DOST7

Initiatives on Energy Efficiency towards a Low Carbon MSMEs in Region 7 (Central Visayas)

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Department of Science and Technology Region VII, Cebu City, Philippines

OUTLINE

1. DOST 7 Programs and Services
2. Local Energy Experts Capability Development
3. Energy Experts in Actions (Energy Audit) and Energy Efficiency Recommendations
4. Technology Development
5. Issues and Concerns

1. DOST 7 Programs & Services

- Small Enterprise Technology Upgrading Program (SETUP)
- Laboratory & Testing Services
- S&T Training & Consultancy Services
- S&T Information, Promotion, ICT Services
- S&T Scholarships
- S&T Network & Linkages

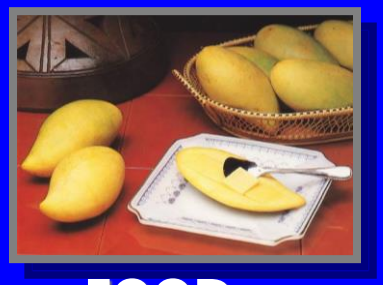
Department of Science and Technology Region 7 (DOST-7)

SMALL ENTERPRISE TECHNOLOGY UPGRADING PROGRAM (SETUP)

Comprehensive package of S&T services and facilities that would improve the competitiveness and productivity of SMEs

SETUP

PRIORITY SECTORS



FOOD

AGRICULTURE

ICT

METALS & ENG'G

FURNITURE

MARINE & AQUACULTURE

SETUP

GDH/Fashion Accessories

HEALTH & PHARMACEUTICALS

PACKAGE OF S&T INTERVENTIONS (SETUP Assistance)

Innovation System Support (ISS)	Technology Needs Assessment (TNA)	Laboratory & Testing
Packaging & Labelling	Training	S&T Consultancy
Product/ Process Development	Value Chain Development	Network & Linkages

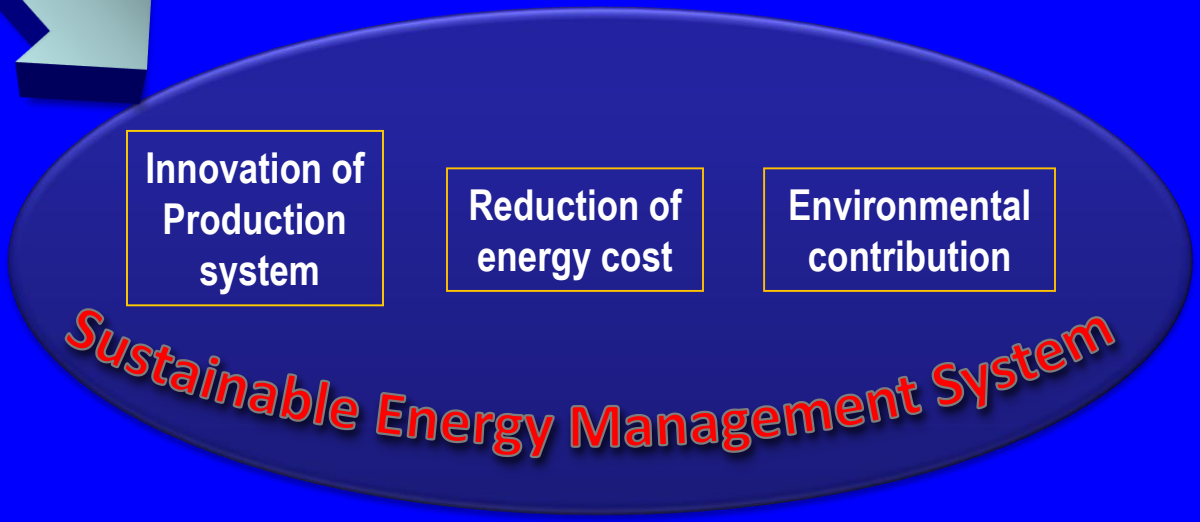
DOST 7 Training & Consultancy Services

- Packaging & Labeling
- Food Processing Technologies
- Manufacturing Productivity Extension (MPEX)
- Consultancy on Agricultural Productivity Extension (CAPE)
- Food Safety
- Energy Audit/ Energy Management (Energy Efficiency)
- Cleaner Production

2. Local Experts Capability Development

- Training of Energy Auditors, Energy Managers, Practitioners and Professionals
- Awareness/Information and Education Campaign on Energy Management, Conservation and Audit Measures
- Energy Audit Walkthroughs (General or Detailed Assessments)

DOST Energy Audit Consultancy and Training Program



Market competitiveness
- Clean company image
- Quality
- Price
- Customer service

Good standing enterprise in 21 century

Started in Oct. 2007

DOST Energy Audit Consultancy and Training Program

- Human resource development of the DOST regional staff and partners in energy conservation and management
  - Training Modules have been designed
  - Procurement of needed energy audit instruments for lightings, electrical systems (motor, compressors, and others), steam systems
  - Training of Trainers (DOST Regional Staff and Partners)
  - Enhancing learning skills in energy audit/management through partnership with international/foreign experts (JICA, JETHRO, ICETT, GTZ/ GIZ, German Senior Experts Program and others undertaking energy efficiency/energy management projects in Cebu and other parts in the Phils.
  - Members of the team attended foreign training in Energy Efficiency/ Management/Conservation
  - Participation in certifying examination as Energy Manager, EnMS Expert (AEMAS, PIEEP DOE-UNIDO)

- **Institutionalization and deployment of Regional Cluster Core Group in Energy Management, Conservation and Audit Measures**
  - **Regional Core Group conducts training on energy conservation/efficiency/ audit/management system**
  - **Regional Core Group conducts energy audit walkthroughs and assessments**









