

Quality



Simple. Straightforward. Successful.

Circles

Team Kinetics

Fiji Electricity Authority

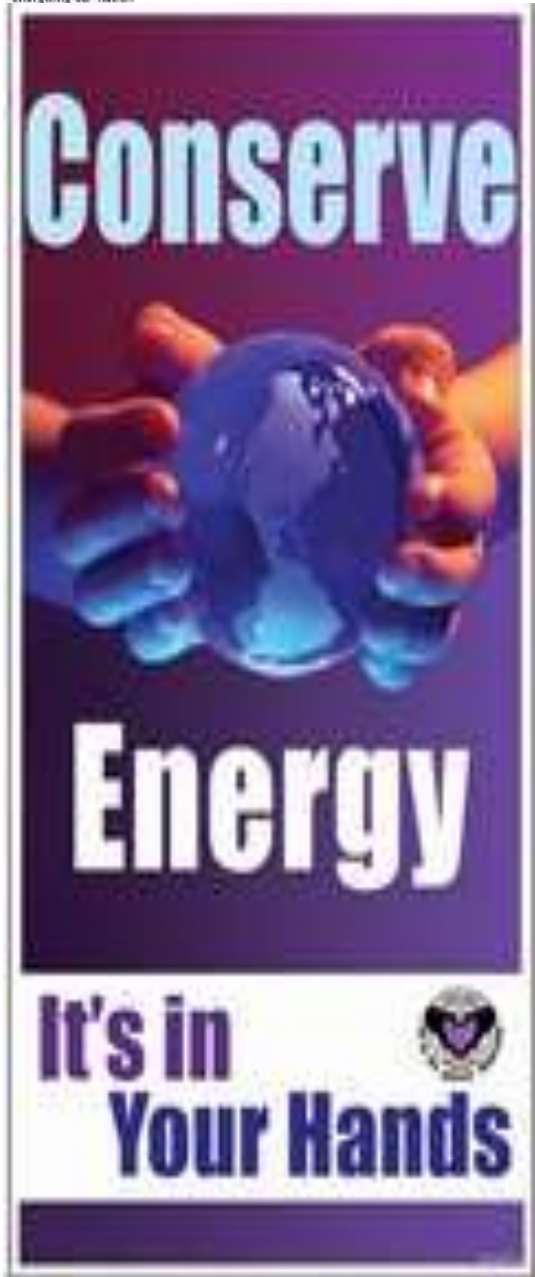
improvement today for a better tomorrow

NTPC's 18th National Convention on Quality 2013

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TEAM KINETICS 2013

INTRODUCTION

- Fiji is experiencing an accelerated economic growth with an annual **energy demand of 10%**
- Current fuel cost to Fiji **\$1.5b** and Fea's fuel bill amounts to **\$180m/y**
- It is clear that a low energy path is the best way towards a sustainable future
- The provision of regular energy supply is critical to the functioning of an economy, however, it is equally important that **we save on energy, money, and more importantly saving the environment.**



Project Theme

Energy Conservation Project aligned to Fea mission & vision

- Energizing the Nation
- 90% energy requirement through renewable resources by 2015



Target Achievement:

"To achieve 10% operational reduction in energy consumption in Kinoya Depot during the year 2013"

Team Kinetics



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QC Facilitator

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INNOVATION THROUGH MOTION

PROBLEM SELECTION TOOLS

Brainstorming

Problem ranking

Cause & Effect Diagram (Fishbone)

Pareto analysis

Decision matrix

PDCA / ADRI

Brain Storming



WHEN
**TIME &
QUALITY**
ARE YOUR
PRIORITY

**Energy
Conservation**

Problem Log



Housekeeping issues



Delay in scrap removal process



Fire risk from combustible materials



Switch gears leaking oil



Waste management



High Energy consumption in the depot



Fire hydrants leaking water

Problem Selection: Decision Matrix

Criteria/ project type	Ease of implementation 1 – 10 (25%)	Skills available to maintain solution 1 – 10 (25%)	Efficiency & Effectiveness of solution 1 – 10 (25%)	Practicality & viability of outcome / benefits 1 – 10 (25%)	Total (100%)
Housekeeping issues	4	5	3	3	15
Delay in scrap removal	5	6	4	5	20
Fire risk of combustible materials in Dep	6	5	5	4	20
Switchgears leaking oil	5	4	6	3	18
Leaking fire hydrants	6	4	5	6	21
High energy consumption	6	7	5	6	24
Waste Management	5	6	6	5	22

Problem Ranking

Criteria/ project type	Total points 100%	Ranking Order
High Energy consumption	24	1
Waste Management	22	2
Leaking Fire Hydrants	21	3
Delay in scrap removal	20	4
Fire risk of combustible materials in Dep	20	5
Leaking Switch gears	18	6
Poor House keeping	15	7

Problem Statement

High energy consumption at Kinoya Operations

Kinoya Distribution complex



Kinoya ICT complex



Kinoya stores complex



[illegible]

