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TA for piloting rapid uptake of Industrial EE and Efficient Water utilization in the Industrial sectors

Project Overview and Audit Finding

Strictly Private and Confidential

November 2018

Agenda

Page

Background & about project

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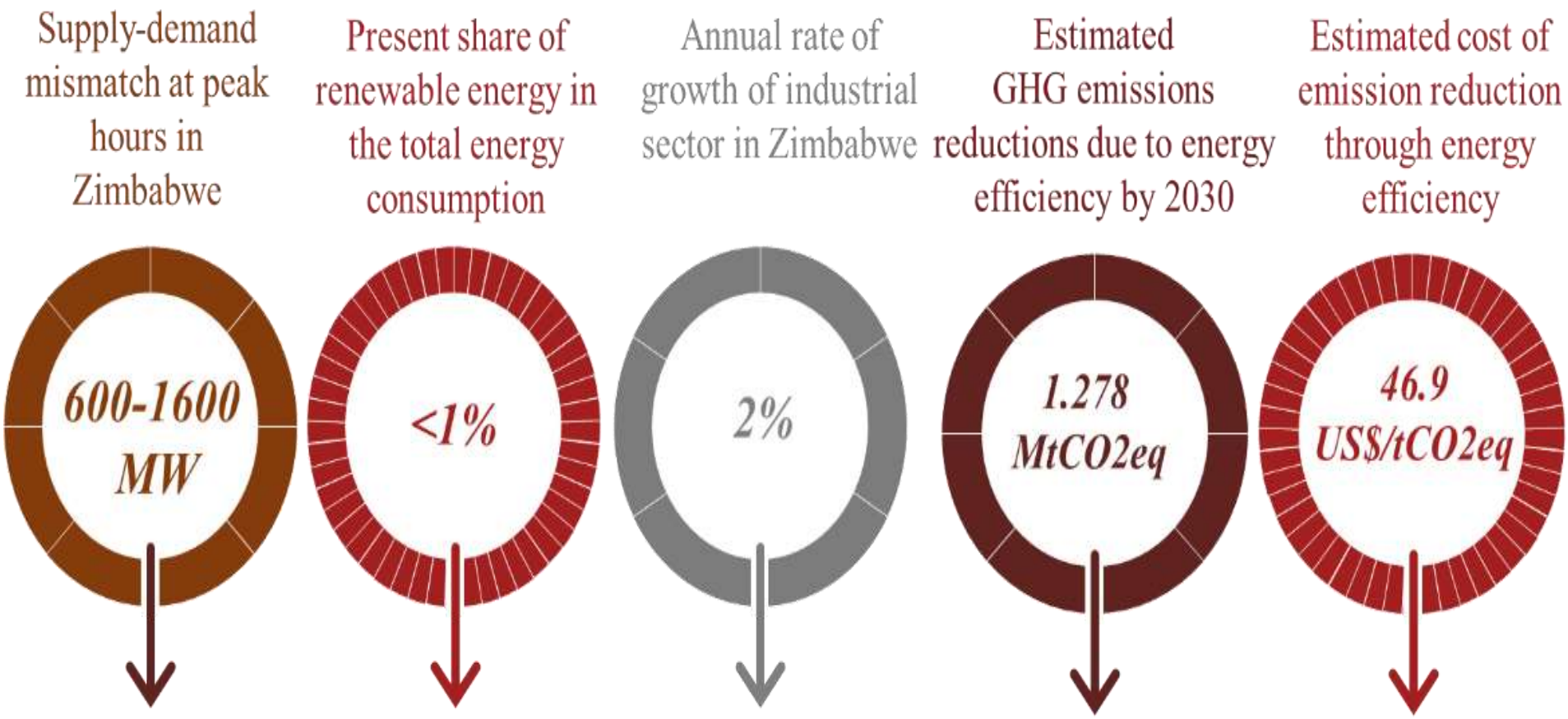
Background

- In Zimbabwe, energy providers and water supply infrastructure struggle to meet the country's increasing demand for energy and water
- **Most plants were designed and built at a time when energy and water efficiency were not points of concern** and therefore also **lack metering (both at process and plant level) for electricity, steam or water**

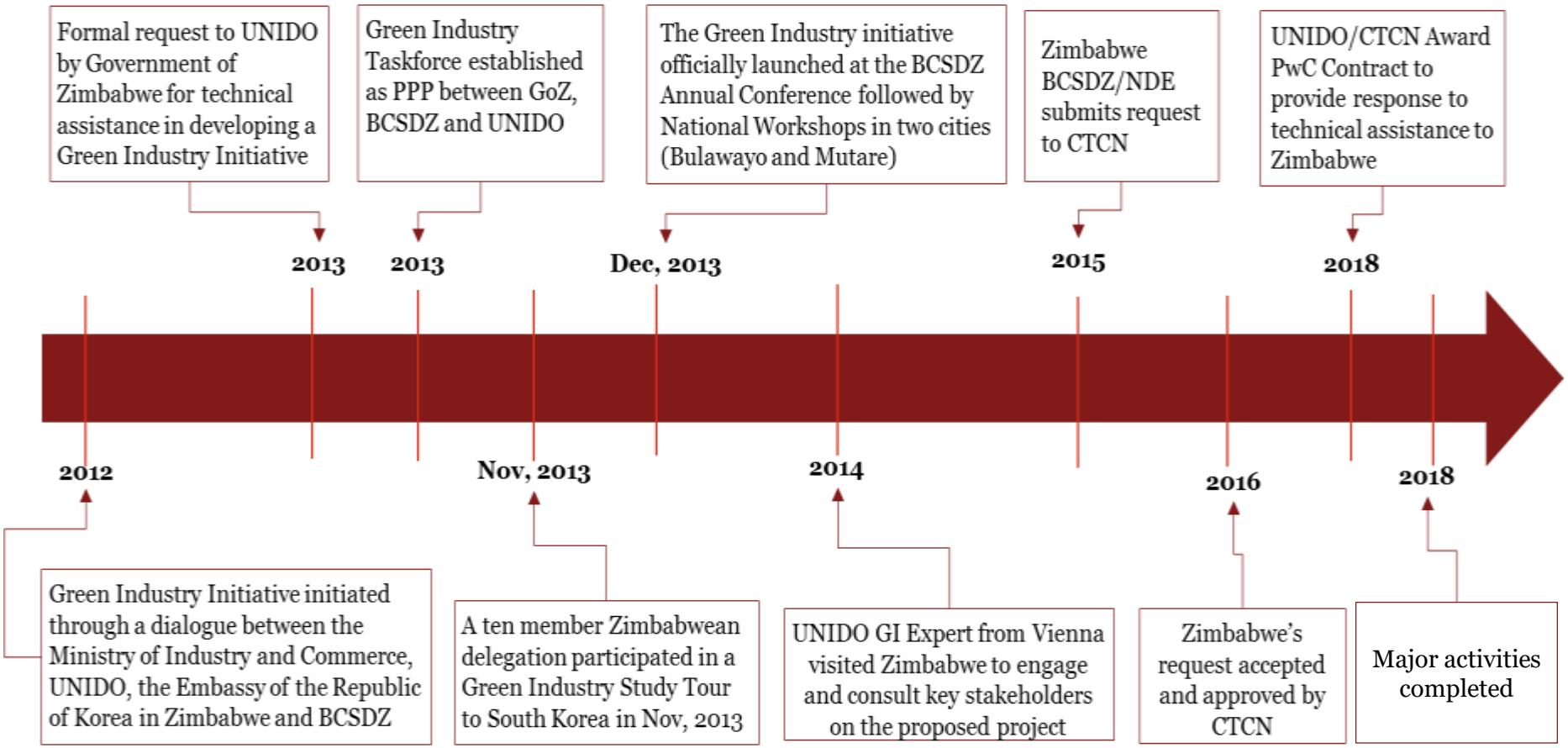
Lack of investment in new energy and water efficient technologies	**Lack of awareness in key decision makers**	**Lack of economic incentives, such as appropriate tariff structures, and therefore of commitment by top management**
Limited access to climate change mitigation/ adaptation technologies	**Limited availability of capacities and skills**	**Lack of compliance with energy and water management systems in industry**

- TA includes conducting energy and water efficiency audits in ten (10) pilot companies, guidance on the implementation of ISO 50001 Energy Management System and awareness raising of the benefits of such measures for a sustainable business

Key indicators – Energy Sector



Genesis of the Technical Assistance



Climate Technology Centre & Network (CTCN)

"Connecting Countries to Climate Technology Solutions"

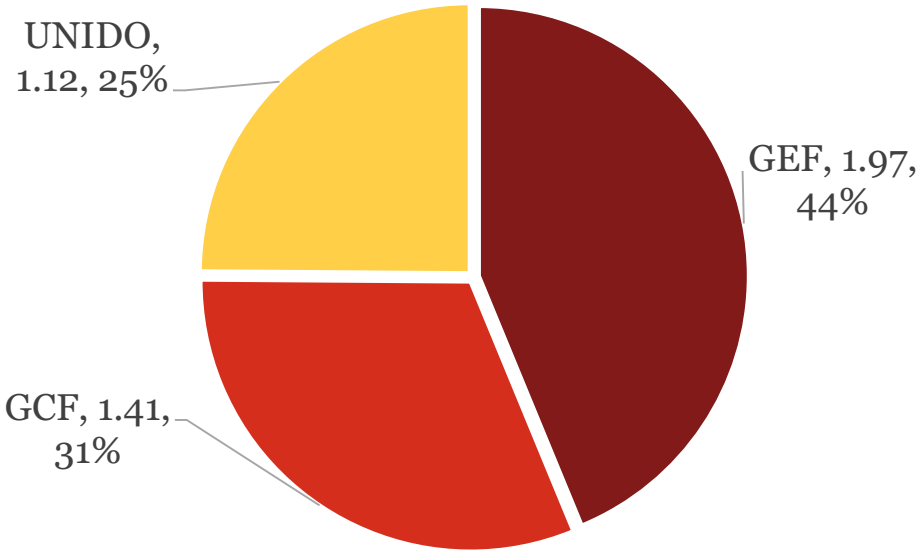
What does CTCN do ?

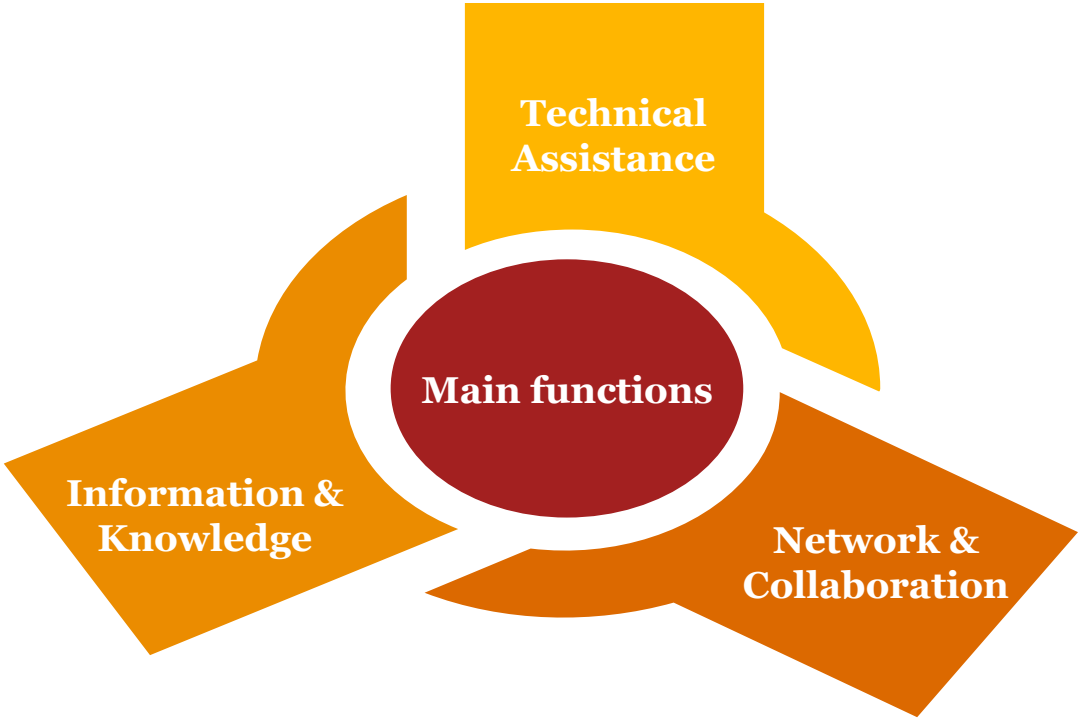
Promotes accelerated, diversified and scaled-up transfer of environmentally sound technologies for climate change mitigation and adaptation, in developing countries, in line with their sustainable development priorities.