On Training Modules

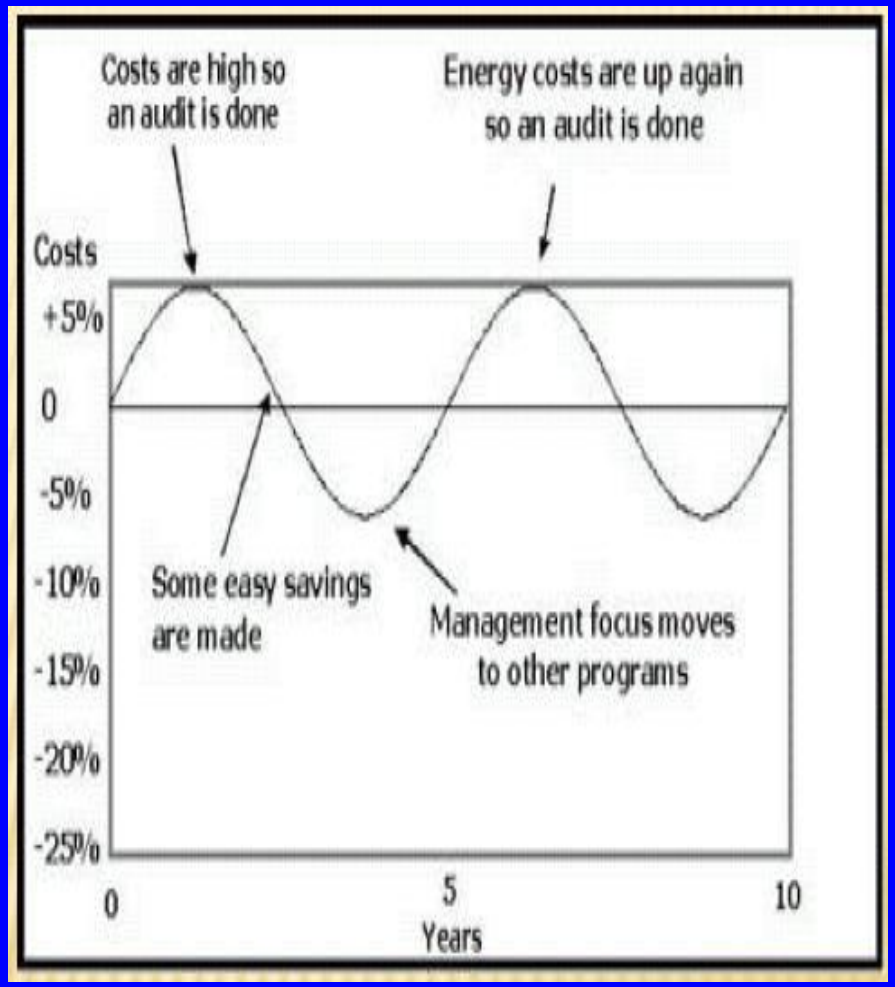
- One (1) Day Awareness and Appreciation Course
- Two (2) Day Users Training Course
- Five (5) Day Energy Auditor Training Course

Topics include introduction to energy conservation, efficiency, management and audit measures e.g. concepts, properties of energy audit and procedures of energy audit; system audit and optimization on rotating machines, lighting systems, compressors, dryers, steam systems and others

On Equipment/Facility Procurement







Without a proper Energy Management System, there is no sustainability in the implementation of Energy Efficiency measures or Energy Management Opportunities

