
Zimbabwe National Energy Efficiency Base Line Study Project : A Presentation

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❖ All Potholes Observed!!

Introduction

Industry uses nearly 40 percent of worldwide energy to produce materials and products consumed by us all on a daily basis. In the process it contributes almost 37 percent of global greenhouse gas emissions (GHG).

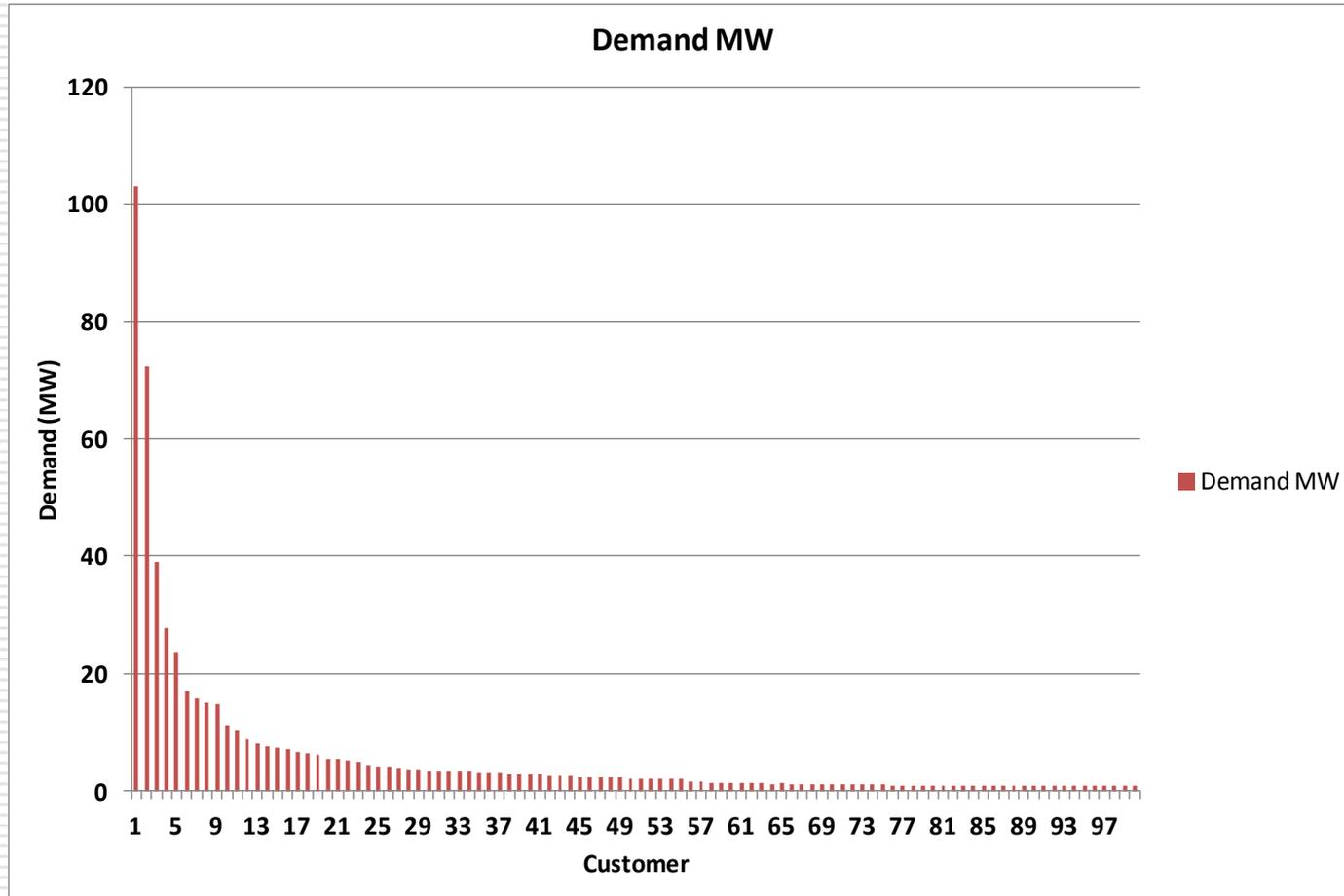
Globally, and in most countries, CO₂ accounts for more than 90 percent of CO₂-eq GHG emissions from the industrial sector, and energy use is the key source of the emissions.