Fishbone Diagram

Material

Method

Lack of records

Lack auxiliary meters

Poor design

Old meters

Poor reading

No metering

High watt lamps

Untimely monitoring

Scattered installations

Non-commitment

Poor lighting

Lack of training

No management directive

Lack environmental awareness

Charges - FOC

Man

Environment

HIGH ENERGY CONSUMPTION

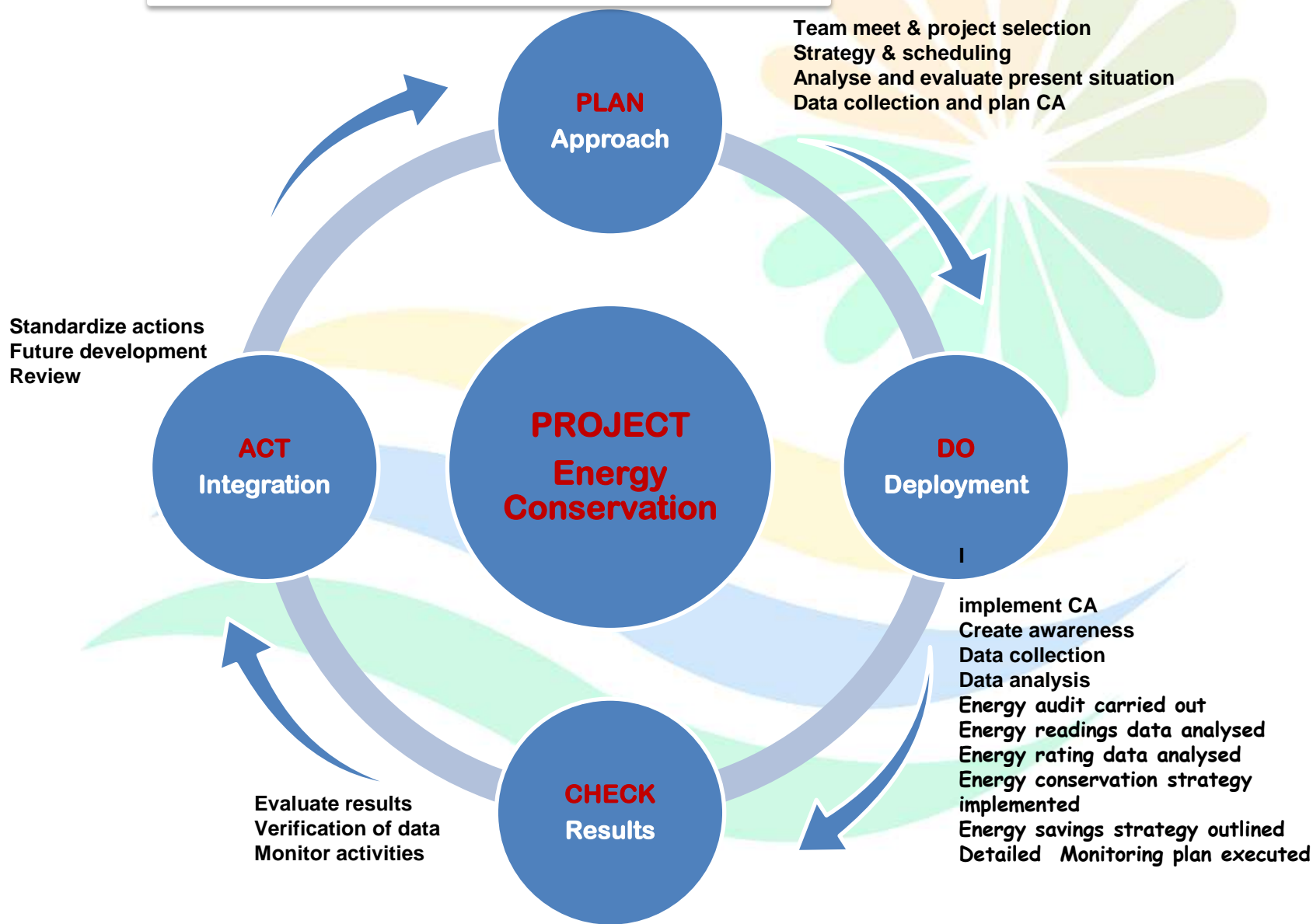
Causes

Effects

Fishbone Analysis

Items	Category	Impact rating	Significance
Lack of aux meters	Operational	medium	medium
Scattered installations	Operational	low	medium
No Mgt directive	Management	medium	low
Lack of awareness	Training	medium	low
Untimely monitoring	Process	medium	medium
Old meters	Technical	low	low
Lack of records	Process	medium	medium
Poor design	System	high	high
High watt lamps	Technical	high	high
Poor lighting	Operational	high	medium
Non-commitment	Management	medium	medium
Charges-FOC	Management	medium	low
Untimely reading	Process	low	medium
Lack of training	Training	medium	medium
Lack of resources	Management	low	low