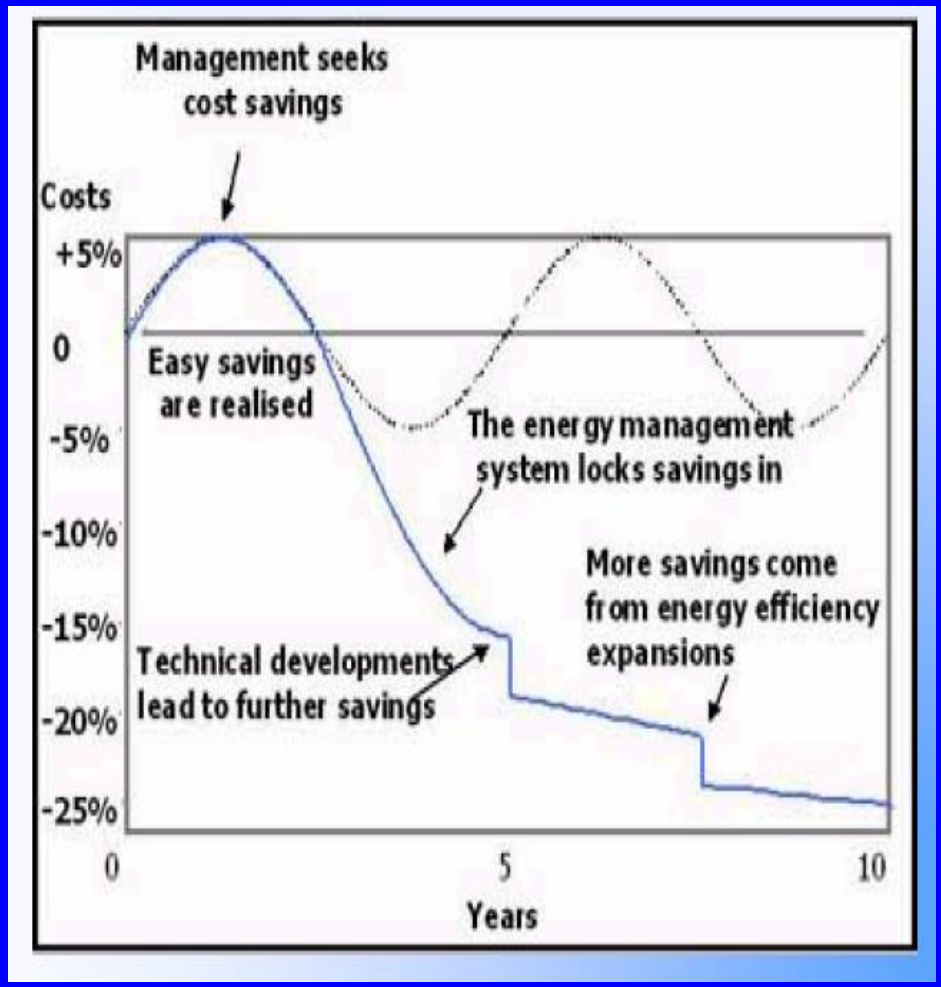
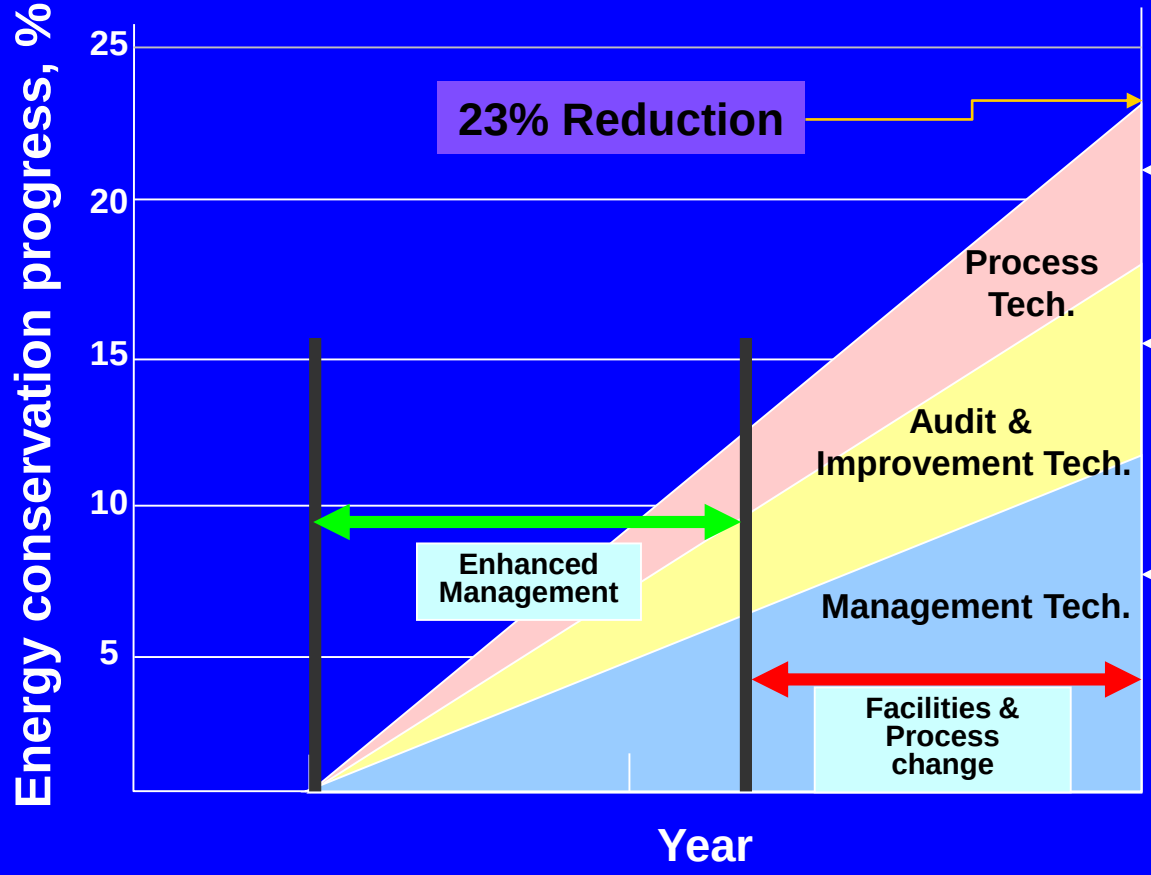


Figure shows the energy cost cycle of the energy conservation program with sustainable energy management system

Energy Management Opportunities & Effects

" 3 Steps for Energy Conservation "



