilities over time

6. Ability to identify and eliminate wasted energy
7. Early access to maintenance issues for repair before critical equipment fails



Depiction of sub metering installation at each building

ECM-3-Replacement of existing 60 Watt ceiling fan with super-efficient 35Watt fan

Title of Recommendation	:	Replacement of high energy consuming non star fans with Five star rated energy efficient fans.
Description of existing System and its operation	:	Ceiling fans operating at 60 watts consuming high energy
Description of proposed system and its operation	:	Five Star rated energy efficient fans for say Crompton maximums operating at 35 watts.
ENERGY SAVING CALCULATIONS		
Population of old fans	:	1093
Running hours per annum	:	$8 \times 1093 = 8744$ hrs (Calculations are based on fan operating for 8 hrs working per day for 5 days a week and Nine months in a year)
Unit consumed by existing one fan per annum	:	$0.06 \text{ kW} \times 8744 \text{ hrs} = 524.64 \text{ kWh}$
Unit Consumed by One five star rated Recommended Fan per annum	:	$0.035 \text{ kW} \times 8744 \text{ hrs} = 306.04 \text{ kWh}$
Annual Energy saving in wattage per fan	:	$524.64 - 306.04 = 218.6 \text{ kWh}$
Total annual energy savings	:	$218.6 \times 1093 = 238929.8 \text{ kWh (units)}$
Total annual energy savings in rupees	:	$238929.8 \times 6.63 = 1584104.57$
COST BENEFIT ANALYSIS		
Saving in Annual operating cost per fan @ Rs 6.63 per unit	:	$218.6 \times 6.63 = ₹ 1450$
Investment on purchase of 5 star rated energy efficient fans	:	₹2350 per fan
Salvage Value of existing fan	:	₹300 per fan
Net Capital investment per fan	:	$2350 - 300 = ₹ 2050$ per fan
Total Capital investment	:	$2050 \times 1093 = ₹ 2240650$
Payback Period	:	1.41 years against a lifespan of 10 years
Total saving after payback period i.e for rest 8.6 years	:	$1584104.57 \times 8.6 = ₹ 13623303$
REDUCTION OF CO2 FOOT PRINT WITH INSTALLATION OF SUPER EFFICIENT FANS (annually)		
	:	$306.04 \times 1093 \times 0.9 = 301012 \text{ kg} \approx 301 \text{ tonnes}$

ECM-4- REPLACEMENT OF EXISTING AIR CONDITIONERS WITH 5 STAR RATED INVERTER TYPE SPLIT AIR CONDITIONERS

Title of Recommendation	:	Replacement of existing one or two star air conditioners with Five star rated air conditioners.
Description of existing System and its operation	:	One star rated window Air conditioners of 1.5 T capacity
Description of proposed system and its operation	:	Five Star rated split Air conditioners with inventor drive of same capacity.
ENERGY SAVING CALCULATIONS		
Population of old ACs	:	50
Annual Running hours of each AC	:	$8 \times 5 \times 30 = 1200$ hrs (Calculations are based on ACs operating for 8 hrs working per day for 5 days a week and 7 months in a year)
Per day consumption (kW) by one existing AC	:	$15.4 \text{ kWh} / 8\text{h} = 1.92$ units
Per day consumption (kW) by one proposed AC	:	$10.4 \text{ kWh} / 8\text{h} = 1.3$ units
Net annual energy savings (kW) per ac	:	$(1.92 - 1.3) \times 1200 = 0.62 \times 1200 = 744$ units
Total annual energy savings in units	:	$744 \times 50 = 37200$ kWh (units)
Total annual energy savings in rupees	:	$37200 \times 6.63 = ₹ 2,46,636$
COST BENEFIT ANALYSIS		
Annual cost saving per AC @ Rs 5.80 per unit	:	$744 \times 6.63 = ₹ 4932.7$
Investment on purchase of proposed system	:	₹33000 per AC
Salvage Value of existing working system	:	₹8000 per AC
Net Capital investment per AC	:	$33000 - 8000 = ₹25000$ per AC