PDCA / ADRI

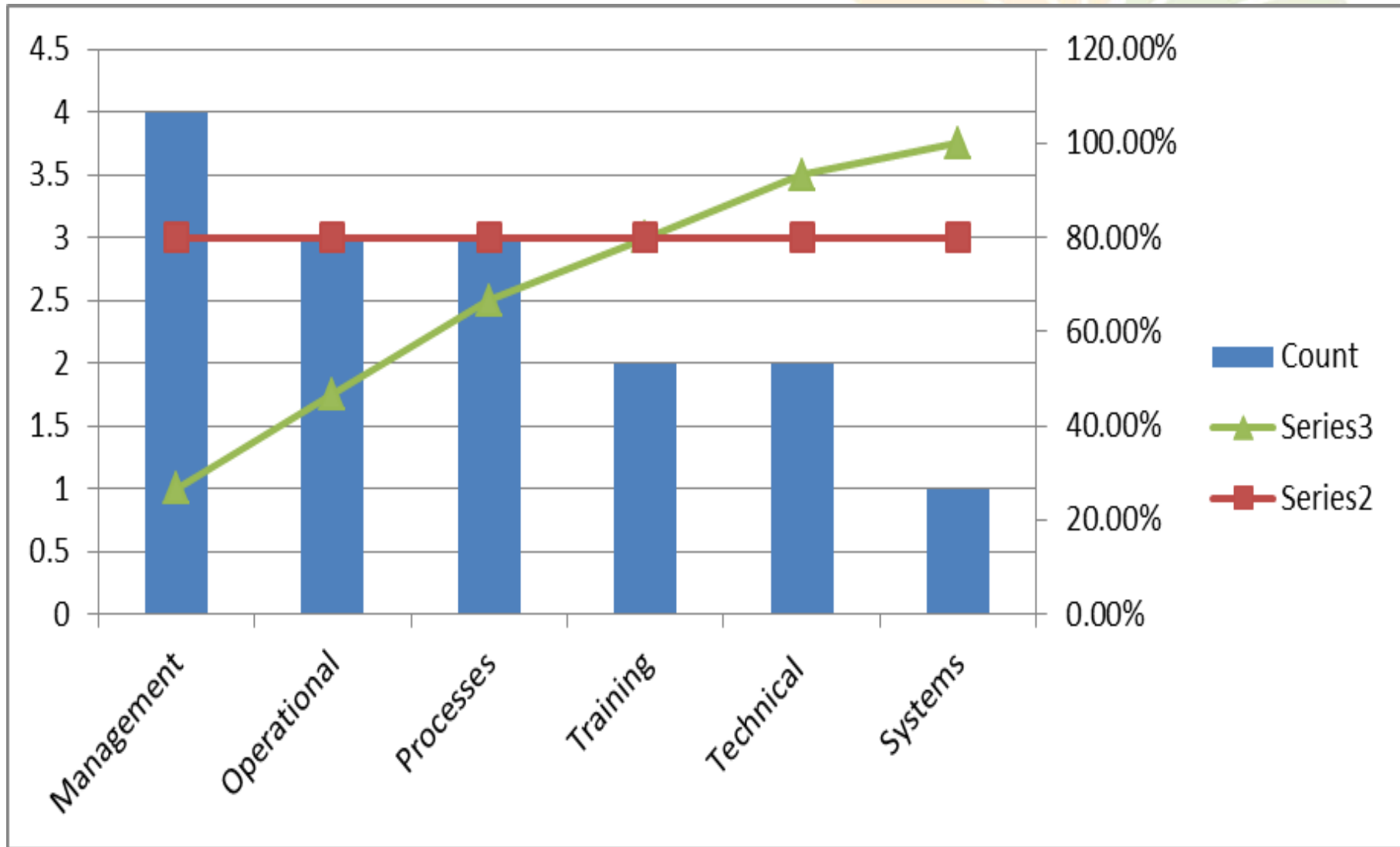


Pareto Analysis

Item Category	Count	Cumulative	Count %	Cumm %
Management	4	4	26.7%	26.7%
Operational	3	7	20%	46.7%
Processes	3	10	20%	66.7%
Training	2	12	13.3%	80%
Technical	2	14	13.3%	93.3%
Systems	1	15	6.7%	100%
Total	15	15	100%	100%

Pareto Analysis

Vital few (significant) and trivial many (insignificant)



Proposed Solutions

- **Management**

- Energy conservation strategies
- Policy development
- Design & planning

- **Operations**

- Install Auxiliary meters
- Install invertors to Air conditioners
- Install skylight roof for better lighting
- Convert to individual switch for high bay lights
- Use individual lamps
- Use energy saver lamps

- **Processes**

- Timely reading
- Adequate monitoring
- Maintain proper records

- **Training**

- Training on Energy conservation
- Awareness to all staff
- Monthly alerts

Solution Matrix

Criteria / Project OFI	Ease of implementation 1-5 (25%)	Skills available / technology 1-5 (25%)	Ability to obtain data 1-5 (25%)	Practicality of outcome/ benefits 1-5 (25%)	Total (100%)
Operations					
Install meters, invertors, skylight	3	5	5	4	17 (85%)
Management					
Policy Development and design	3	3	4	3	13 (65%)
Process					
Timely reading, monitoring & recording	2	3	4	3	12 (60%)
Training					
In-house training and awareness	2	3	3	3	11 (55%)

Energy Audit - Distribution

ENERGY AUDIT - ELECTRICAL EQUIPMENT &

FITTINGS

	Fittings	Quantity	Ratings	Kwh	Cost/ Day	CPM	CPY
1	4ft Tubelights	93	72 watts	80Kwh	\$31.20	\$624	\$7488
2	Downlights	18	26 watts	3.75Kwh	\$1.46	\$29.2	\$350.4
3	workshop lights	24	250 watts	48 Kwh	\$18.72	\$374.4	\$4492.8
4	Security lights	6	125 watts	9 Kwh	\$3.51	\$70.2	\$842.4
	Total	141			\$54.89	\$1097.8	\$13173.6