Investment: Large
Ⓒ **Effect: 5%**

Investment: Medium
Ⓑ **Effect: 7%**

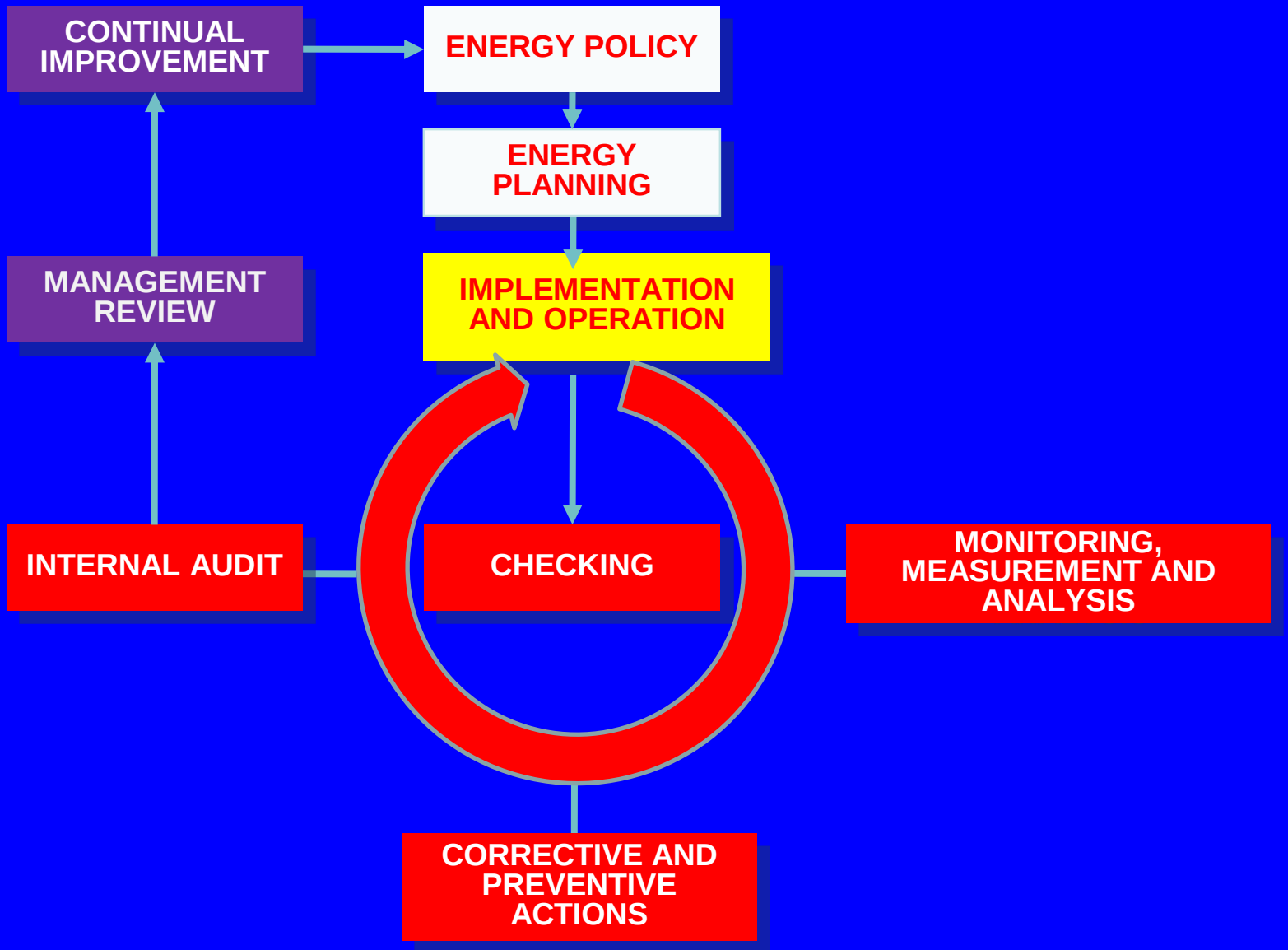
Investment: Small
Ⓐ **Effect: 11%**

Investment for Promotion of Enhanced Management:
- Measuring Instrument
- Control System

<An example of audit>

ADOPTION OF INTERNATIONAL STANDARDS FOR ENERGY MANAGEMENT SYSTEM (EnMS): ISO 50001

ENERGY MANAGEMENT SYSTEM MODEL FOR ISO 50001



Plan - Do - Check - Act (PDCA)

ISO 50001 is based on the Plan - Do - Check - Act (PDCA) continual improvement framework and incorporates energy management practices into everyday organizational activities. As per ISO/FDIS 50001:2011:

- Plan: conduct the energy use assessment, establish the baseline, energy performance indicators (EnPIs), objectives, targets and action plans necessary to deliver results that will improve energy performance (measurable results related to energy efficiency, use and consumption) in line with the organization's energy policy;
- Do: implement the energy management action plans;
- Check: monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives, and report the results;
- Act: take actions to continually improve energy performance and the EnMS.

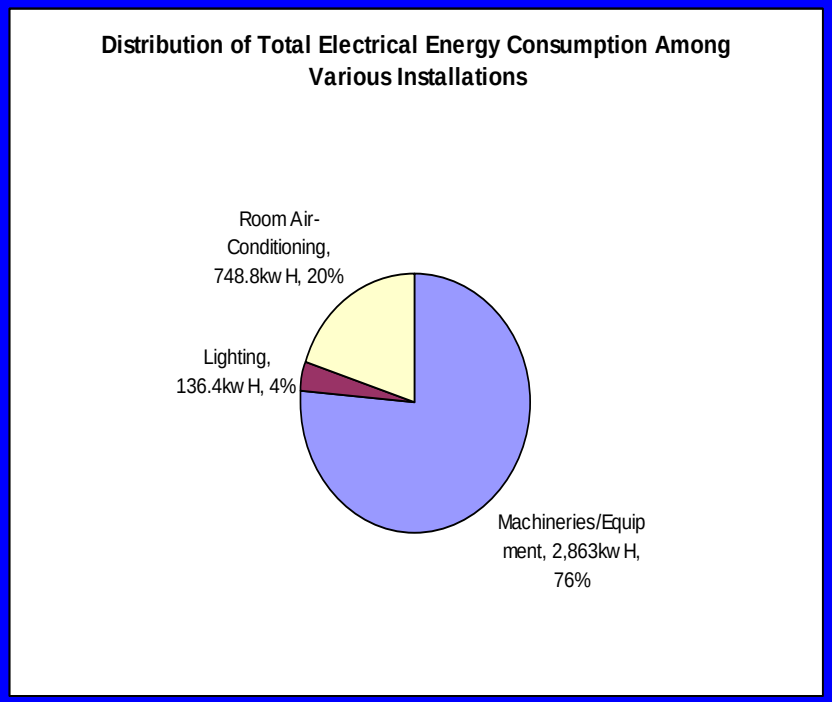
Adoption of ISO 50001 by any organization will:

- Reduces energy bills
- Makes manufacturing more sustainable
- Promotes energy efficiency throughout the supply chain
- Helps in meeting National GHG reduction targets

3. Energy Experts in Actions (Energy Audit) & Energy Efficiency Recommendations

MSME 1:

Metal Manufacturing and Fabrication, company that outsourced services of the shipbuilding/shipyard firms and others local and foreign firms



SEU (Significant Energy Users)

FINDINGS

The facility has an average monthly electrical energy consumption of 3,748.3 KwH amounting to P26,000.00 based on submitted monthly bills from January to December of 2011.