Mission

"To stimulate technology cooperation and enhance the development and transfer of technologies to developing country parties at their request"

Donation amount (in Million US$)



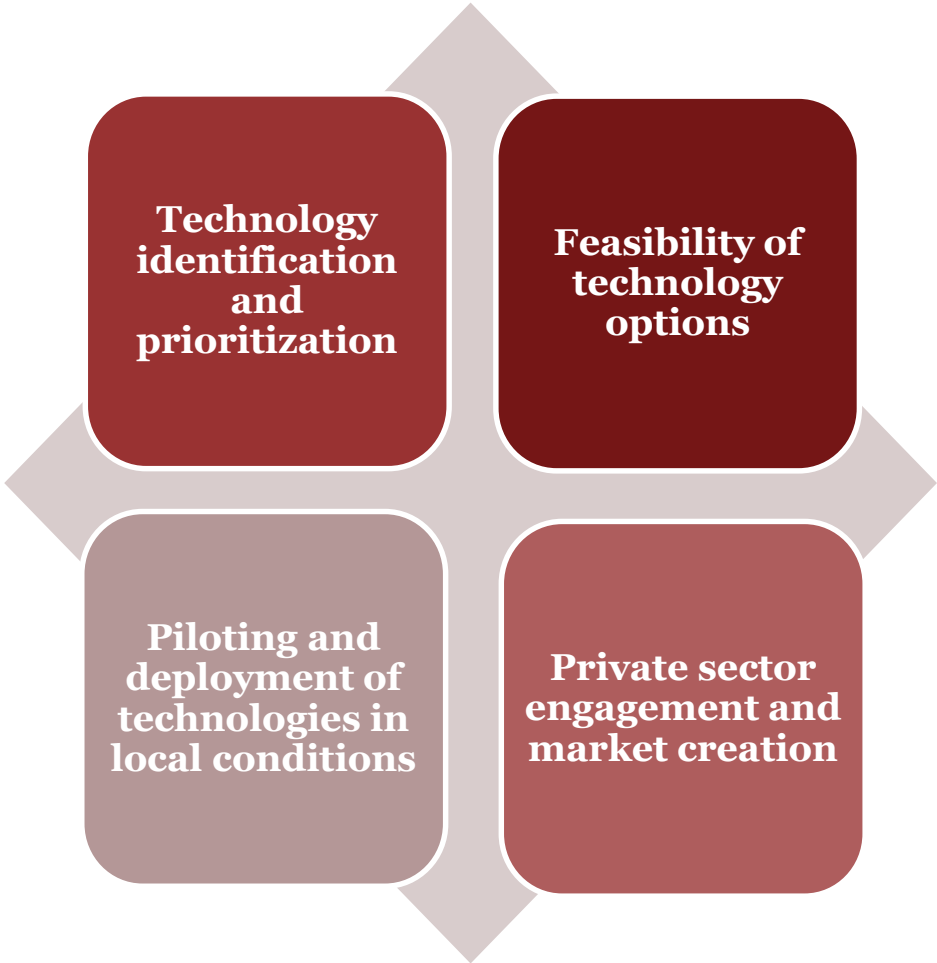


GEF is the biggest donor organization for CTCN (44%).

Objectives of the assignment

Identify energy, water efficiency and management improvement potential in 10 selected pilot companies

Create capacities to replicate and implement such interventions in companies across Zimbabwe in the future



Focus areas of Technical Assistance

Key Stakeholders

National Designated Entity	• Ministry of Environment, Water and Climate Change
Project Proponent	• Business Council of Sustainable Development Zimbabwe
Consultants:	• PwC India and PwC Zimbabwe
Key ministries	• Ministry of Environment, Water and Climate Change , Ministry of Energy and Power Development, Ministry of Industry
Other key stakeholders	• Zimbabwe National Cleaner Production Centre, Standards Association of Zimbabwe, Scientific and Industrial Research and Development Centre (SIRDC), Zimbabwe, Environmental Management Agency, Zimbabwe Energy Regulatory Authority (ZERA)

Linkage of assignment to key policies

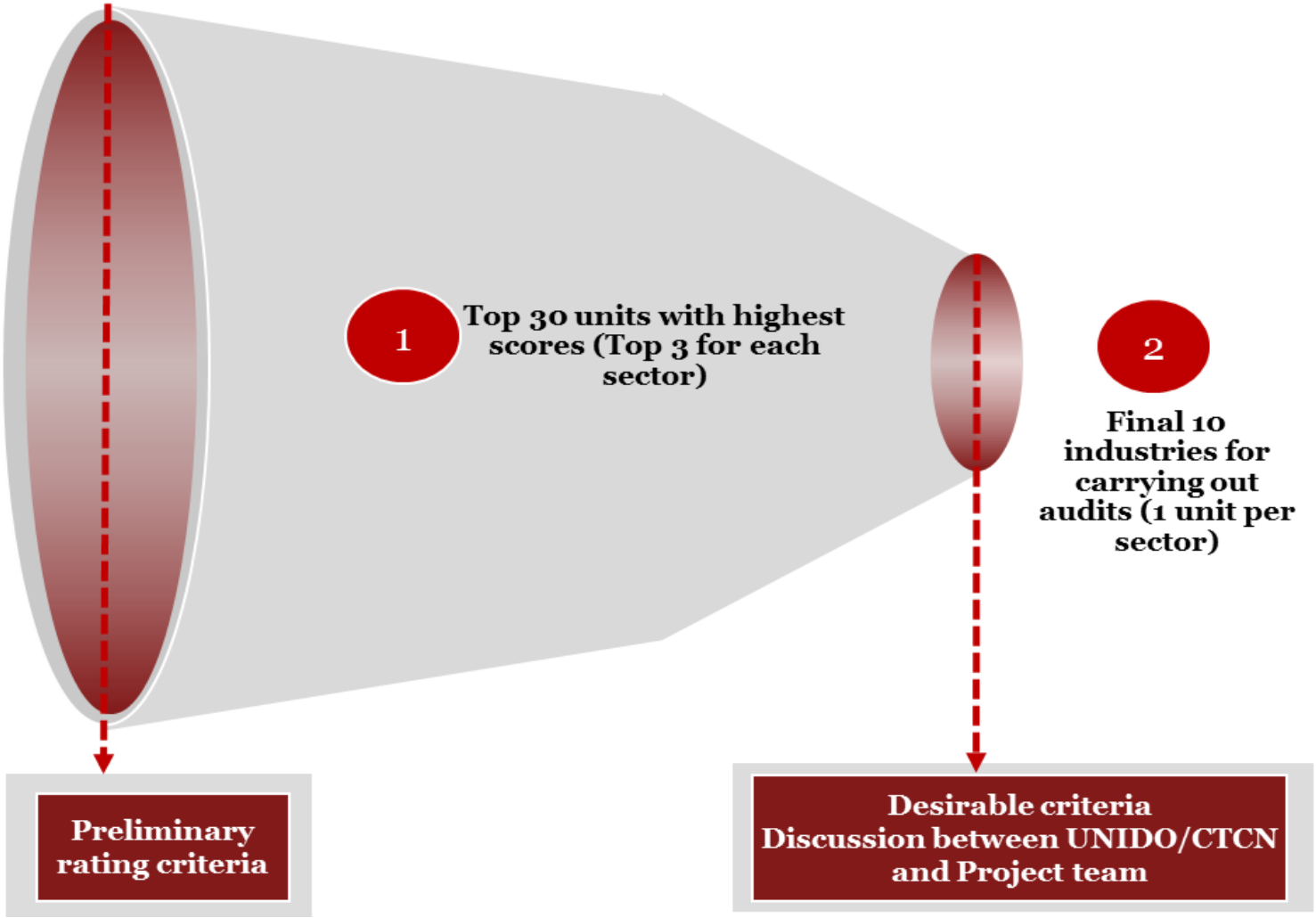
Zimbabwe's National Policies			Linkages to current assignment								
Policy	*Year*	*Implementing Agency*	*Mitigation*	*Adaptation*	*Energy /Water sector Targets*	*Renewable Energy adoption*	*Capacity Utilization*	*Industry Sector Focus*	*Finance Allocation*	*Capacity building*	*Value addition*
Zimbabwe Climate Change Response Strategy	2014	Ministry of Environment, Water and Climate	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zim Asset (2013-2018)	2013	Office of President and Cabinet	✓	✓	✓	✓	✓	✓*		✓	✓
IDP (2012-2016)	2012	Ministry of Industry and Commerce	✓	✓		✓	✓	✓*	✓	✓	✓
National Energy Policy	2008	Ministry of Energy and Power development	✓		✓	✓		✓*		✓	
Third communication to UNFCCC	2016	Ministry of Environment, Water and Climate	✓	✓	✓	✓	✓	✓		✓	✓
ZUNDAF (2016-2020)	2015	Office of President & Cabinet and UN				✓		✓	✓	✓	✓

Unit Selection & Training

Screening process of industrial units

Units from following sectors in Zimbabwe

- Food processing and Beverages
- Leather and Footwear
- Agrochemical Production
- Timber processing
- Mining, Mineral processing and Metal finishing
- Cement production
- Cable manufacturing
- Buildings and Construction
- Waste Management and Recycling
- Dairy Sector



Shortlisted units for detailed energy & water audit

Agrochemical
(2 units)

Cable
(1 unit)

Cement
(1 unit)

Food & Beverages
(3 units)

Mining
(3 units)

Training details

Title	Training programme on Energy & water efficiency with focus on ISO 50001
Dates	25th - 27th June 2018 (3 days)
Venue	PwC Training Hall, Arundel Office Park, Norfolk Road, Mount Pleasant, Harare

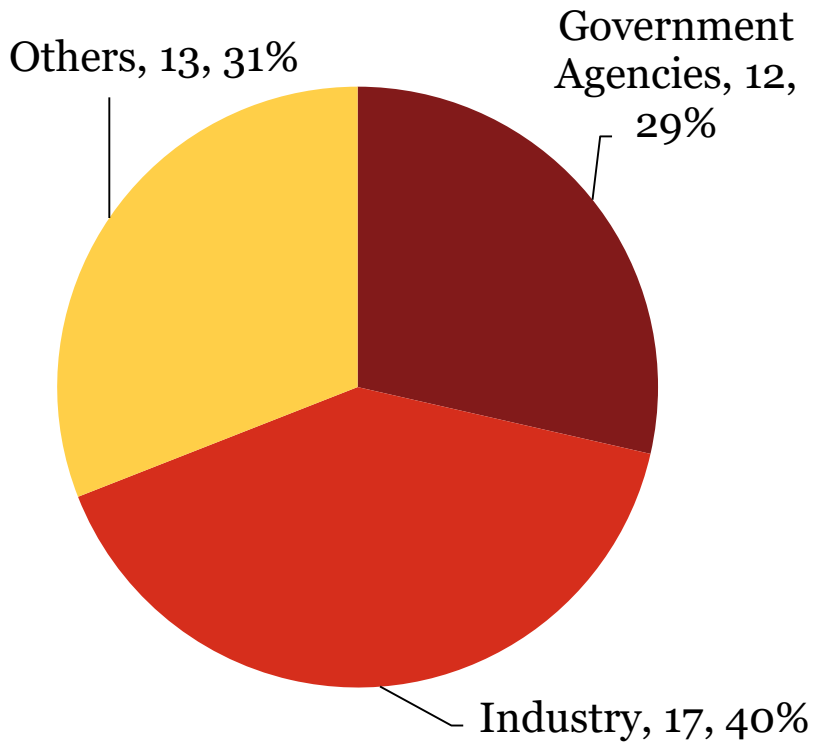
Topics covered during the training program

- Energy performance assessment
  - Energy efficiency
- Water use efficiency and conservation
  - Water balance
- Renewable resource assessment
  - Potential estimation
- ISO 50001: Basics
  - Implementation process
- Case studies Energy, Water and ISO 50001