	Equipment's	Quantity	Ratings				
5	Computers	26	1.08KW	674Kwh	\$262.86	\$5257.2	\$63086.4
6	Laptops	6	0.98 KW	47 Kwh	\$7.15	143	1716
7	Printers	2	0.75KW	36Kwh	\$14.04	280.8	3369.6
8	Heater	2	4.32KW	207Kwh	\$80.73	1614.6	19375.2
9	Elements(heat tent)	10	500W	88Kwh	\$34.32	686.4	8236.8
10	Air conditioner	25	1.8KW	360Kwh	\$143.91	2878.2	34538.4
11	Test bench	1	5.98KW	23.5Kwh	\$9.16	183.2	2198.4
	Total	72			\$532.67	\$10653.4	\$127840.8

Energy Audit Stores

Fittings	Quantity	Ratings	Kwh	Cost/ Day	CPM	CPY
4ft Tubelights	14	72 watts	8kwh	\$3.12	\$62.40	\$748.8
High bay lights	20	400 watts	64kwh	\$24.96	\$499.20	\$5990.4
Security lights	6	125 watts	9kwh	\$3.50	\$70.20	\$842.40
Total	40	597w	83kwh	\$31.52	\$631.80	\$7581.6
Equipment's	Quantity	Ratings				
Computers	3	1.08KW	77.76kwh	\$30.34	\$910.26	\$10923.12
Electric Urn	1	2.0kw	48kwh	\$18.72	\$561.60	\$6739.20
Printers	1	0.75KW	18kwh	\$7.02	\$210.60	\$2527.20
Electronic Scale	1	500w	12kwh	\$4.68	\$112.32	\$1347.84
Air conditioner	3	1.8KW	43.2kwh	\$16.85	\$336.96	\$4043.52
Total	11	198.9kw	198.96kwh	\$77.61	\$3131.74	\$25580.88

Energy Audit ICT

Fittings	Quantity	Ratings	Kwh	Cost/ Day	CPM	CPY
4ft Tubelights	12	72 watts	6.9kwh	\$2.70	\$53.82	\$645.84
High bay lights						
Security lights	4	125 watts	6kwh	\$2.34	\$46.80	\$561.60
Total	16	197w	12.9kwh	\$5.04	\$100.62	\$1207.44
Equipment's	Quantity	Ratings				
Computers	6	1.08KW	77.76kwh	\$30.34	\$910.26	\$10923.12
Electric Urn	1	2.0kw	48kwh	\$18.72	\$561.60	\$6739.20
Printers	1	0.75KW	18kwh	\$7.02	\$210.60	\$2527.20
Server units	1	3.6kw	86.4kwh	\$33.69	\$1010.88	\$12130.56
Air conditioner	6	1.8KW	129.6kwh	\$50.54	\$1263.40	\$15163.20
Total	15	9.23kw	359.76kwh	\$140.31	\$3956.74	\$47483.28

Solution Implementation

- **Kinoya Stores**

- Installed skylight roof
- Cost of installation \$3150
- 18 high bay lights (250w) switched off during the day
- Separation of switches

- **Kinoya Distribution Building**

- 24 down lights (high bay) (250w)
- Installed Auxiliary meter (\$250)
- Separation of switches by workshop electricians
- Use of mobile stand lamp during transformer maintenance
- cost of implementation \$2450

- **Kinoya ICT workshop**

- Use energy saver tubes instead of flood lamps
- Switch off lights/ AC / computers when workshop not occupied
- Cost of implementation \$250

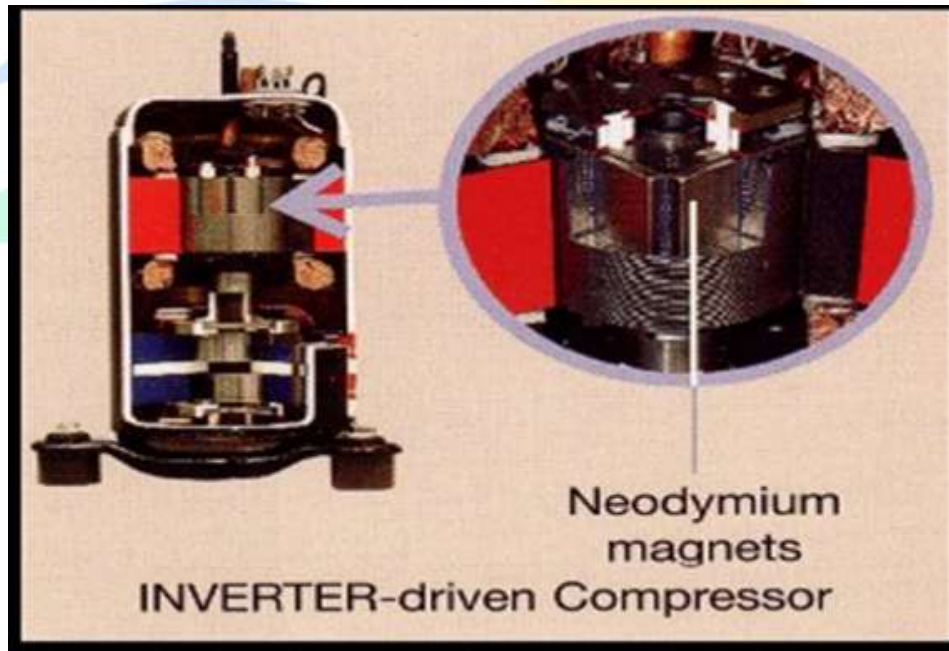
Solution Implementation

- **Air-conditioning Units fitted with invertors to reduce energy consumption**
- 25/40 (62.5%) of the A/C units were fitted with a/c invertors

Inverter technology uses a variable speed compressor motor that provides more precise room temperature without the temperature fluctuations of fixed speed systems.