- The facility doesn't have a fully metered and measured load factors on each of the motor.
- Motor run time is another parameter that is very difficult to get. Motor is used in an application where it is not constantly running on.
- An actual motor load factor measurement on Lathe Machine No. 3 with a rated power of 5Kw, 3P, 240V. It revealed that the load factor is only 35% w/c is quite low because of a small work piece the machine carried out.
- Motors are not properly cleaned, presence of dust accumulated inside the motor casing.

Benefits in Improving the Electrical Distribution System

SHORT TERM

- Increased efficiency of plant electrical system
- Correcting Power Factor (PF) from 0.5 to 0.9

will results:

- Demand can be reduced to 30 KVA from 54.1 KVA
- 24.1 KVA transformer capacity released
- 24.1 KVA can be saved or at least 44.5% power reduction
- Payback period of installing the Capacitor KVAR=28 is about 2.5 months

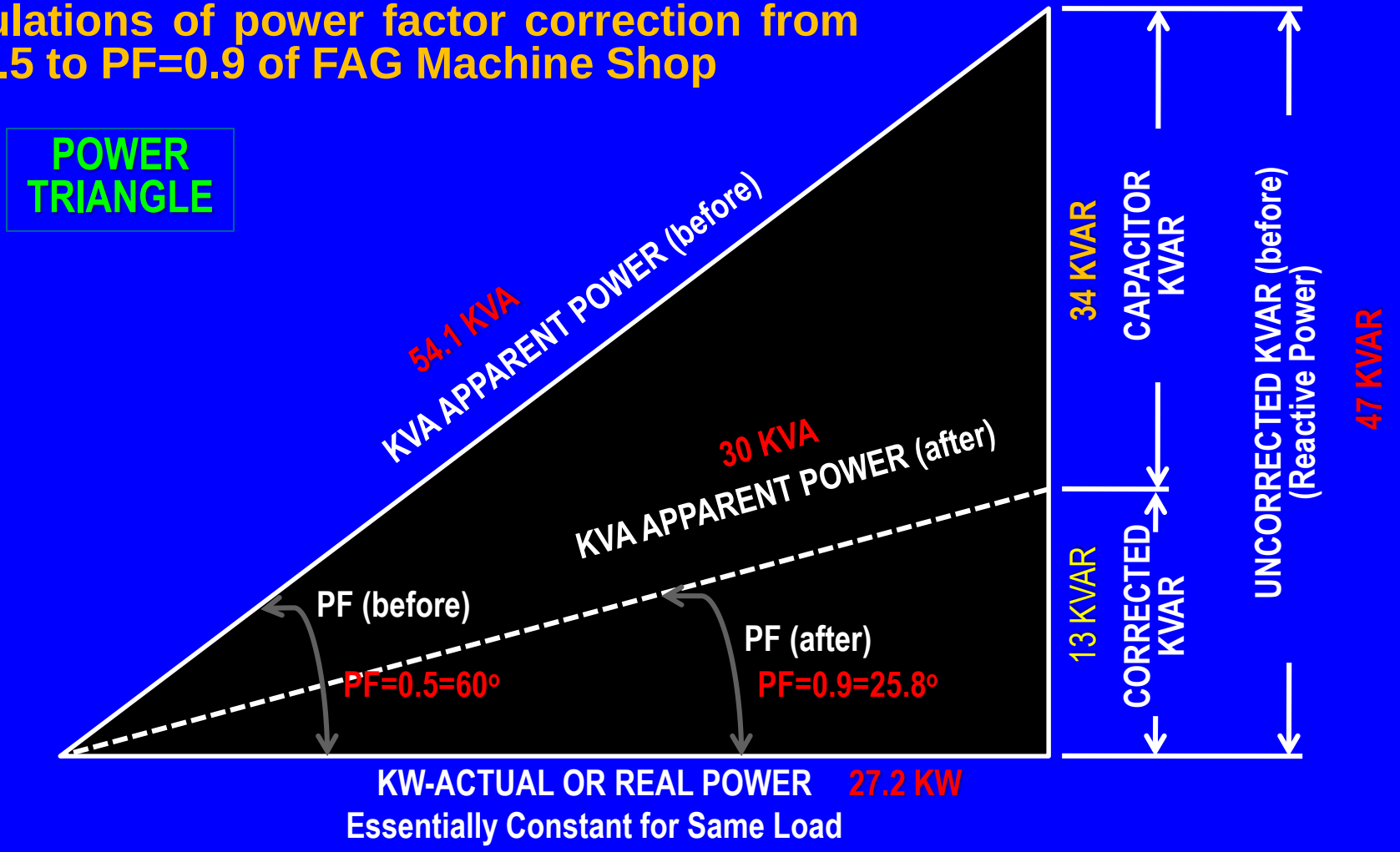
Improve Power Factor (PF)

Why we are concerned of POWER FACTOR (PF)?