Some photos from training programme

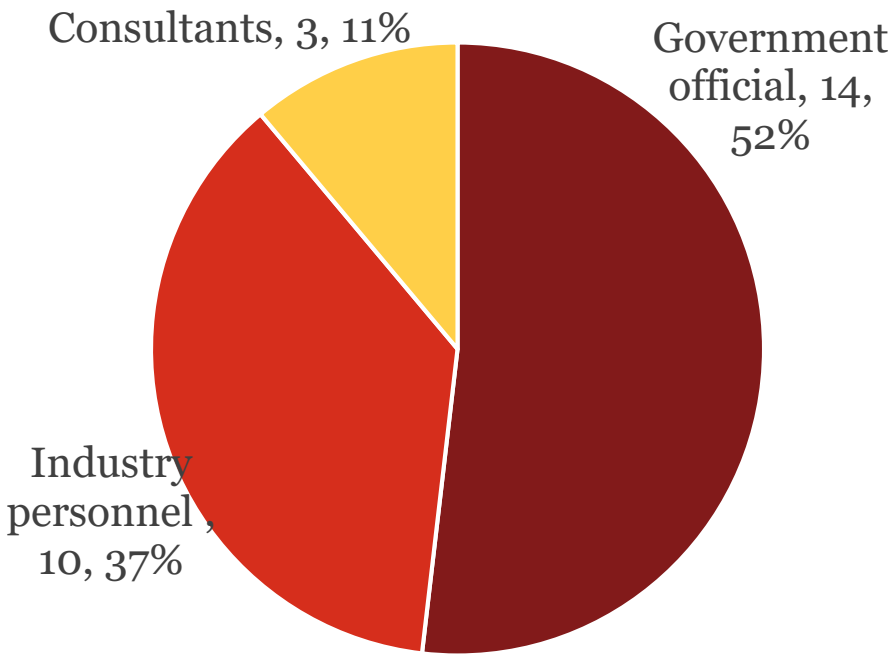
Training demographics

Classroom training (Total no of people who attended: 42)



Majority of the participants were Industry officials (40%)

Hands on training (Total no of people who attended: 27)



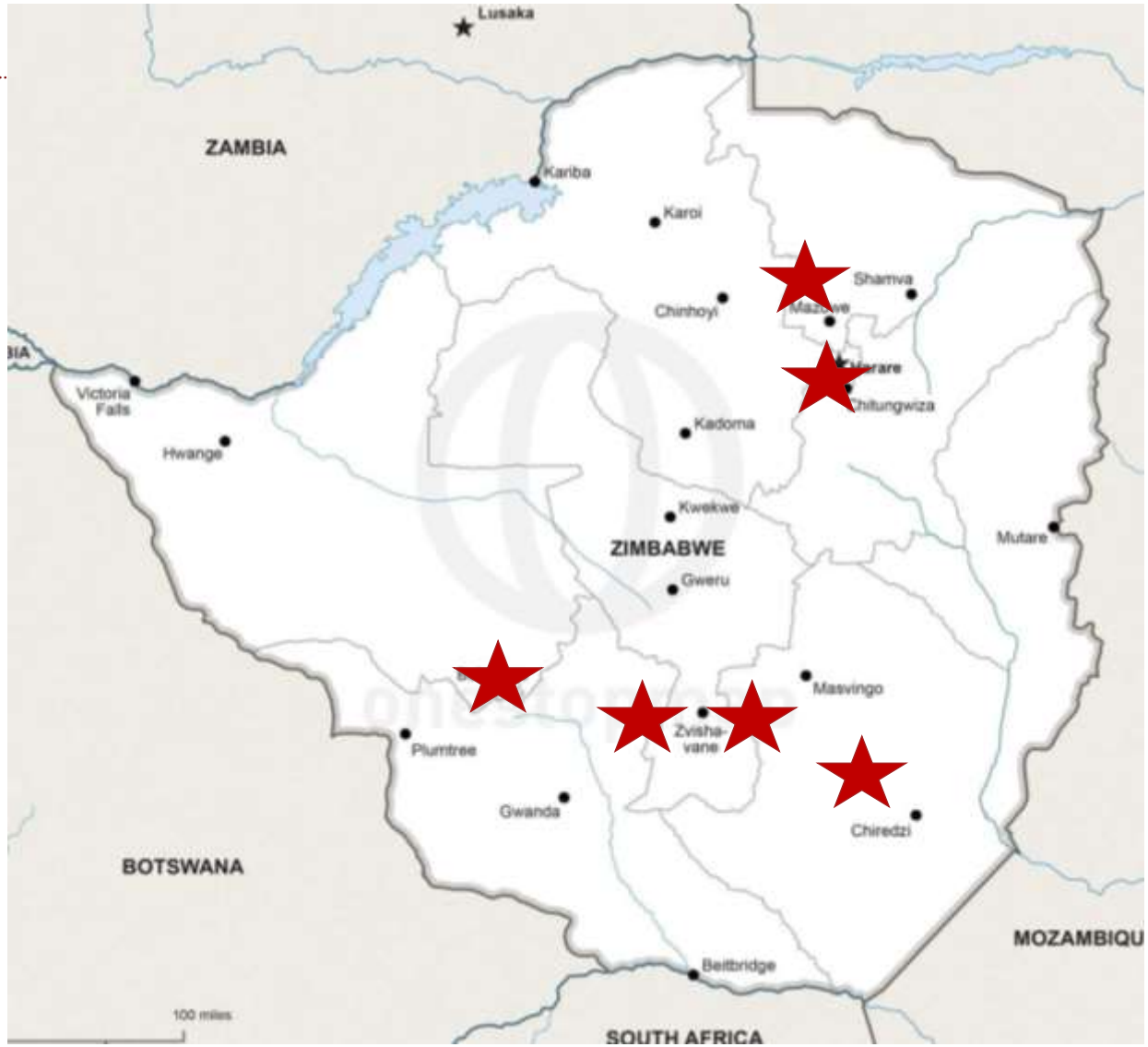
Majority of the participants were government officials (52%)

Hands on training

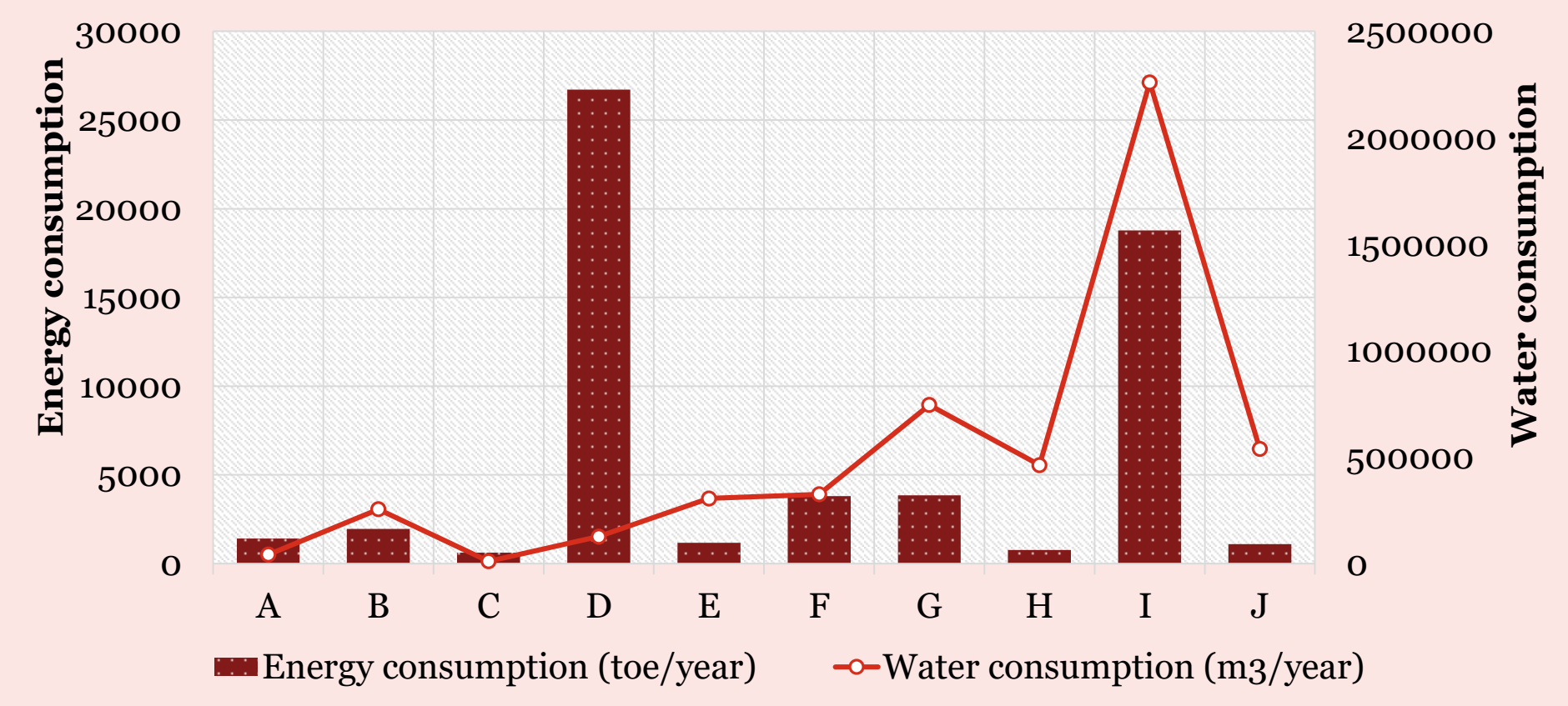
Audit findings

Demonstration units

Sector	Unit
Agrochemical	A
Agrochemical	B
Cables	C
Cement	D
Food & beverages	E
Food & beverages	F
Food & beverages	G
Mining	H
Mining	I
Mining	J



Water and energy consumption of demo. units



Water consumption
- 5.1 million cubic meter

Energy consumption
- 60,161 tonnes of oil equivalent

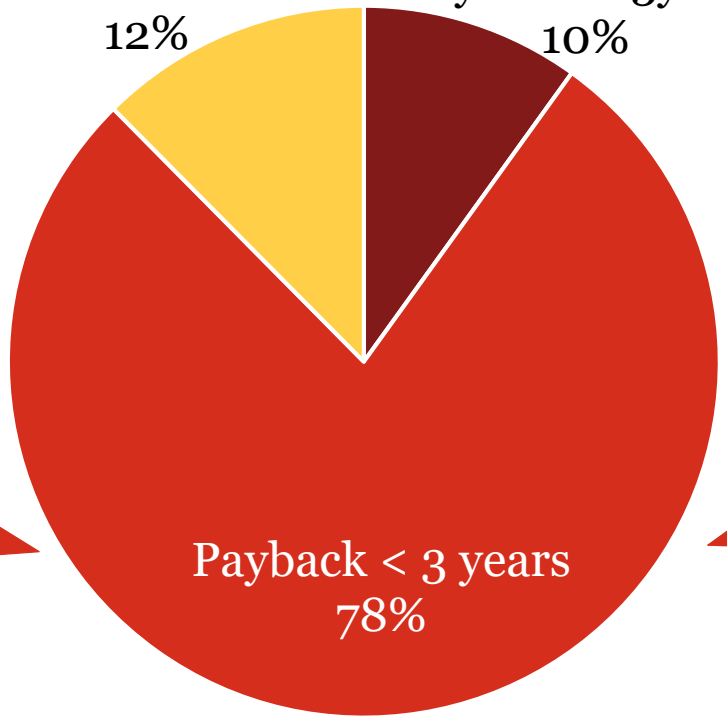
Combined peak demand equivalent to 3% of Zimbabwe's total peak demand

Audit process

Energy and water saving recommendations

No. of energy and water recommendations identified: 161

- Leaks reduction: Water, compressed air
- Process optimization in boiler / Hot air generators



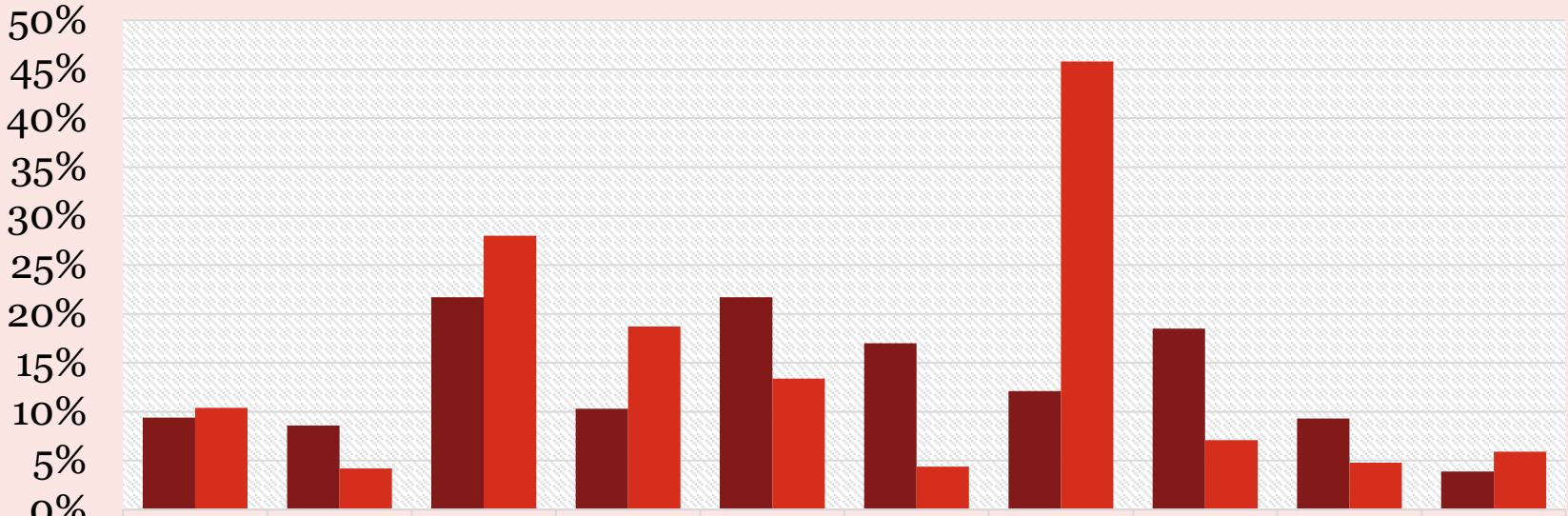
Replacement of

- Smelting furnace
- Boiler
- LED lighting
- Refrigeration compressor

- VFD retrofit on compressor
- Cogged V-belt
- Boiler automation
- Reduce heat loss