Total Capital investment	:	25000×50= ₹ 12,50,000
Payback Period	:	5 years against a lifespan of 10 years
Total saving after payback period i.e for rest 5 years	:	₹ 2,46,636 * 5= ₹ 12,33,180
REDUCTION OF CO₂ FOOT PRINT WITH INSTALLATION OF INVERTER TYPE SPLIT ACs (annually)		
	:	37200 units* 0.9 kg-carbon/unit= 33480 kg ≈ 33 tonnes

ECM-5- Installation of Solar Street Lights in the campus

Total No. of Street Lights in the Campus: 20

Wattage of each light: 40 Watts

Operating Hours per day of each light: 09 Hours daily

Energy saving by each light: $0.04 * 9 = 0.36$ KWH per day

Energy Consumed by 20 lights $0.36 * 20 = 7.2$ KWH per day

Energy saves by 20 lights monthly: 216 KWH

Energy saves by 20 lights annually: 2628 KWH

Avg. Unit Cost: Rs.6.63/- per KWH

Energy cost saving by solar light: Rs.17424/- Annually

Cost of one solar street light 15 W: Rs.10000/-(including all)

Cost of 20 solar lights: Rs. 2, 00,000/-

This Energy Conservation Measure (ECM) is already in process of procuring and installation in phases.

ECM-6- Replacement of existing geysers with solar water heater system in the campus:

Total No. of 25 liters Geysers installed in the guest house: 25

Approximate No. of Hours use of each geezer in winters: 03 Hours daily

No. of days in winter season (for 05 months): 150 days

Working hours of each geyser in winter season: 450 hours

Working hours of 25 geysers in the season: 11250 hours

Wattage of each geyser: 2 KW (approx.)

Energy consumed by 25 geysers in the season: 22500 KWH

Approx. Rate of Energy unit: Rs. 6.63 per KWH

Energy cost by 25 geysers in the season: Rs.150000/-

Capacity of solar water heater (one unit): 500 liters

Cost of solar water heater (one time investment): 55,000/-

Energy saves annually: 22500 KWH

Energy costs save annually: Rs.150000/-

Payback period: 4.5 months

Zero-Cost Energy Saving Measures

- Turn off electrical/heat producing equipment when not in use: lights, TVs, computers etc.
- Check and clean the Air conditioner filter every month. This will improve cooling, reduce compressor running time and save energy.
- Keep the doors and windows closed, while using the Air conditioner
- Make sure your doors and windows are well sealed; you will pay a lot more to cool your office when the cold air easily escapes. Do-it-yourself weather stripping for doors and caulk for windows is easy to install, and cheap.
- Use venetian blind or curtains for windows to minimize the solar radiation heat. Reflective film reflects the sun's heat from your windows and can block 40-60% of heat and modern films reflect heat away *without* blocking the light too, so you can still have nice, bright rooms.
- Thermostat setting of 23°C – 25°C provides comfort. Do not keep lower settings. It will increase compressor run time and increase your energy bill
- Clean the condenser/evaporator coils at the beginning of each season by an AC specialist
- A ceiling fan is running along with AC will provide good air circulation and comfort feeling. It may also help in increasing the thermostat setting to say 25°C – 26°C, still feeling comfortable and saving energy.

Final Summary

NITTR team has performed thorough energy analysis of the Kanya Maha Vidyalaya, Jalandhar. The calculations were done using all the measurement taken at all energy consuming units at the facility. The results obtained after the calculation were thoroughly observed. The possible energy efficiency measures were given for the units to reduce the energy consumption and to improve the overall energy efficiency of the facility building. The energy efficiency measures given for each unit are summarized in the below table with the details.