- ☐ Inverter units are Approximately 30% more efficient than fixed speed units.
- ☐ Inverter units reach the set room temperature quicker.

Impressively low operating cost is a key advantage of inverter air conditioners.



AC Inverters



Penrith Air Supply



Inverter Temperature Comparison

INVERTER

TEMPERATURE

Set Point

Reach set point faster

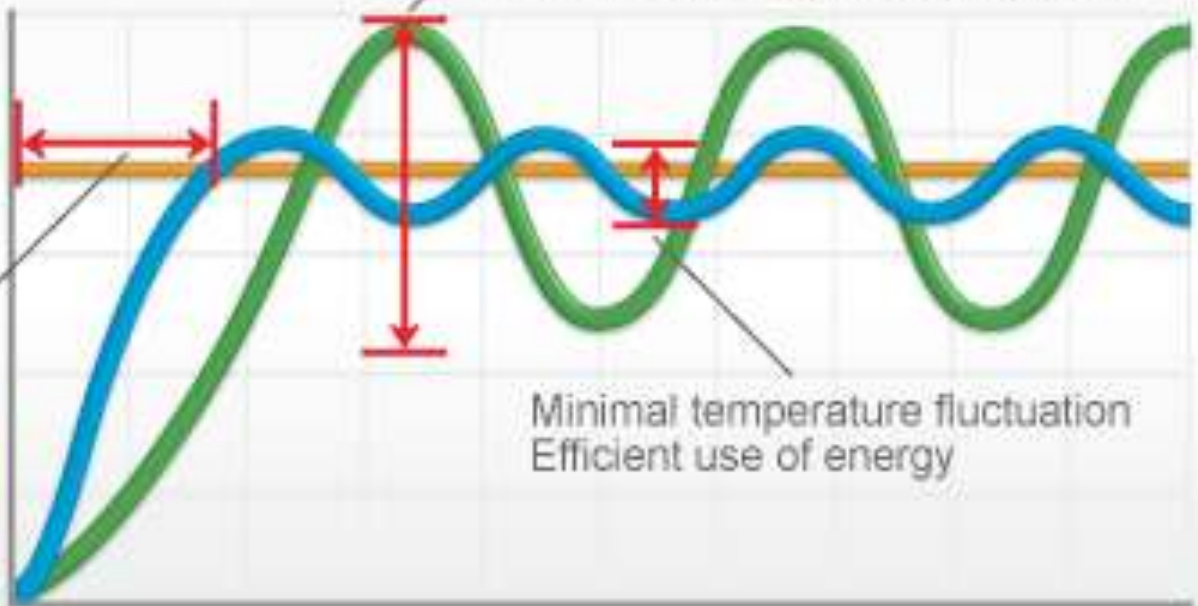
Inverter AC

Non-Inverter AC

Over cooling: Poor temperature control & inefficient use of energy

Minimal temperature fluctuation
Efficient use of energy

TIME



Innovation



Following decision to switch off high bay lights during the day. Technicians designed a stand lamp on wheels that can be taken anywhere within the workshop.

Excellent idea: materials used from scrap lying around the workshop
Cost : \$100



Corrective Action

Action Item	Action by	Requirement	Comments
Switch off High bay lights in stores	Store supervisor	Utilise skylight to maximum benefit	actioned
Switch off high bay lights in workshop	Workshop supervisor	Utilise mobile flood lamp	actioned
Switch off A/C units after work everyday	Team leaders & supervisors	Off the units when not in use	Actioned
Switch off computers when not in use	All staffs	Fully utilise battery on laptops prior to powering on	Actioned
Awareness for all staffs in Kinoya	QC committee	Generate understanding of the importance of conserving energy	actioned
Go green project	QC committee	Plant trees along the Depot for shade and aesthetic looks	actioned
Install new auxiliary meter for Kinoya distribution building	ULDC / Meter technicians	Building to be metered and consumption measured and monitored	Actioned
High bay light switches to be separated in the workshop	ULDC / workshop supervisor	Separate switches to enable effective utilization of lights in the building	Actioned
Tube lights to be converted to energy saver and switch to be separated in Office area	ULDC / electrician	Separate switch to enable effective utilization of lights during bright days	Pending