- In Industrial Facilities, the loads are mostly inductive e.g. Induction Motors
- Energy Efficient Motors not optimized for PF
- Low power factor is caused by oversized or lightly loaded induction motors
- Low power factor results in:
  - ✓ Poor electrical efficiency!
  - ✓ Higher utility bills
  - ✓ Lower system capacity
  - ✓ On the Supply Side, Generation Capacity & Line Losses

- Power Factor Correction provides an economical means for improving Energy Utilization

Calculations of power factor correction from PF=0.5 to PF=0.9 of FAG Machine Shop



Computations:

(1) From Table 1, the multiplier to improve the PF from 0.5 to 0.9 is 1.248

(2) Capacitor KVAR = Kw x Table 1 Multiplier
= 27.2 x 1.248
= 33.95 or 34

Results of this Recommendation will:

(1) Demand can be reduced to 30 KVA from 54.1 KVA

(2) 24.1 KVA transformer capacity release

(3) 24.1 KVA can be saved or at least 44.5% power reduction

KW multipliers for determining Kilovars

Using this Table:

Find your existing power factor in the left column, then across the same line, locate your desired power factor. This give you a KW multiplier, which you then use to figure the number of KVAR you need

Original Power Factor	Corrected Power Factor																				
Existing Power Factor	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.0
0.50	0.982	1.008	1.034	1.060	1.086	1.112	1.139	1.165	1.192	1.220	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.589	1.732
0.51	0.937	0.962	0.989	1.015	1.041	1.067	1.094	1.120	1.147	1.175	1.203	1.231	1.261	1.292	1.324	1.358	1.395	1.436	1.484	1.544	1.687
0.52	0.893	0.919	0.945	0.971	0.997	1.023	1.050	1.076	1.103	1.131	1.159	1.187	1.217	1.248	1.280	1.314	1.351	1.392	1.440	1.500	1.643
0.53	0.850	0.876	0.902	0.928	0.954	0.980	1.007	1.033	1.060	1.088	1.116	1.144	1.174	1.205	1.237	1.271	1.308	1.349	1.397	1.457	1.600
0.54	0.809	0.835	0.861	0.887	0.913	0.939	0.966	0.992	1.019	1.047	1.075	1.103	1.133	1.164	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.55	0.769	0.795	0.821	0.847	0.873	0.899	0.926	0.952	0.979	1.007	1.035	1.063	1.093	1.124	1.156	1.190	1.227	1.268	1.316	1.376	1.519
0.56	0.730	0.756	0.782	0.808	0.834	0.860	0.887	0.913	0.940	0.968	0.996	1.024	1.054	1.085	1.117	1.151	1.188	1.229	1.277	1.337	1.480
0.57	0.692	0.718	0.744	0.770	0.796	0.822	0.849	0.875	0.902	0.930	0.958	0.986	1.016	1.047	1.079	1.113	1.150	1.191	1.239	1.299	1.442
0.58	0.655	0.681	0.707	0.733	0.759	0.785	0.812	0.838	0.865	0.893	0.921	0.949	0.979	1.010	1.042	1.076	1.113	1.154	1.202	1.262	1.405
0.59	0.619	0.645	0.671	0.697	0.723	0.749	0.776	0.802	0.829	0.857	0.885	0.913	0.943	0.974	1.006	1.040	1.077	1.118	1.166	1.226	1.369
0.60	0.583	0.609	0.635	0.661	0.687	0.713	0.740	0.766	0.793	0.821	0.849	0.877	0.907	0.938	0.970	1.004	1.041	1.082	1.130	1.190	1.333
0.61	0.549	0.575	0.601	0.627	0.653	0.679	0.706	0.732	0.759	0.787	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.156	1.299
0.62	0.516	0.542	0.568	0.594	0.620	0.646	0.673	0.699	0.726	0.754	0.782	0.810	0.840	0.871	0.903	0.937	0.974	1.015	1.063	1.123	1.266
0.63	0.483	0.509	0.535	0.561	0.587	0.613	0.640	0.666	0.693	0.721	0.749	0.777	0.807	0.838	0.870	0.904	0.941	0.982	1.030	1.090	1.233
0.64	0.451	0.474	0.503	0.529	0.555	0.581	0.608	0.634	0.661	0.689	0.717	0.745	0.775	0.806	0.838	0.872	0.909	0.950	0.998	1.068	1.201
0.65	0.419	0.445	0.471	0.497	0.523	0.549	0.576	0.602	0.629	0.657	0.685	0.713	0.743	0.774	0.806	0.840	0.877	0.918	0.966	1.026	1.169
0.66	0.388	0.414	0.440	0.466	0.492	0.518	0.545	0.571	0.598	0.626	0.654	0.682	0.712	0.743	0.775	0.809	0.846	0.887	0.935	0.995	1.138
0.67	0.358	0.384	0.410	0.436	0.462	0.488	0.515	0.541	0.568	0.596	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.965	1.108
0.68	0.328	0.354	0.380	0.406	0.432	0.458	0.485	0.511	0.538	0.566	0.594	0.622	0.652	0.683	0.715	0.749	0.786	0.827	0.875	0.935	1.078
0.69	0.299	0.325	0.351	0.377	0.403	0.429	0.456	0.482	0.509	0.537	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.906	1.049
0.70	0.270	0.296	0.322	0.348	0.374	0.400	0.427	0.453	0.480	0.508	0.536	0.564	0.594	0.625	0.657	0.691	0.728	0.769	0.817	0.877	1.020
0.71	0.242	0.268	0.294	0.320	0.346	0.372	0.399	0.425	0.452	0.480	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.72	0.214	0.240	0.266	0.292	0.318	0.344	0.371	0.397	0.424	0.452	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.73	0.186	0.212	0.238	0.264	0.290	0.316	0.343	0.369	0.396	0.424	0.452	0.480	0.510	0.541	0.573	0.607	0.644	0.685	0.733	0.793	0.936
0.74	0.159	0.185	0.211	0.237	0.263	0.289	0.316	0.342	0.369	0.397	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.75	0.132	0.158	0.184	0.210	0.236	0.262	0.289	0.315	0.342	0.370	0.398	0.426	0.456	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.76	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.288	0.315	0.343	0.371	0.399	0.429	0.460	0.492	0.526	0.563	0.604	0.652	0.712	0.855
0.77	0.079	0.105	0.131	0.157	0.183	0.209	0.236	0.262	0.289	0.317	0.345	0.373	0.403	0.434	0.466	0.500	0.537	0.578	0.626	0.685	0.829
0.78	0.052	0.078	0.104	0.130	0.156	0.182	0.209	0.235	0.262	0.290	0.318	0.346	0.376	0.407	0.439	0.473	0.510	0.551	0.599	0.659	0.802
0.79	0.026	0.052	0.078	0.104	0.130	0.156	0.183	0.209	0.236	0.264	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.633	0.776
0.80	0.000	0.026	0.052	0.078	0.104	0.130	0.157	0.183	0.210	0.238	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.499	0.547	0.609	0.750
0.81		0.000	0.026	0.052	0.078	0.104	0.131	0.157	0.184	0.212	0.240	0.268	0.298	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.82			0.000	0.026	0.052	0.078	0.105	0.131	0.158	0.186	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.495	0.555	0.698
0.83				0.000	0.026	0.052	0.079	0.105	0.132	0.160	0.188	0.216	0.246	0.277	0.309	0.343	0.380	0.421	0.469	0.529	0.672
0.84					0.000	0.026	0.053	0.079	0.106	0.134	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.85						0.000	0.027	0.053	0.080	0.108	0.136	0.164	0.194	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.86							0.000	0.026	0.053	0.081	0.109	0.137	0.167	0.198	0.230	0.264	0.301	0.342	0.390	0.450	0.593
0.87								0.000	0.027	0.055	0.083	0.111	0.141	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.88									0.000	0.028	0.056	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.89										0.000	0.028	0.056	0.086	0.117	0.149	0.183	0.220	0.261	0.309	0.369	0.512
0.90											0.000	0.028	0.058	0.089	0.121	0.155	0.192	0.233	0.281	0.341	0.484
0.91												0.000	0.030	0.061	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.92													0.000	0.031	0.063	0.097	0.134	0.175	0.223	0.283	0.426
0.93														0.000	0.032	0.066	0.103	0.144	0.192	0.252	0.395
0.94															0.000	0.034	0.071	0.112	0.160	0.220	0.363
0.95																0.000	0.037	0.079	0.126	0.186	0.329
0.96																	0.000	0.041	0.089	0.149	0.292
0.97																		0.000	0.048	0.108	0.251
0.98																			0.000	0.060	0.203
0.99																				0.000	0.143
																					0.000