- Rain water harvesting
- High pressure nozzle for ablution
- Flow restrictors

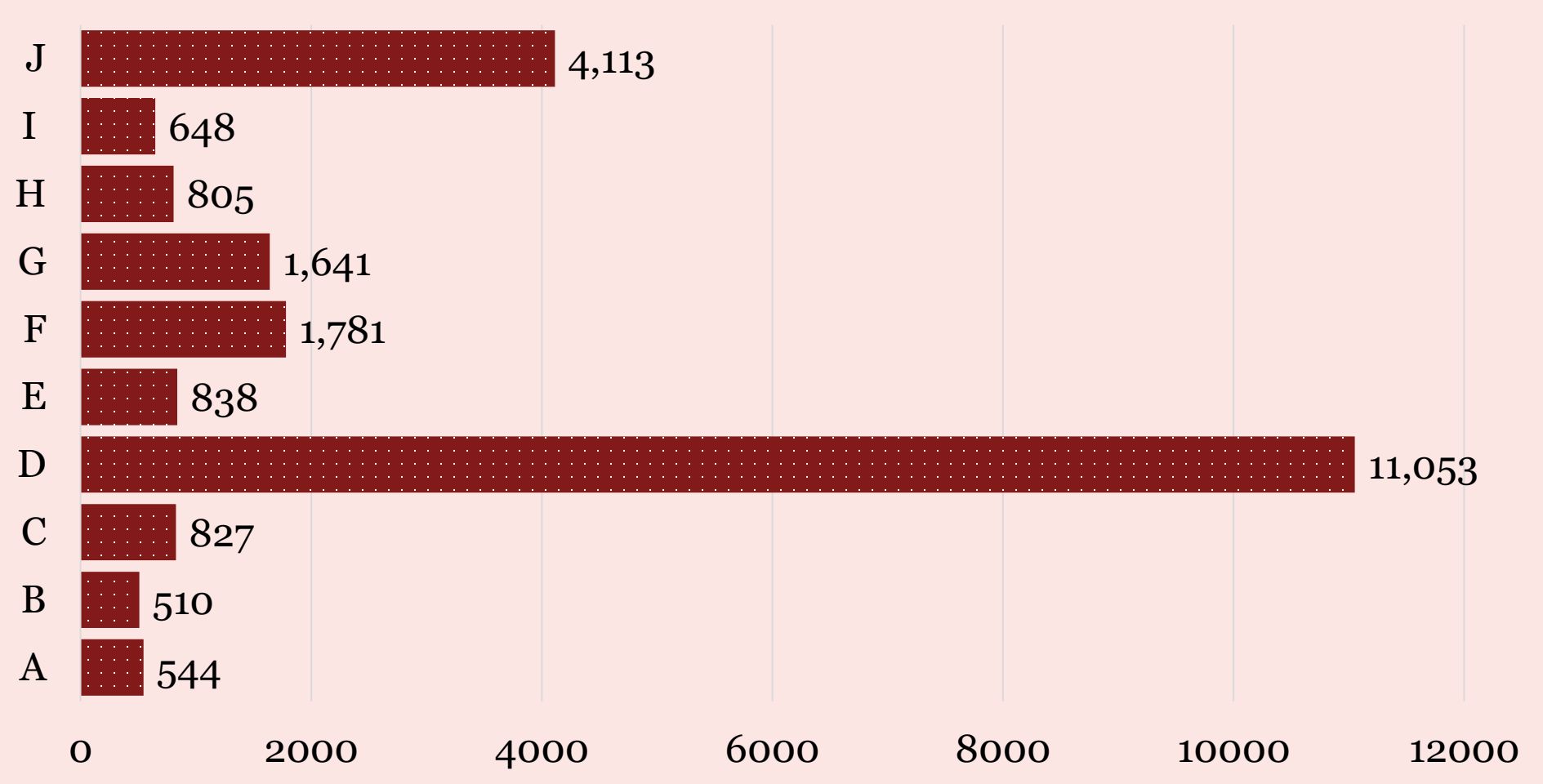
Energy and water saving potential identified (%)



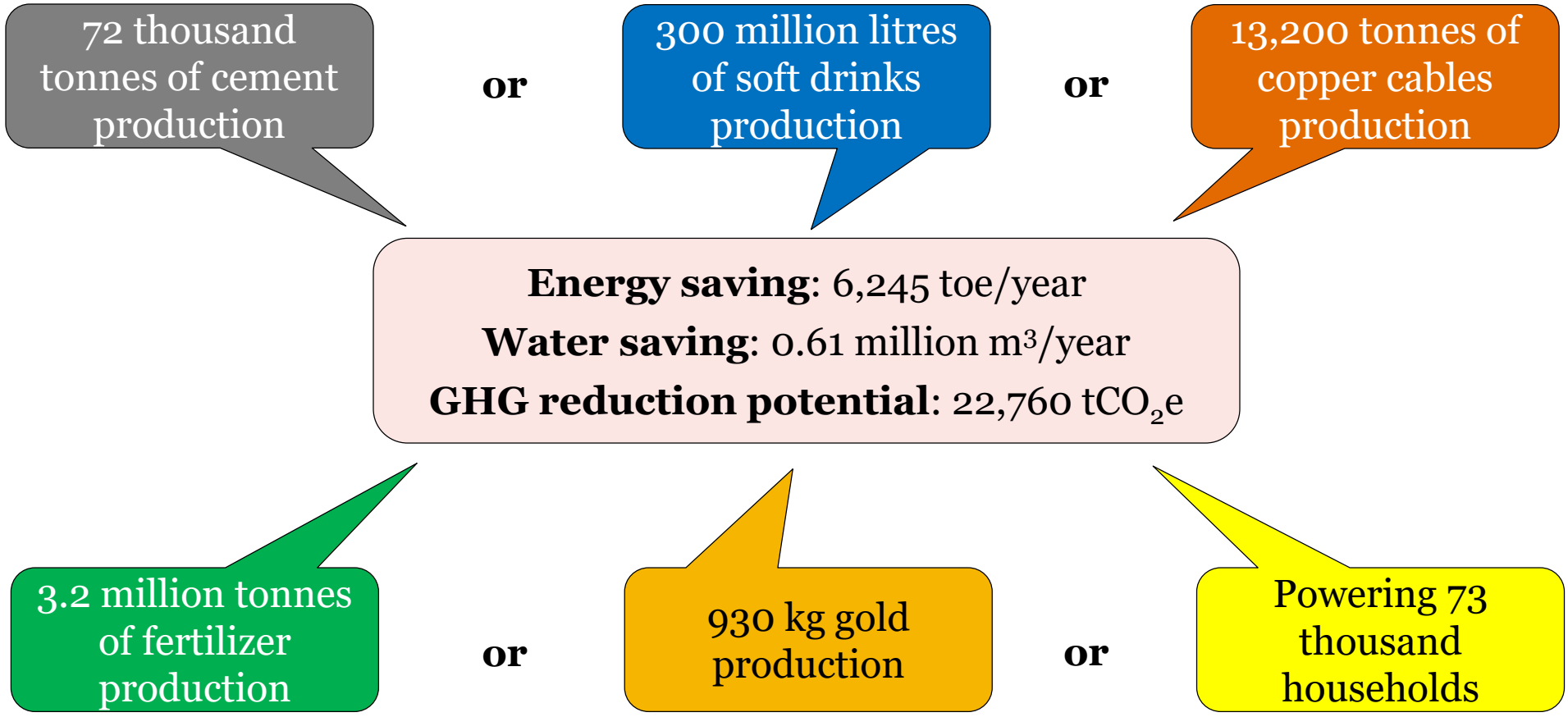
	A	B	C	D	E	F	G	H	I	J
Energy saving	9.4%	8.6%	21.7%	10.3%	21.7%	17.0%	12.1%	18.5%	9.3%	3.9%
Water saving	10.4%	4.2%	28.0%	18.7%	13.4%	4.4%	45.8%	7.1%	4.8%	5.9%

Avg. Saving	Agrochemical	Cables	Cement	Food & beverages	Mining
Energy	8.9%	21.7%	10.3%	15.5%	9.4%
Water	5.1%	28.0%	18.7%	28.8%	5.3%

GHG Reduction Potential (tCO_2 equivalent)



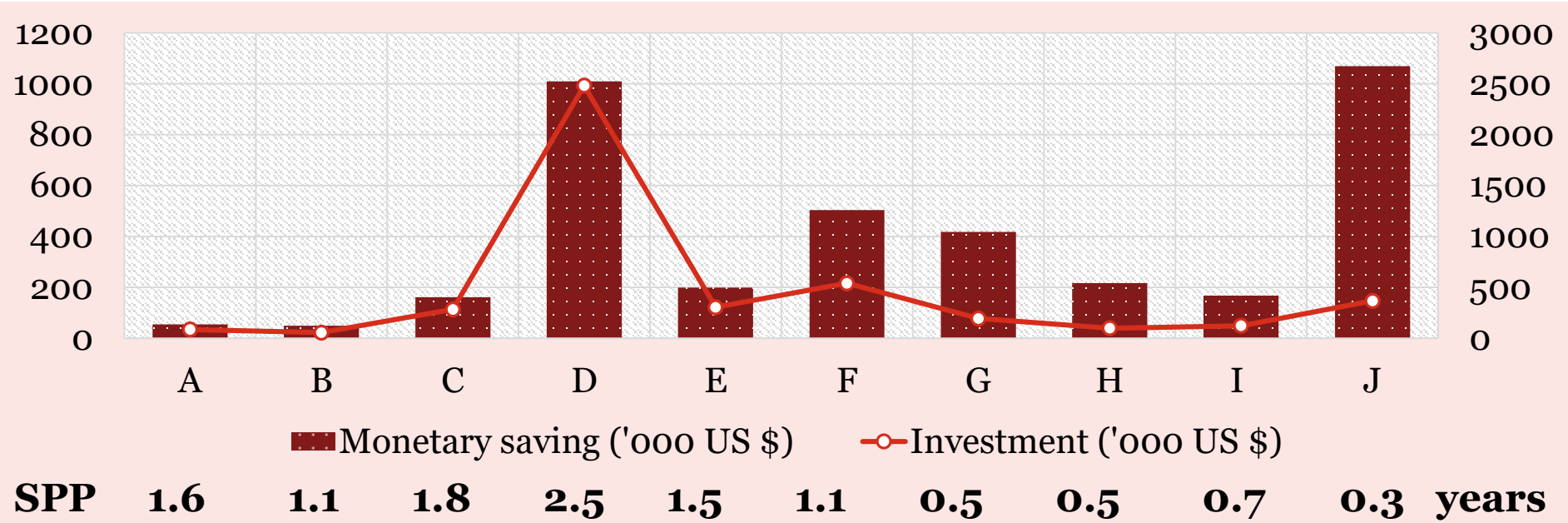
Saving potential identified



Equivalent to avoided power generation capacity: 10 MW

Investment potential and monetary saving

Investment proposed: US $ 4.53 million
Monetary saving potential: US $ 3.85 million