CA Management review



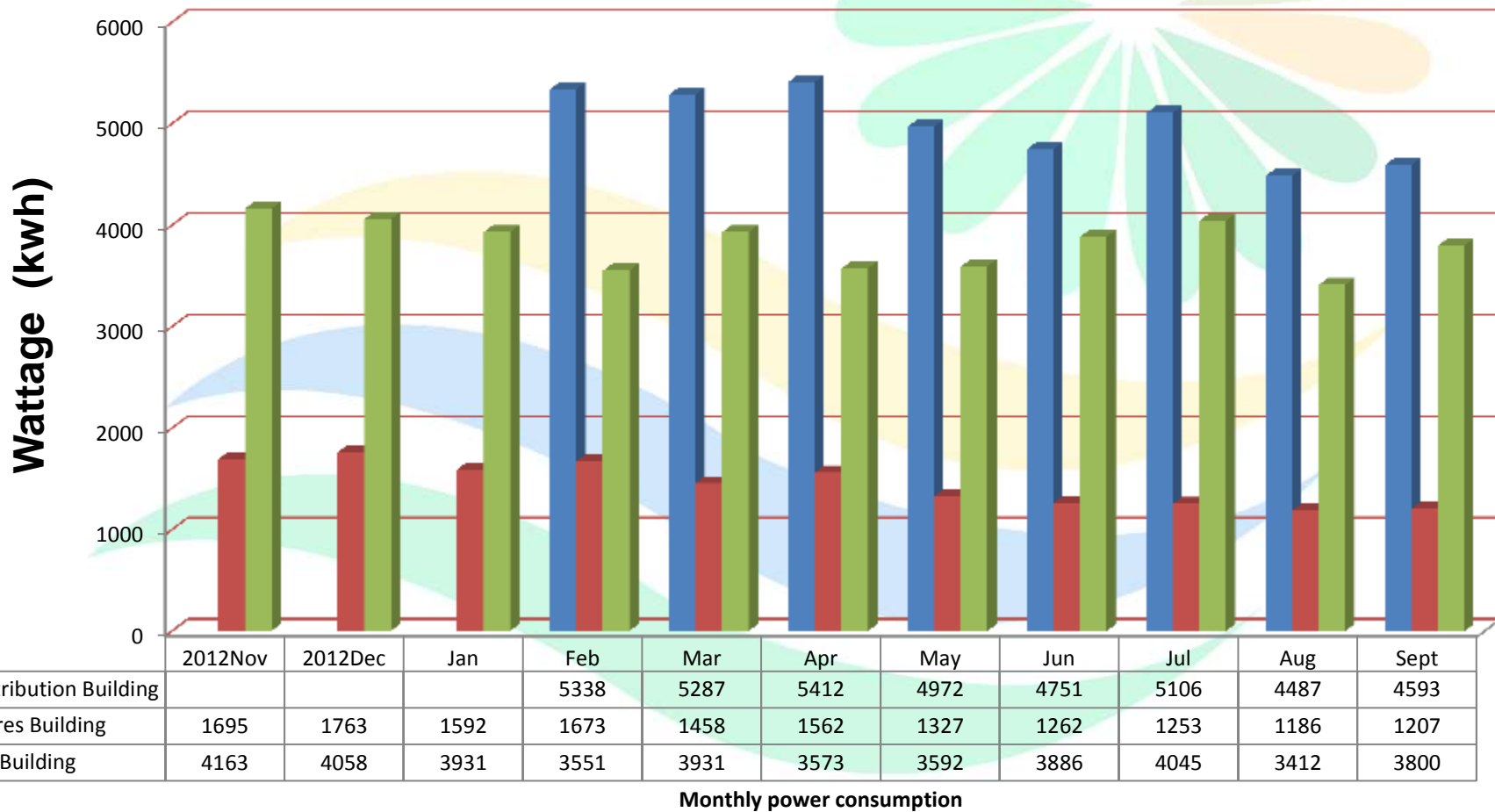
24 high bay lights switched off in transformer workshop while utilising natural light

20 high bay lights switched off and utilization of natural light within the store premises . Use of skylight roof strictly adhered to