Table 2. *KW Multipliers for Determining Kilovars*

MSME 2: 46.3 hectare Fish Farm for Shrimp and Milkfish

FINDINGS

- The facility has a monthly consumption of PhP 1.0 M
- Energy consumption is 12% of the production cost
- Overloaded Transformer
- Under capacity conductors
- Power of 0.77

BENEFITS

- Improving electrical system by setting the power factor to 0.9 has reduced electrical billing to PhP 0.75 M at a payback period of 2 months
- Has normalized the utilization of the transformer

Replacement to better system/equipment

	Before SETUP	After SETUP
Picture		
Specifications	1 hp 3 phase 220 V 60 Hz	1 hp 3 phase 220 V 60 Hz
No. of paddles	2	4
Number of units installed per pond during the last stage of shrimp growing prior to harvesting (at 8500 sq. m/pond)	20 units 	12 units 
Energy Consumed in 24 hours operation per pond	358.08 kW-hr	214.848 kW-hr
% efficiency	-	60 % more efficient
Amount	P 23,000.00/unit (VAT inclusive, 2012 price consideration)	P 27,000.00 (VAT inclusive, 2019 price consideration)

MSME 3: A Food Manufacturing company that produces baked products such as breads, pastries, pies, cookies and native delicacies

FINDINGS

- High electricity cost in the production
- Inadequate and inefficient equipment

BENEFITS/IMPACTS

- Sustainable, clean and efficient energy source with less incurring monthly cost. Pioneering and a showcase of PV technology for a bakeshop (On-Grid solar panel system, 51 KW installed capacity that can generate 306 KWHr per day on a 6 solar hours/day thus generating a monthly 9.18 MWHr , 170 solar panels in 276 sq. meter area)
- Savings on energy cost of PhP 45,900 per month
- High production volume which are consistent in quality, size, shape, weight result to more competitive products

Name of Company/ Address	Products	Energy Reduction Interventions/ measures	Impacts of energy reduction measures
Bakeshop Mandaue City, Cebu, Phils	Pastry Products like Otap, Rosquillos, Caycay, Patatas and Piaya	1. Regular cleaning of light bulbs 2. Installation of light reflectors 3. Regular cleaning of electric fans 4. Maintenance of motors 5. Replacement of inefficient LPG oven 6. Maintenance of diesel oven 7. Replacement of diesel oven w/ new more efficient design	1. Increase light luminance 2. Increase light luminance 3. Energy savings of Php 1,560.00 4. Increase motor efficiency and annual energy savings of Php 5,153.00 5. Reduce LPG consumption and annual fuel savings of Php 0.045M 6. Increase oven efficiency, reduce fuel consumption and annual fuel savings of Php 45,000.00 7. Increase production efficiency and reduce production cost
Metal Technology Cebu City, Philippines	Badges, Pins, Medals, Nameplates and Seals	1. Regular cleaning of light bulbs 2. Re-lamping of T12 lamps to T5 lamps 3. Regular cleaning of electric fans 4. Improvements of wooden oven 5. Replacement of LPG-fired furnaces 6. Cleaning of LPG-fired stoves	1. Increase light luminance 2. Annual energy savings of Php 4,608.00 3. Increase air flow and annual energy savings of Php 936.00 4. Increase efficiency and annual energy savings of Php 7,440.00 5. Increase efficiency and annual fuel saving of Php 433,224.00 6. Increase heating efficiency and reduced fuel consumption