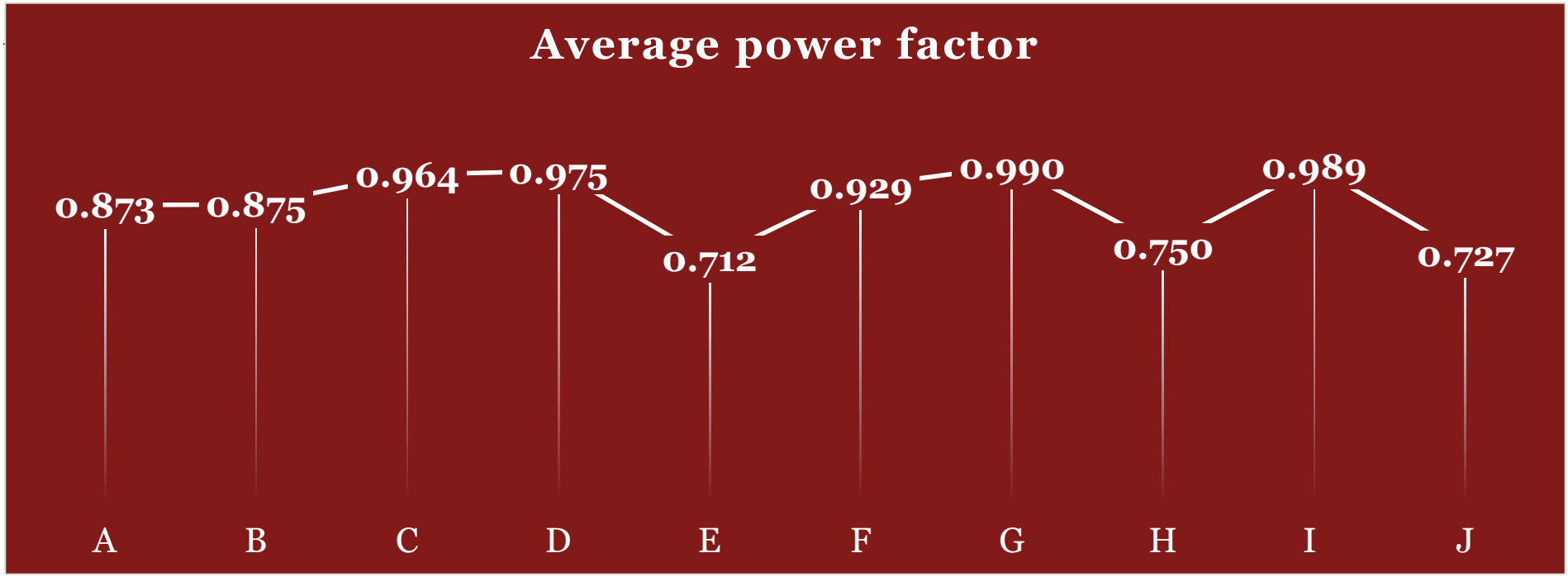


SPP	**1.6**	**1.1**	**1.8**	**2.5**	**1.5**	**1.1**	**0.5**	**0.5**	**0.7**	**0.3**	**years**

Implementation prioritization

No investment measures → Payback less than 1 years → Payback less than 3 years → Payback more than 3 years

Power factor improvement and demand reduction



Improving PF to 0.999 in all units will:

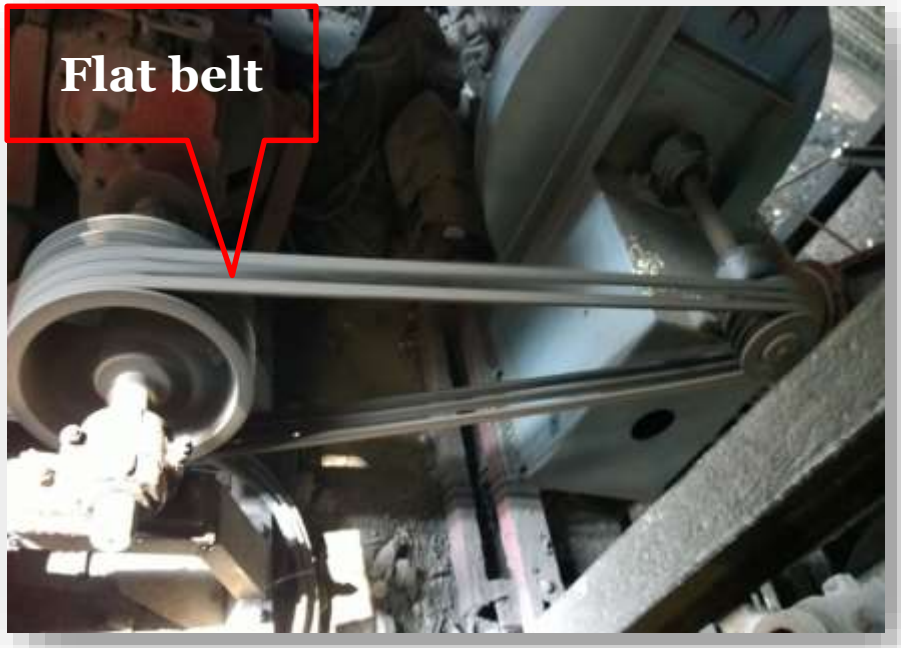
(a) Reduce demand by 5,700 kVA

(b) Reduce distribution losses by 0.2%

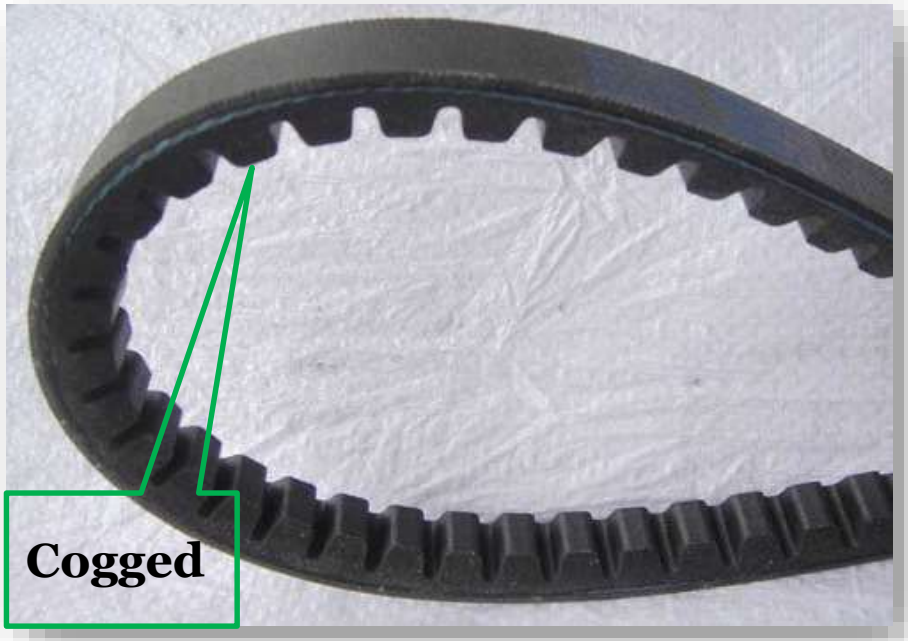
(c) Lead to monetary saving of > US $ 400 thousand

Energy Conservation Measure – Case Study

Existing - Flat V-belts used



Proposed - Use cogged V-belts



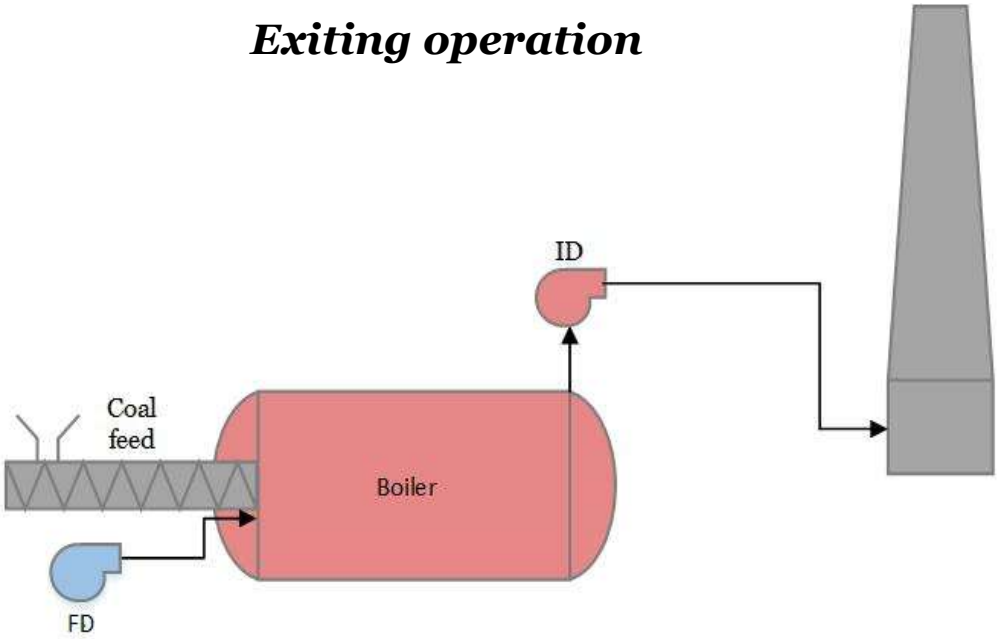
Energy saving by improved transmission
Increased life of belt

- Total belts replace – 12 motors
- Annual monetary savings – US $ 2,760
- Simple payback – 6 months
- Energy savings – 1 to 3%

Energy Conservation Measure – Case Study

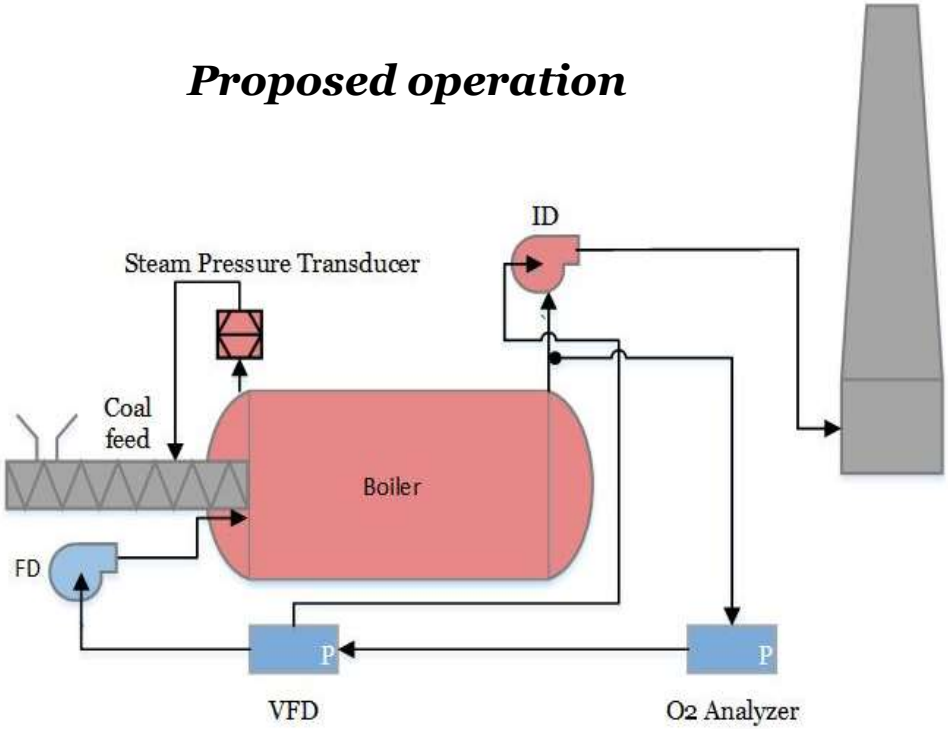
Boiler Automation

Exiting operation



- O_2 analyser at the flue path just before ID fan
- Pressure sensor of steam to control coal feed rate

Proposed operation



- Annual monetary savings – US $ 15,500
- Simple payback – 1 year
- Energy saving – 3 to 5%

Energy Conservation Measure – Case Study

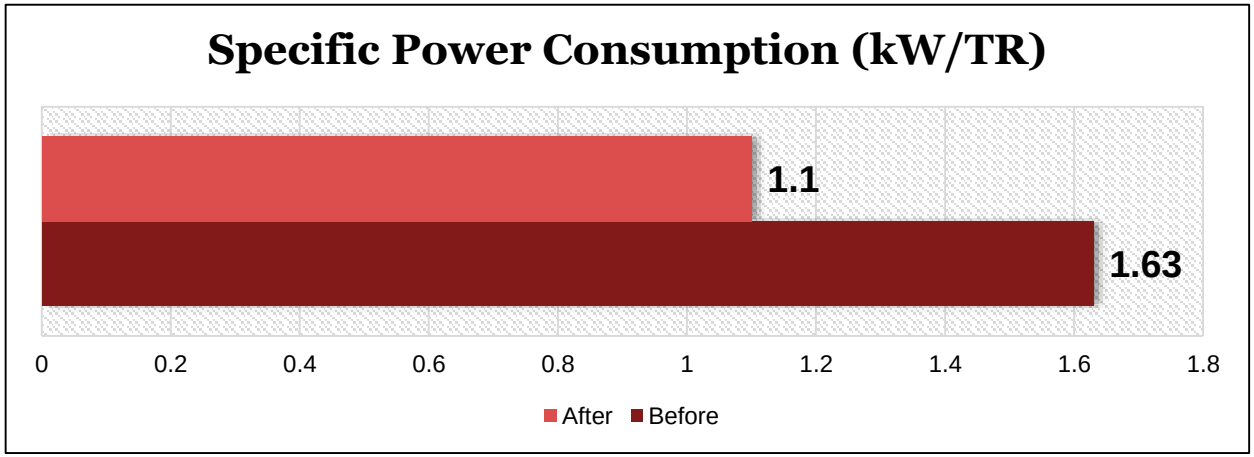
Screw compressor for refrigeration system