Summary of ECM Suggested to KMV with energy savings

ECM	Description	Remarks
ECM 1	Use of Occupancy and Daylighting Sensors	An occupancy sensor is an indoor motion detecting device used to detect the presence of a person to automatically control lights or temperature or ventilation systems.
ECM 2	Sub Metering	Will help in monitoring and logging
ECM 3	Replacement of existing 60 Watt ceiling fan with super-efficient 35Watt fan	By adopting this ECM, it is assumed to reduce 238929.8 kWh (units) of energy consumption and 301 tonnes of CO ₂ footprint reduction.
ECM 4	Replacement of existing air conditioners with 5 star rated inverter type split air conditioners	By adopting this ECM, it is assumed to reduce 37200 kWh (units) of energy consumption and 33 tonnes of CO ₂ footprint reduction.
ECM 5	Installation of Solar Street Lights in the campus	100 % renewable option
ECM 6	Replacement of existing geysers with solar water heater system in the campus	Solar water heater is one of the renewable resources for heating water.

APPENDIX A

SOLAR ROOF TOP AGREEMENT

AGREEMENT

M/s Navraj & Co., Jalandhar has awarded work of installation of 260 KW of roof top solar power plant at KMV College, Jalandhar. Plant will be installed under operational expenses (RESCO MODEL) model. This project will be governed under below said terms and conditions.

- 1) M/s Navraj & Co., Jalandhar is installing a solar roof top plant of capacity to 60 KW as per the space and requirement to produce electricity in the premises of KMV College and check the production of solar plant and solar check meter is also installed showing number of units of electricity produced through Solar Roof Top Power Plant.
- 2) The Solar Check meter is installed by PSPCL in the premises of KMV College adjacent to solar plant. This meter will be sealed and locked by PSPCL employees. This meter is installed in the campus of KMV College hence the KMV College will undertake and ensure that no employee of its will tamper with the meter and in case tampering is found it will be responsibility of KMV College to get the meter replaced and to pay for the damages of electricity department Punjab will increase the repayment period equivalent to period during which the meter was tampered. If in case meter is damaged by natural reasons, then there will be no charge to college and no change in the contract. M/s Navraj & Co., Jalandhar will get meter corrected at its own cost.
- 3) Subsidy if any released by PEDDA or any other nodal agency will be shared equally between KMV College and M/s Navraj & Co., Jalandhar. Both the parties will share at the rate of 50% each.
- 4) KMV College Jalandhar undertakes to give monthly payment to M/s Navraj & Co., Jalandhar towards number of electricity units produced by Solar Roof Top Plant in a month as shown in solar check meter at the rate of Rs. 5.35/- per unit (incl. of all taxes for a period of 180 months on monthly basis. After expiry of first 15 years, the agreement/contact will be extended for further 15 years at the rate of Rs. 3.50/- per unit (incl. of all taxes).
- 5) The mutually agreed rate of electricity is Rs.5.35/- per unit and shall remain same for 15 years or 180 months irrespective of any fluctuation in electricity unit rate, by PSPCL or any other government or private body.
- 6) KMV College, Jalandhar is not investing anything in the project and M/s Navraj & Co., Jalandhar by expecting a good repayment from KMV College is investing the entire project cost
- 7) KMV College, Jalandhar has ensured and agreed that monthly payment will be paid by 15% of every month to M/s Navraj & Co., Jalandhar.
- 8) KMV College Jalandhar has nominated Principal KMV College for all the correspondence and has given email address id kmyoffice1886@gmail.com as registered id for all correspondence