Name of Company/ Address	Products	Energy Reduction Interventions/ measures	Impacts of energy reduction measures
Food Product Talamban, Cebu City, Phils.	Smoked Longaniza and Pork Siomai	1. Regular cleaning of light bulbs 2. Installation of light reflectors 3. Re-lamping of T12 lamps to T5 lamps 4. Regular cleaning of electric fans 5. Improvement of smokehouse 6. Using of smoke flavor instead of actual smoking	1. Increase light luminance 2. Increase light luminance 3. Annual energy saving of Php 1,152.00 4. Increase airflow and annual energy savings of Php 963.003 5. Increase efficiency of the smokehouse and annual energy saving of Php 59,400.00 6. Elimination of using charcoal thus reducing energy cost up to Php 198,000.00 annually. Reducing production process time and reducing company's carbon footprint.
Meat Food Product Tisa, Cebu City	Pork Chicharon	1. Cooking stove waste heat management 2. Proper cleaning and maintenance of exhaust fan 3. Improvement of light luminance in the packaging area 4. Replacement of inefficient light bulbs 5. Elevating the tarpaulin covering on the motor	1. Reduce consumption of LPG that lead to savings of Php 20,580.00 annually and improve cooking efficiency 2. Increase efficiency of exhaust fan and annual energy savings of Php 253.50 3. Adhere to DOLE standard in workplace safety 4. Improve light luminosity and annual energy savings of Php 1,014.00 5. Improve airflow which also improve the motor 's economic life.

4. Technology Development

DOST 7 HYBRID DRYER ver 2.0

A Disaster Resilient Equipment

FEATURES:

• Application of combined heat sources using solar heated water and indirect fired LPG auxiliary heater or electrical as a heating medium of the dryer.

• Powered by 1000W Solar PV system packed with 4 pcs. 100AH, 12V deep cycle lead acid batteries to supply the air circulating system and hot water pumping system. (Installation: preferably at the rooftop)

• Provided with 4 units 10” diameter fans, 80W responsible for air movement inside the drying chamber and a 300 GPM, 50W hot water circulating pump.

• Recycling of exhaust air or a portion thereof back into the process with proper control.

• Dryer casing is generally made out of 2” thick insulated panels, gauge 18 G.I. sheets for outer and inner walls coated with food contact paint and 2” high density Styrofoam insulation.

• Can accommodate 10 pcs. 80cm x 80cm drying trays. Stainless steel frames with S/S surface netting.

• Provided with manual control damper for humidity and air mixing.

• Equipped with thermostatic controller and temperature gauges.

• Can be easily transported due to its knockdown design.

SPECIFICATIONS:

• Can hold up to 30kg wet load (fish)

• Operating temperature range: 40°C to 70°C.

• Cabinet dimensions: L = 1.8m, W = 1.0m, H = 1.2m.

• Heating medium: Hot water and LPG or electric heater

• Solar water heater type: Vacuum tube

• Heat exchanger: copper coils with aluminum fins for hot water, S/S heat exchanger for gas (LPG) or electirc heater

• High heat 300GPM hot water pump

DOST 7 HYBRID DRYER ver 1.0

(A Disaster Resilient Equipment)

FEATURES:

- Application of combined heat sources using solar heater and furnace type boiler to produce hot water as a heating medium of the dryer.
- Powered by 500W Solar PV setup packed with 2 pcs. 70AH, 12V deep cycle lead acid batteries to supply the air circulating system and hot water pump.
- Provided with 2 units 10” diameter fans, 80W responsible for air movement inside the drying chamber and a 300 GPM, 50W hot water circulating pump. All powered by 12VDC battery.
- Recycling of exhaust air or a portion thereof back into the process with proper control.
- Dryer casing is made of 2” thick insulated panels, ga. 18 G.I. sheets for outer and inner walls coated with food contact paint and 2” high density Styrofoam insulation.
- Can accommodate 10 pcs. 60cm x 80cm drying trays. Stainless steel frames for trays with S/S screen surface netting.
- Provided with manual control damper for humidity and air mixing.
- Can be easily transported due to its knockdown design.

SPECIFICATIONS:

- Can hold up to 20kg wet load (fish)
- Operating temperature range : 40 deg C to 70 deg C.
- Cabinet dimensions: L=6 ft., W=4 ft, H=4 ft.
- Heating medium: Hot water
- Heat exchanger: copper coils with aluminum fins

Department of Science and Technology Region VII, Cebu City, Philippines

5. Issues and Concerns

- Implementing rules and regulations of RA No. 11285 (Energy Efficiency and Conservation Act) has identified designated and other establishments
    - Type 1 designated establishment with annual energy consumption of 500,000 kWh to 4,000,000 kWh
    - Type 2 designated establishment with annual energy consumption of more than 4,000,000 kWh
    - Other Establishments with annual energy consumption of at least 100,000 kWh but less than 500,000 kWh
- No clear cut incentives to MSMEs undertaking energy efficiency program (Fiscal and Non Fiscal Incentives)
- Problem on procurement of expertise and equipment
- High cost in technology development
- Availability of technology components

THANK YOU