Existing

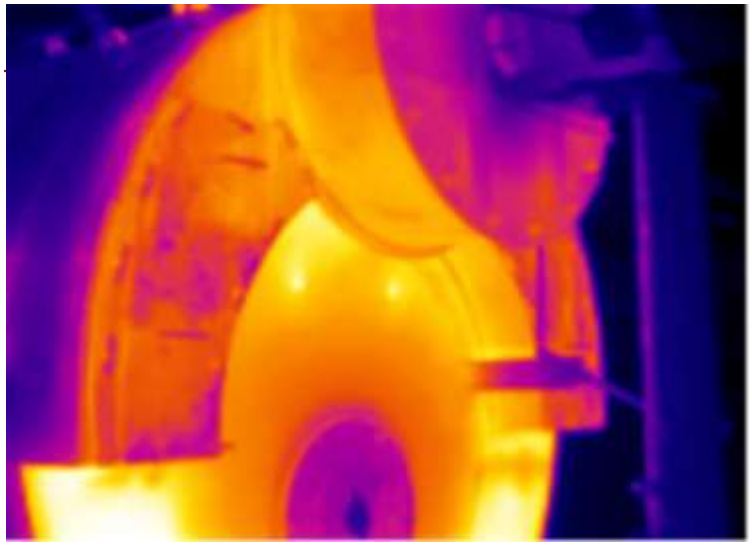
Savings

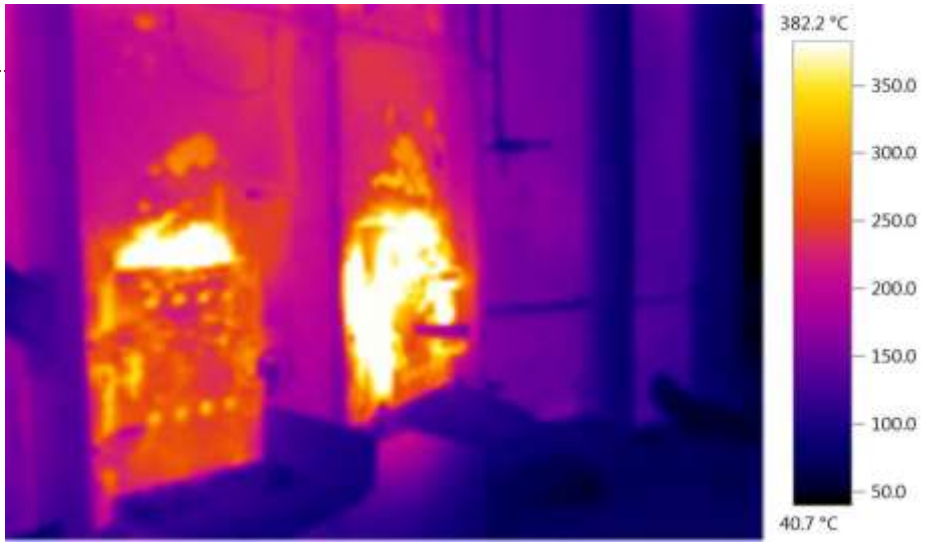
- Refrigeration load – 127.4 TR
- Power consumption – 208 kW
- Annual electricity saving – 275 MWh
- Annual monetary savings – US $ 27,750
- Simple payback – 2 years
- Energy savings – 32.5%