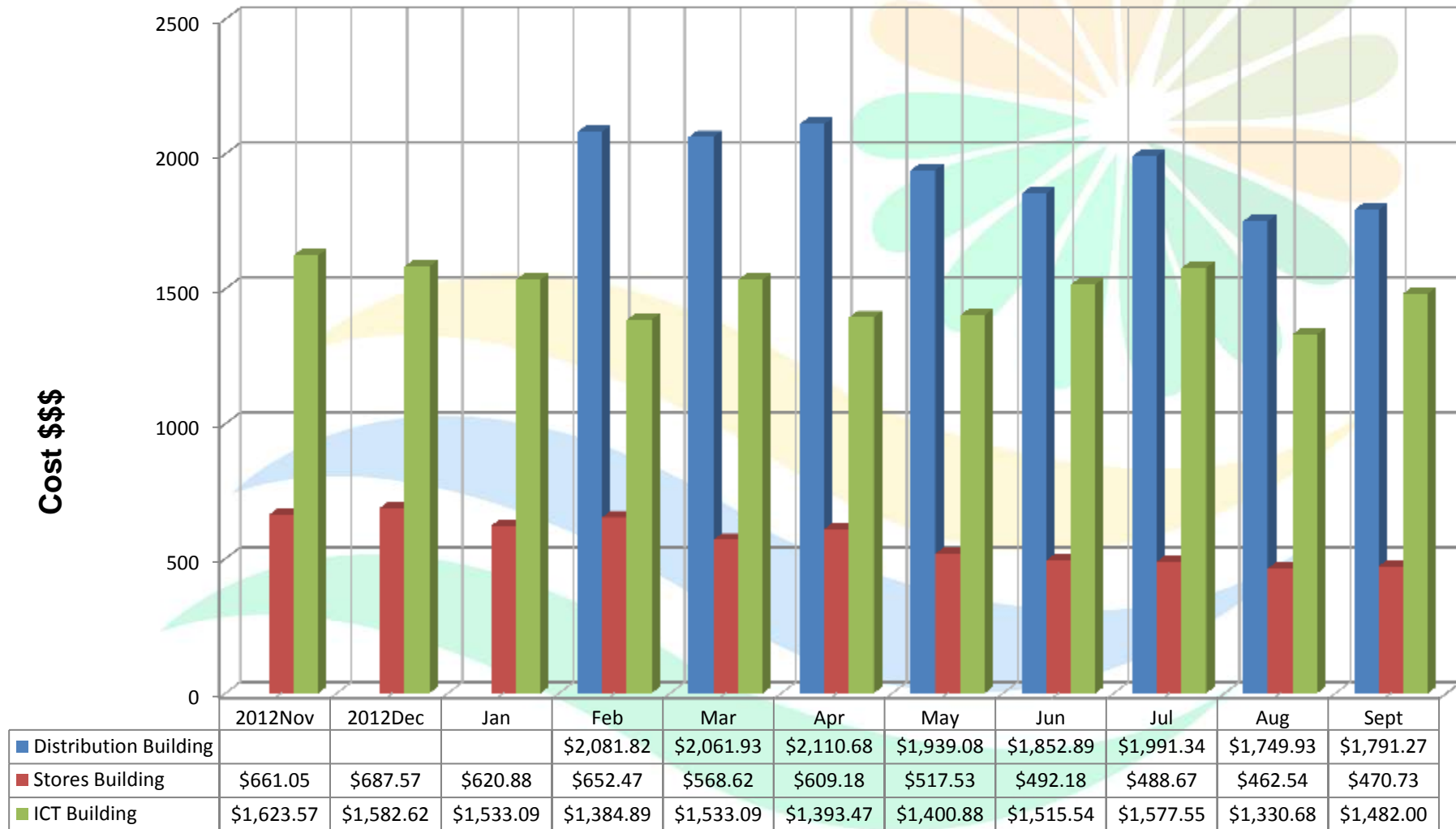
Results

Energy consumption Kinoya Depot 2013 KWH



Results

Cost of energy consumption Kinoya Depot in \$\$\$ per month



Monthly costs \$\$\$

Results

Location	KWH	Before Average	KWH	After Average	Diff	% Reductn	Overall
Distribution	10,625	5,312.5	29,321	4,886.8	425.7	8.0	
Stores	8,181	1,632.2	7,797	1,299.5	332.7	20.3	
ICT	19,634	3,926.8	22,308	3,718	208.8	5.3	
Total	38,440		32,426		6,014	33.6/3	11.2%

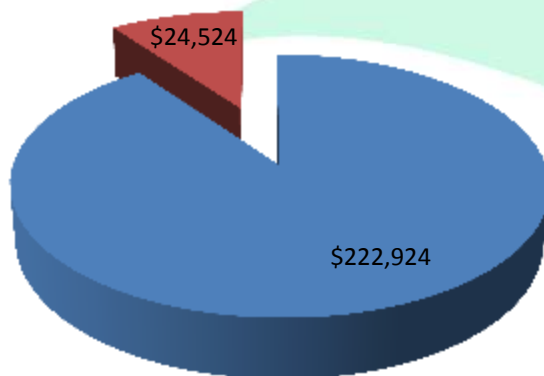
Results

Evaluated cost for Kinoya depot per year

Distribution building	-	\$141,017.10
Stores	-	\$33,162.48
ICT	-	\$48,690.48
TOTAL	-	\$222,924.48