- 20
- 9) M/s Navraj & Co., Jalandhar for all the correspondence and has given email ID – as the registered ID navrajandco@smsil.com for all correspondence. All the correspondence on mail is to be treated as registered and valid.
 - 10) All the legal heirs and management and chair bearers of both parties are bound to honour this written and notarized agreement. The agreement cannot be revoked and cancelled by either party without consent of both parties before completion of 15 years.
 - 11) All the insurances up to 15 years will be borne by M/s Navraj & Co., Jalandhar.
 - 12) Operation & Maintenance for first 15 years is free of cost.
 - 13) No maintenance cost will be charged to college during operating period of 15 years.
 - 14) M/s Navraj & Co., Jalandhar will be totally responsibility for Installation, obtaining permissions and to make the unit operational.
 - 15) Any damage done to college property due to installation or later due to faulty installation of equipment, will be borne and fixed by M/s Navraj & Co., Jalandhar.
 - 16) The entire project will be installed by M/s Navraj & Co., Jalandhar. The quoted proposal is inclusive of approvals, design, manufacturing, sourcing, testing, supply, installation and commissioning as per the bill of materials and ratings submitted by M/s Navraj & Co., Jalandhar along with the final offer. The price quoted is CIF side and is firm. The price is inclusive of all annual maintenance charges and comprehensive maintenance charges or operation & maintenance charges.
 - 17) Effective date of commissioning of plant will be 40 days after the work order placed by the college.
 - 18) If in case State Electricity Department refuses for net metering arrangement, then either M/s Navraj & Co., Jalandhar will remove the entire project or will provide any alternate solution so that college continues to get shavings in electricity bill.
 - 19) If in case the Gross you need price of electricity supplied by State, Electricity Board reduces below Rs. 5.35/- inclusive all charges, then M/s Navraj & Co., Jalandhar will also reduce the price of electricity and power unit charges will remain same as that of State Electricity Board.
 - 19) If in case any supply of electricity or electricity line is damaged by Solar Power, then M/s Navraj & Co., Jalandhar will get it repaired. In case the damage is caused due to light cables or old cables then M/s Navraj & Co., Jalandhar will not be liable for any loss.

- 20) If in case any dispute or disagreement over some of matter arises then terms mentioned in this agreement will be followed. In no case the agreement will be revoked. Hence, in no case this agreement can be revoked or cancelled.
- 21) As per manufacturer warranty, Solar Panel will show a degradation of 0.5% every year. Guidelines of Solar Panel Manufacturer will be followed at the time of handover of project to KMV College after 15 days.
- 22) **ACCESS AND PERMITS** The Client will ensure proper Access and Permits to site. In order to complete the task in time, M/s Navraj & Co., Jalandhar will need 24 hours working permission with the proper lighting arrangements.
- 23) **DELIVERY AND HANDOVER** M/s Navraj & Co., Jalandhar shall complete the project within 90 days from the date of order, placement and acceptance of order by KMV College, Jalandhar or as mutually agreed between the parties in the agreement.
- 24) If KMV wants to buy the Solar Panel System from M/s Navraj & Co., Jalandhar before the completion of 15 years of project. The annual rate of depreciation of 4% every year will be applicable.

25) **WARRANTY**

Item	Manufacturing Firm	No. of Years
Solar Modules		
Inverters		
Balance of System Components		

26) **SECURITY AND SAFETY**

On delivery of supplies to customers side in good condition customer shall be responsible for safety and security of the materials till handing over to the same to M/s Navraj & Co., Jalandhar designated personnel for installation. In case there are public disturbances at site which a note exclusively attributable to M/s Navraj & Co., Jalandhar. Customer shall resolve the same at its own risk and cost for smooth execution of the project by firm. In such case, customer shall provide safety and security for the M/s Navraj & Co., Jalandhar designated personnel working at site. Any delay in execution or damage of materials due to public disturbance at site shall we attribute able to add compensated by customer.

27) **INDEMNIFICATION**

M/s KMY College, Jalandhar and now M/s Navraj & Co., Jalandhar shall fully indemnify and hold harmless each other and their affiliates, associates, directors and employees from and against any and all losses caused damages, injuries, liabilities claims and causes of action, including without limitation arising out of or resulting from claims by third parties, active, omissions and breach of any of the customers, affiliates, suppliers, employees agents Or contractors in the performance of customers obligations under this proposal or any resultant

agreement or otherwise arising out of any breakage of asbestos roof, other health hazards arising out of roof conditions, the solar power system and its usage.

That both the parties have signed this agreement in the presence of witnesses as a token of acceptance.

APPENDIX B

Certifications of Audit Team

End of Report

Let's Build a Better Planet