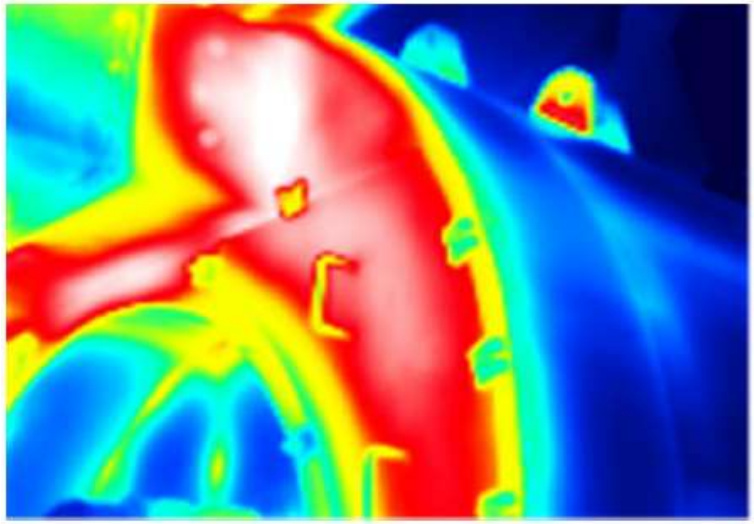
Proposed

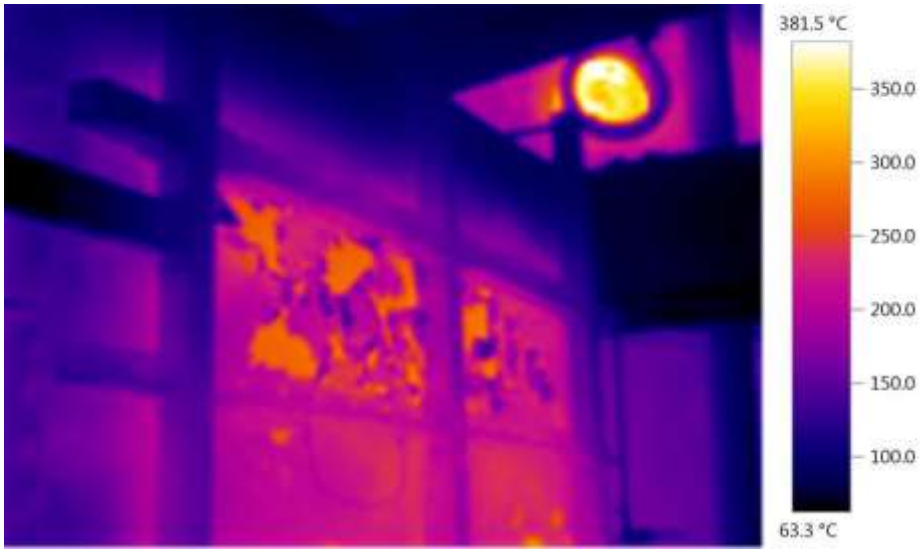


Energy Conservation Measure – Thermal Images

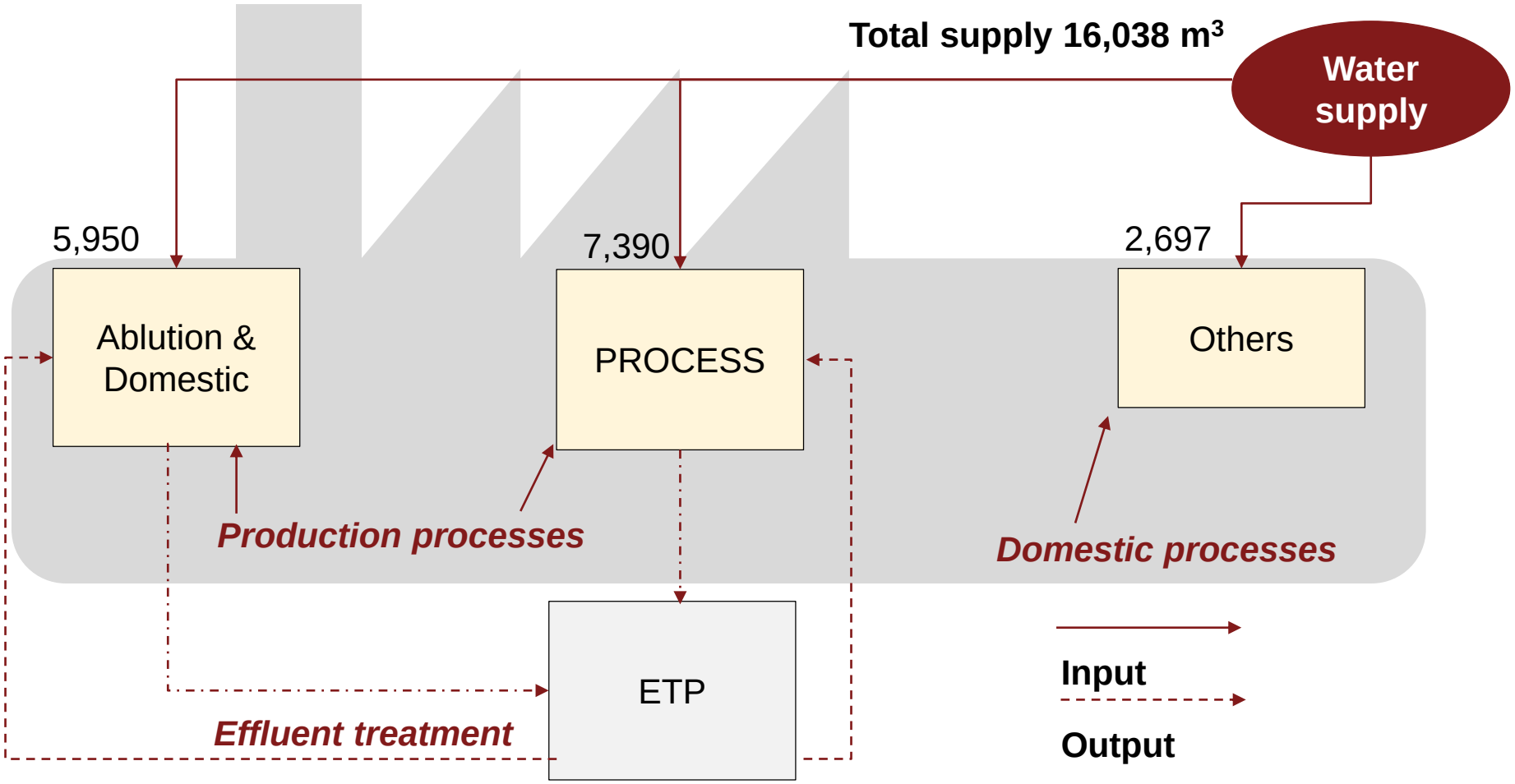






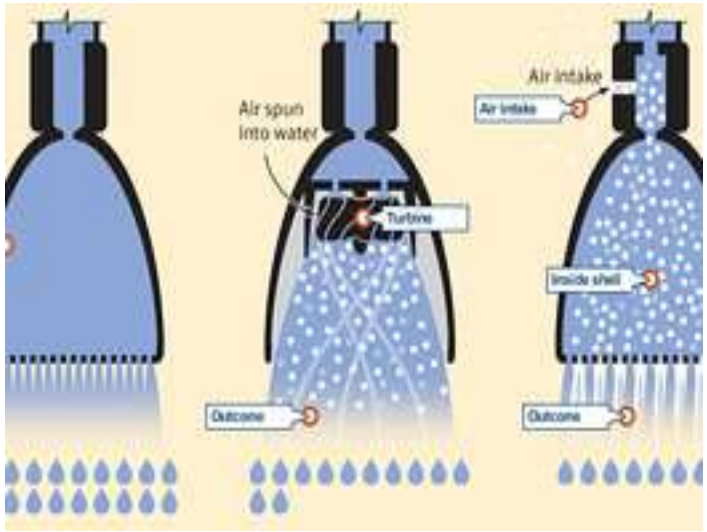


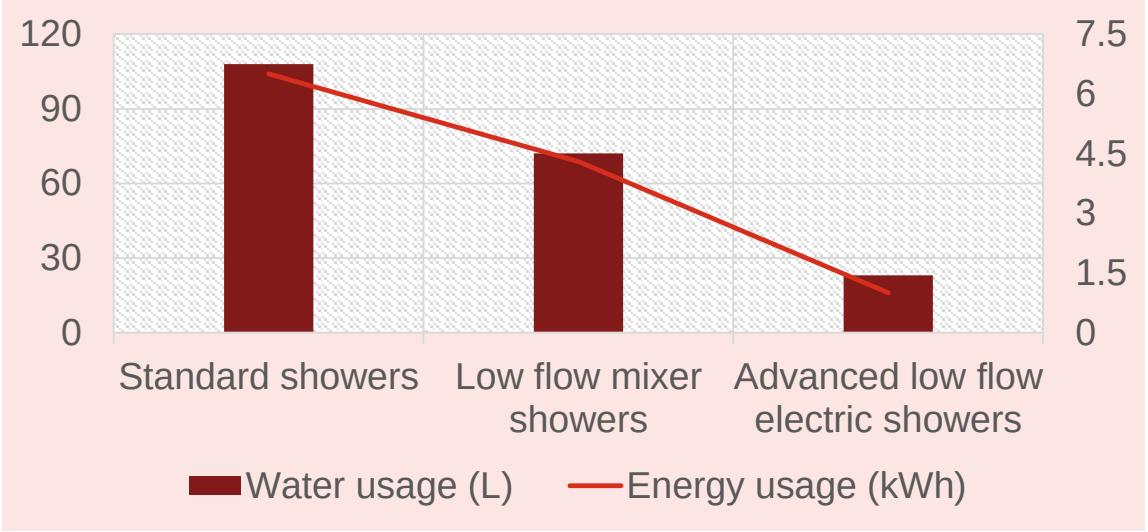
Water Balance of the Plant: Typical



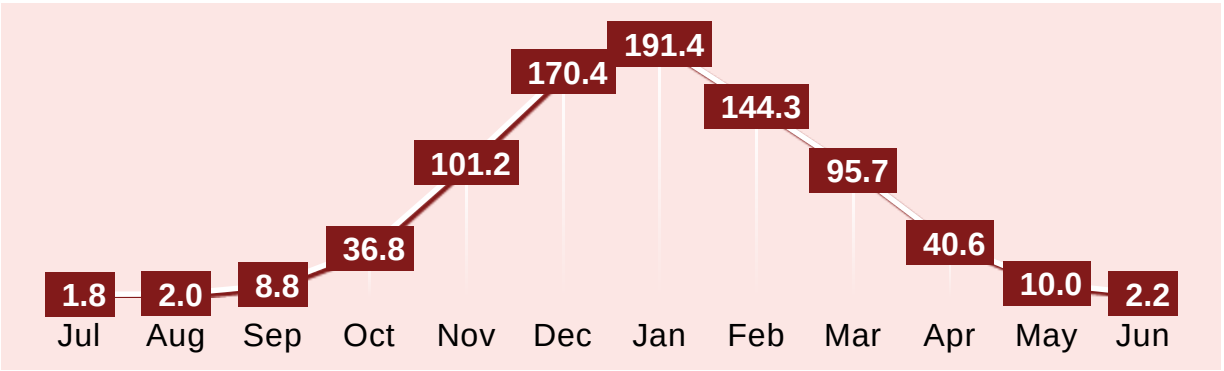
Water Conservation Measures – Case Example

Low flow showers





Rain water harvesting



- Average annual rainfall in Harare 840 mm
- 2.3 L/ft²/in rainfall

Solar Legislative Framework

GRID CODE

- Any user seeking to establish a new, or modified arrangements for connection to and/or use of the National Transmission System. Any Grid Tied system should comply with the technical and legal requirements of the Grid Code.

NET METERING

- Net Metering Regulations meant to govern the generation of electricity from small scale, grid tied renewable energy generators like solar PV on rooftops were gazetted by the Government of Zimbabwe in early 2018. Net metering regulations will apply up to a threshold of 100kW above this threshold the tariff code will apply.

TARIFF CODE

- The tariff code has a methodology which was approved by ZERA in 2017. It stipulates a method of arriving to a particular tariff by looking at the cost of sales, cost of capital, depreciation and other production related costs. It has to be proven that the plant is operating efficiently.

Solar PV

Tariff code

- LCOE
- 100 kW – 50 MW
- High investment
- High payback period

Net metering

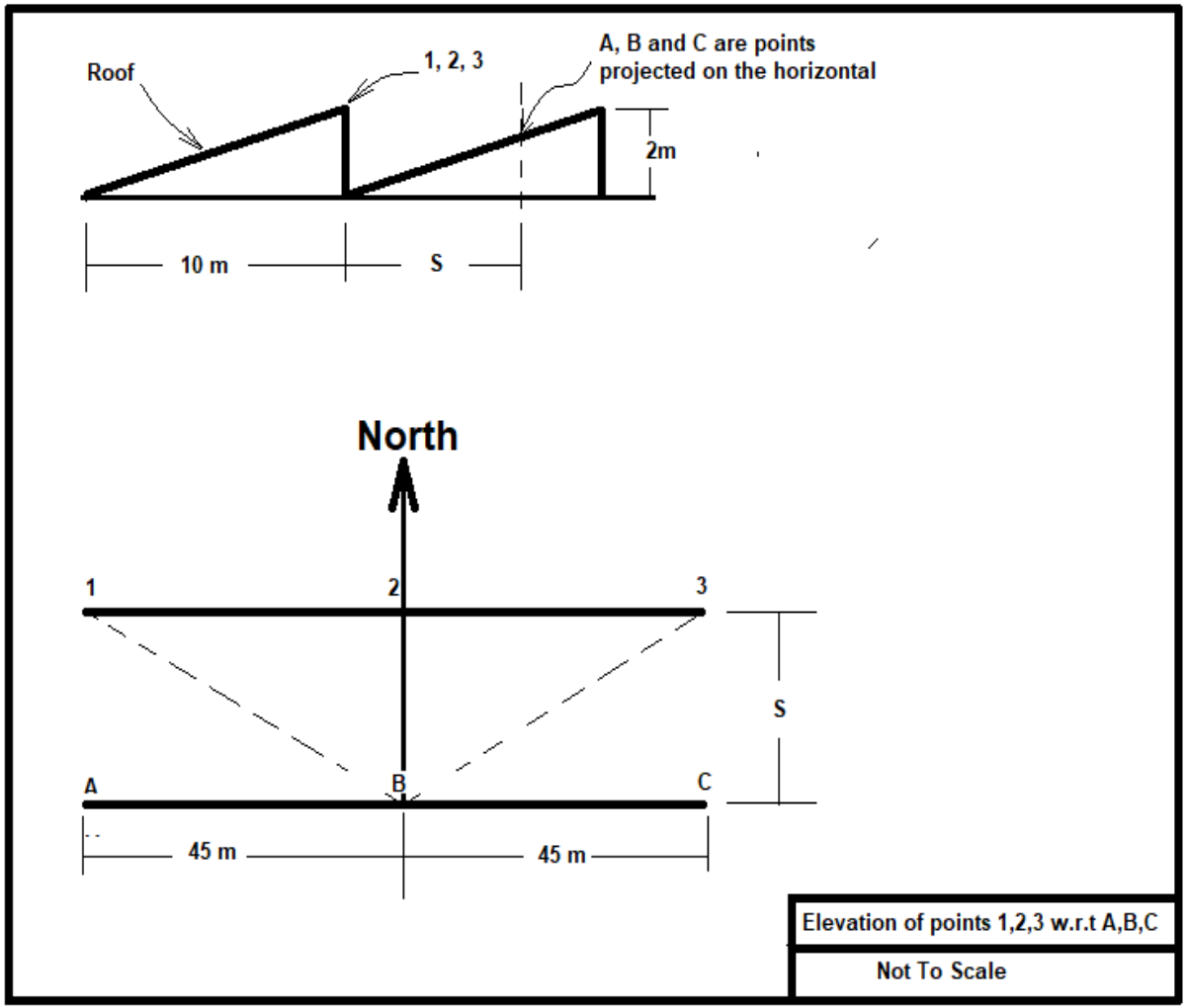
- Restricted to 100 kWp
- Suitable for office and lighting load

Battery inverter

- Sized for office load
- Security system backup
- Replacement of admin block DG set

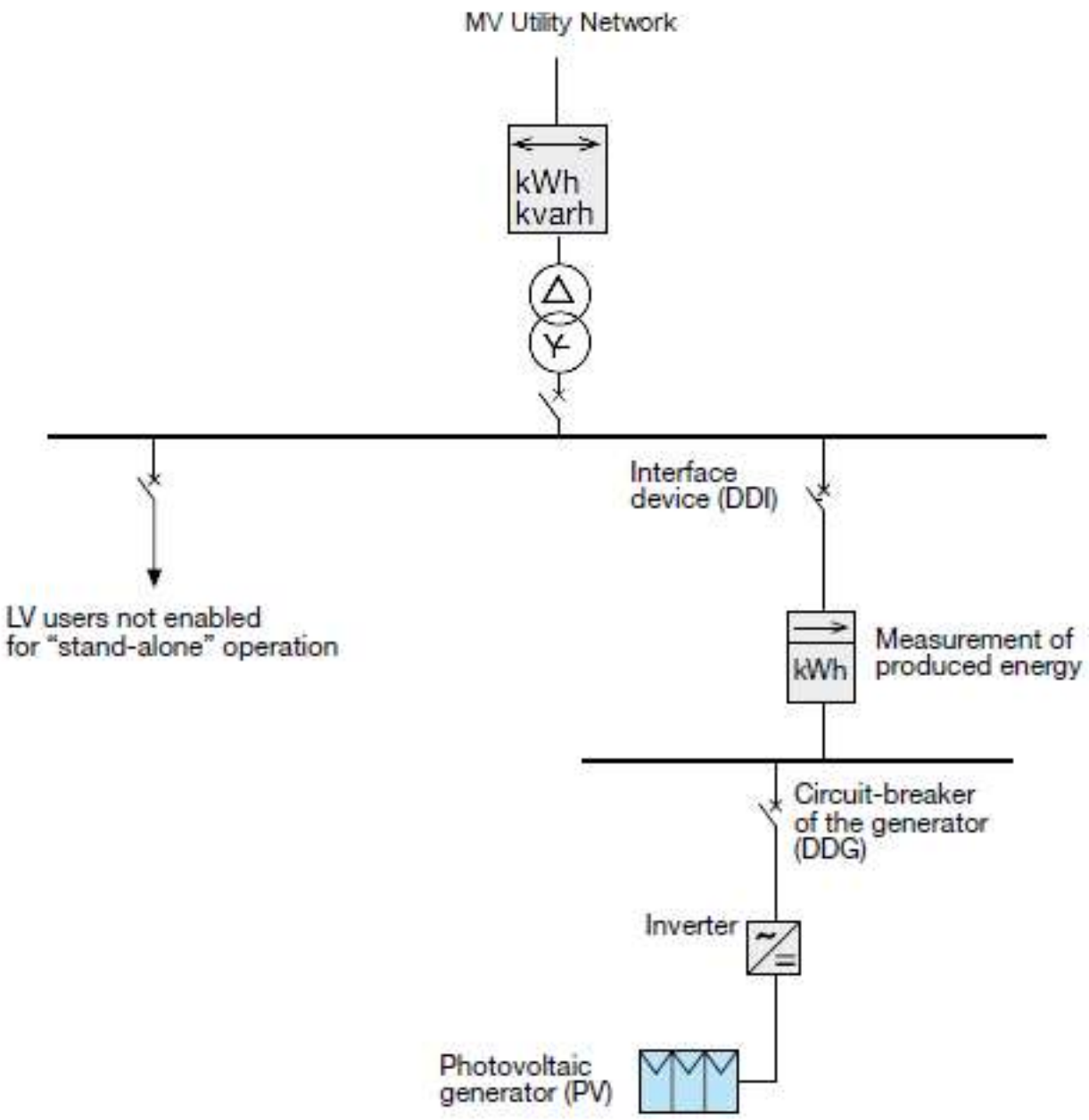
Technology	Capacity	Tariff (US $/kWh)
Solar PV	100 kW - 1 MW	0.138
	1 MW - 5 MW	0.131
	5 MW - 50 MW	0.118