11% energy reduction - **\$24,524.97**

Energy Saving



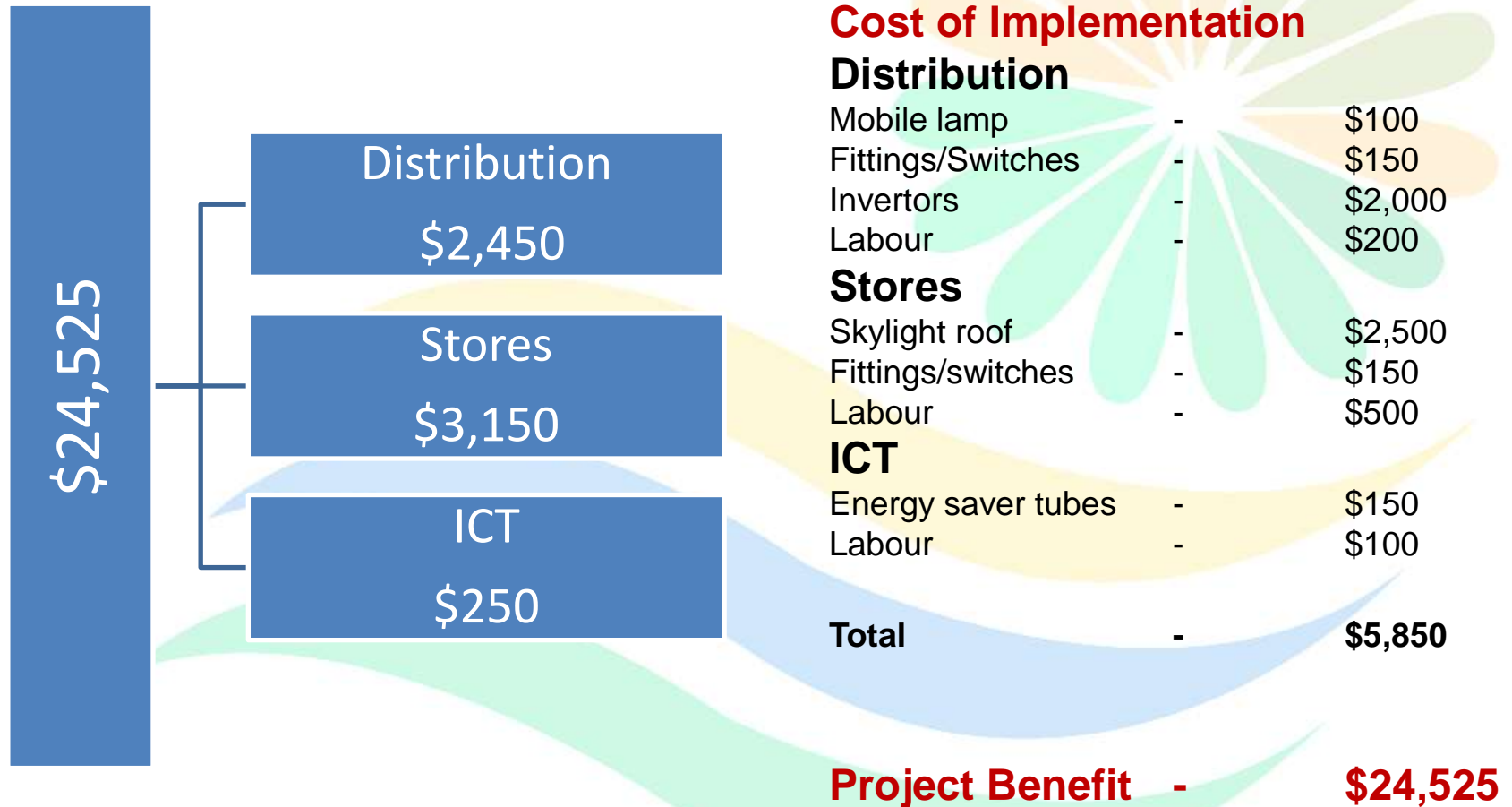
■ Energy consumption ■ 11% Saving

Kinoya energy consumption



■ Distribution ■ Stores ■ ICT

Cost Benefit Analysis



Tangible Benefits

- Total energy savings of 11%
- Translates to \$24,524.97
- Switches separated in workshop to reduce costs (24)
- Skylight roof reduced the need to put on the lights (8)
- Aircon inverters reduce 30% energy consumption(25)



Intangible Benefits

- Building a greater network of Teams
- Creative and innovative thinking
- Greater passion and motivation for team work
- Be more energy efficient



Standardization

- **Application – entire organisation**
- **All auxiliary units to be metered**
- **Management Policy on energy conservation**
- **AC inverters**
- **Awareness**



BETTER TOMORROW
SUCCESSFUL BUSINESS

Go Green Project



2012



2013

Kinoya tree planting



Team members planting trees around Kinoya store building

Organisational Alignment

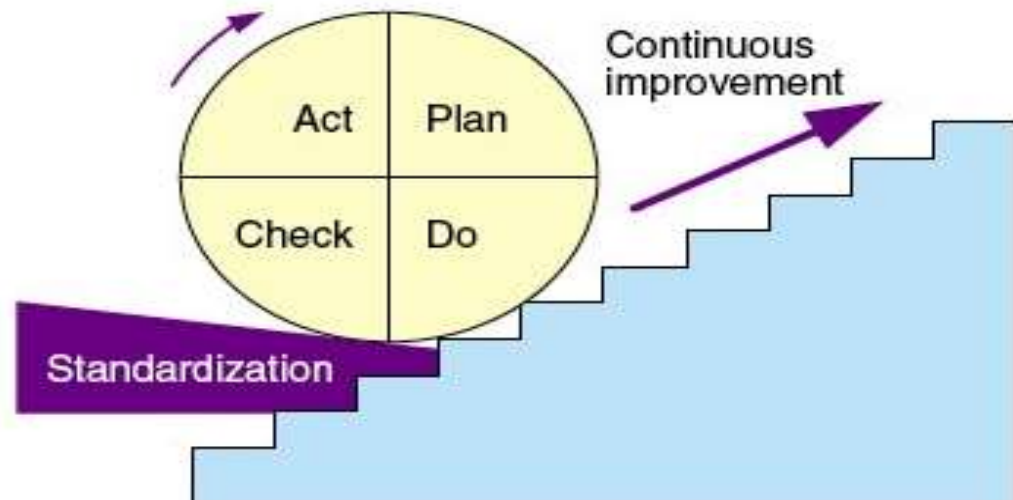
Project sustainability

- we choose to challenge ourselves in everyway to improve quality and assist the organisation save on the enormous diesel costs – 2004 - \$400m / 2008 - \$1.2b / 2013 - \$1.5b
- *We remain committed to our vision, mission to achieve 90% renewable by 2015*



UN Sustainable Energy for All

UN Secretary-General Ban Ki-moon made sustainable energy one of his five priorities that will guide his second 5-year term. Specifically, he will direct the United Nations to extend energy's reach in order to achieve sustainable development



Celebrating Success

Met our objective target 10% reduction in Energy consumption at Kinoya operations.

Take home message

Celebrate success



Team Kinoya



Next Project

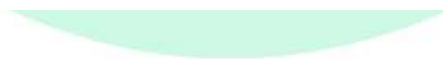
Continue this project in Kinoya and benchmark this to all other installations within the organisation.

WASTE MANAGEMENT

The Waste Management logo is enclosed in a white rounded rectangle with a green border. It features the letters 'WM' in a large, bold, sans-serif font. The 'W' is dark green and the 'M' is yellow. Below 'WM' is the text 'WASTE MANAGEMENT' in a smaller, bold, dark green, sans-serif font. At the bottom is the slogan 'Think Green.' in a bold, dark green, sans-serif font, followed by a registered trademark symbol (®).

WM[®]
WASTE MANAGEMENT
Think Green.[®]

Thank
You





Close

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