Solar Resource Assessment and Shading Analysis



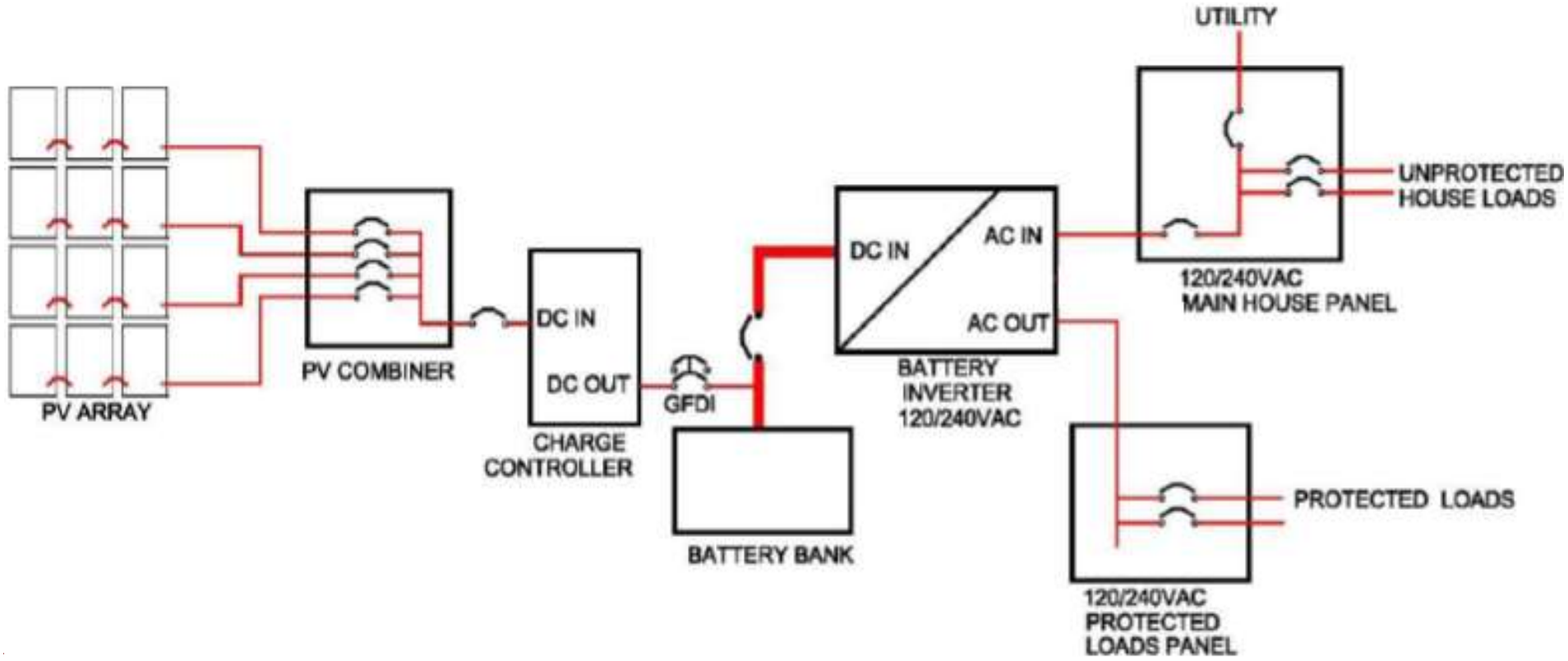
Solar PV – Grid tied

- Proposed size of grid tied solar PV few kW to 5 MW
- Typical Payback Period 6 - 7 years
- It's a strategic investment

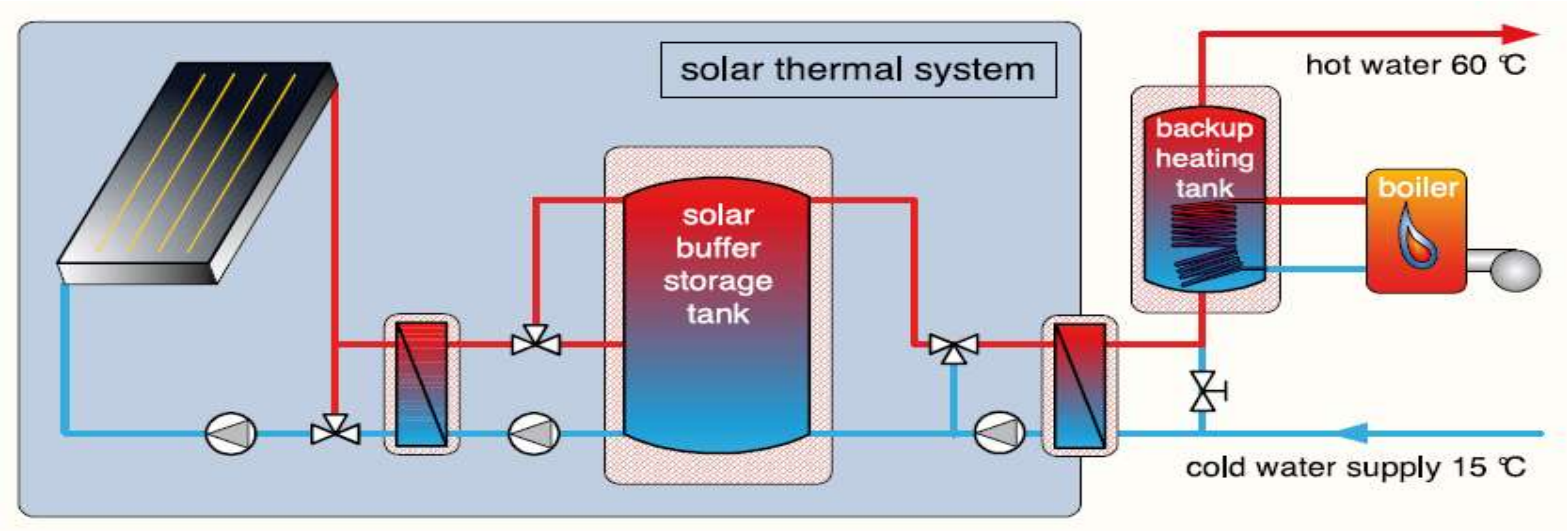


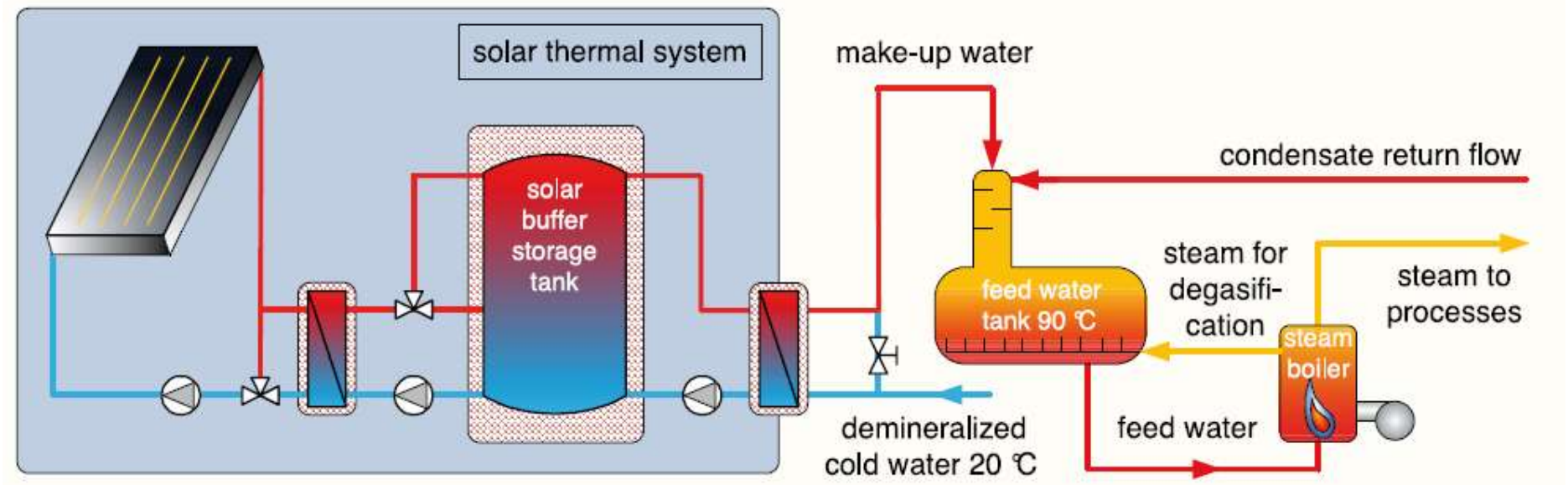
Solar PV – Battery Inverter

- Proposed based on office load and security lighting requirement
- Typical Payback Period 7 – 9 years
- It's a strategic investment



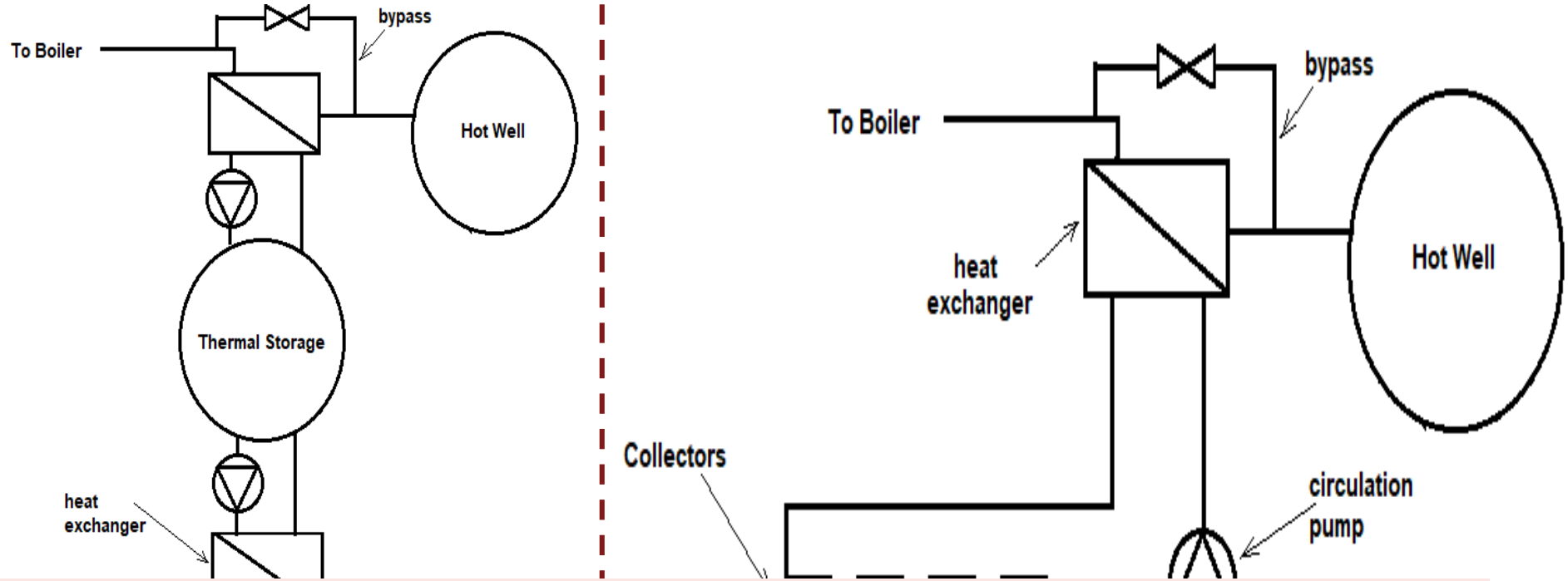
Solar Thermal





Solar Thermal

Solar water heater applications: Boiler feed water, Pasteurization, etc.



- Proposed based on roof space available and hot water demand of unit
- Typical Payback Period about 5 years

Biogas option

Bio-gas is a type of biofuel which is produced by decomposition of organic waste naturally

Biogas consists of: 50 – 80% CH_4, 20 – 35% CO_2 and traces of H_2, N_2, H_2S

Gas production rate: 0.3 m^3/kg

Hydraulic retention time of 30 days

1.1 m^3 biogas can replace a 12 kW industrial stove

- Proposed based on kitchen waste available
- Typical Payback Period about a year

Key points for policymakers

Area/Sector	Key policy level observations and recommendations
Energy 	▪ ***Capacity building programmes*** are necessary to generate awareness among industries ▪ ***Cluster/Sector specific project*** could be developed for farther penetration for enhancement of resource efficiency in industries ▪ ***Low Carbon Technology Transfer projects*** to support implementation of pilot technologies to showcase benefits in the country ▪ ***Setting up Energy Management Centre*** with support from international funding which would be equipped with audit instruments and trained professional to use them to conduct studies in large number of industries at lower cost ▪ Promotion for adoption of ***ISO 50001 Energy Management System*** ▪ ***Low cost financing/ Line of credit*** could be explored to implement high cost EE interventions in structured manner.

Key points for policymakers

Area/Sector	Key policy level observations and recommendations
Tariff 	▪ Tariff re-structure: ***PF penalty/rebate system*** could be introduced ▪ A number of industries are on ***preferential tariffs***, operating at ***power factors lower than 0.7***, leading to increased demand on the power system ▪ ***Demand Side Management programmes*** could be proposed to help tariff structuring and managing the load, peak demand ▪ ***Training programs for ZERA/ZESA employees on energy efficiency and management, demand side management***

Key points for policymakers

Area/Sector	Key policy level observations and recommendations
Water 	▪ ***Capacity building and training*** of industries on water use efficiency and water conservation ▪ ***Tariffs on water are very low*** leading to inefficient use ▪ ***Improper treatment of wastewater and almost no reuse of water***. Programmes could be developed to generate awareness on reuse of water ▪ No regulation on discharge of waste water, a program could be developed to ***establish Specific Waste Water Discharge allowed*** for different sectors

Thanks!

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