(UNIDO Working Paper on Barriers to Energy Efficiency, 2011)

Inside this presentation

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- ❖ Executive Summary
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- ❖ Estimation of Energy Savings
- ❖ Discussion on EE Policy Instruments around the World.
- ❖ Policy Instrument Options for Zimbabwe
- ❖ Conclusions

Demand for Energy in Zimbabwe



Electricity Demand in Zimbabwe

Summary: 4 out of 100 (4%) of the customers are responsible for 40% of the total demand. About 10% are responsible for 60% of the total demand, and 30 % for 80% of the total demand

Why invest in Energy Management and Energy Management Systems?

❖ On average, 30% of the energy used in commercial buildings is wasted, according to the U.S. Environmental Protection Agency

What is 11-7?

What is \$11-\$7?

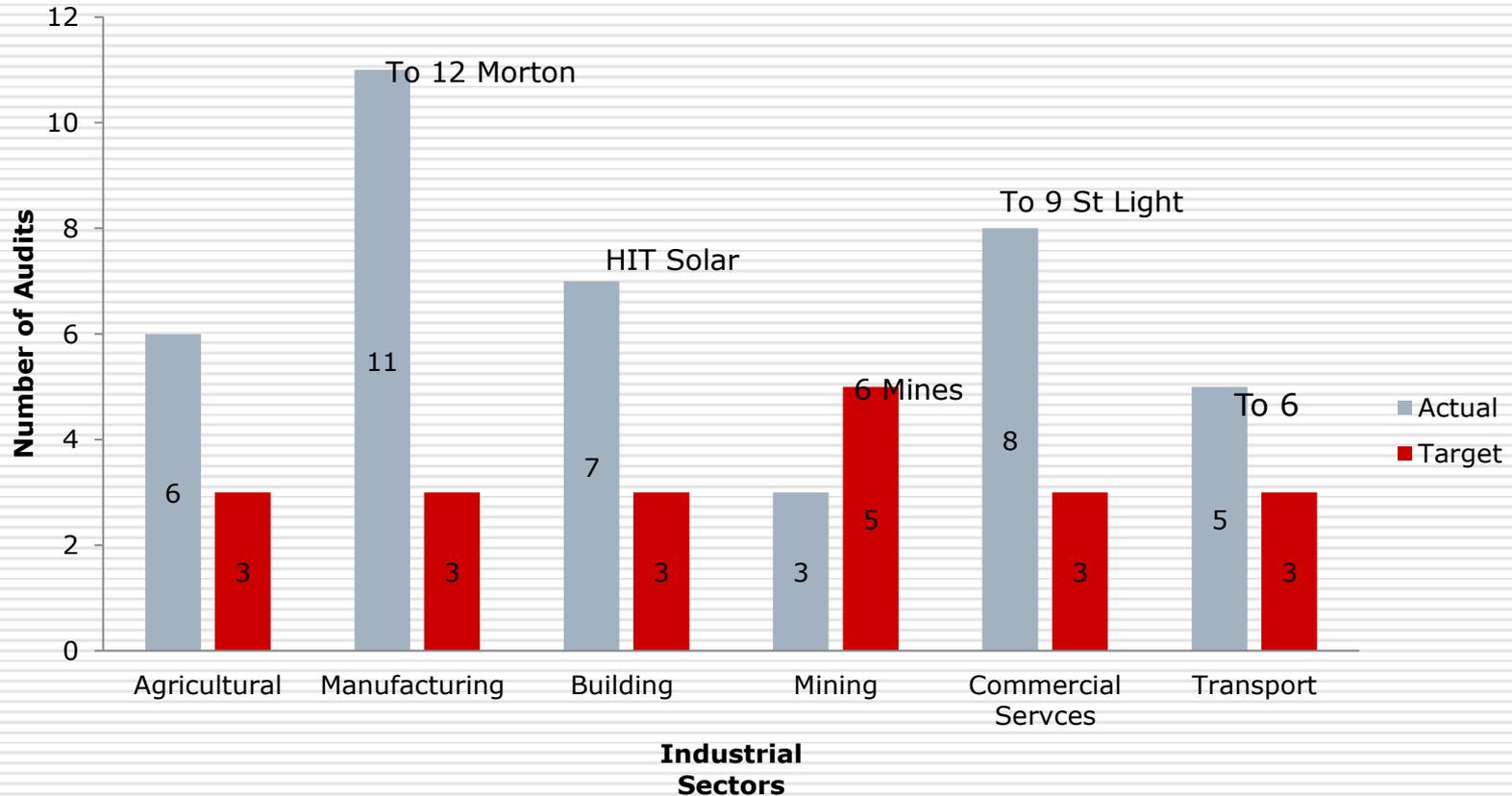
❖ Finding ways to save energy is like finding money.

Money Saving Opportunities

Most **Conservatively**, US\$20 million **Per Month** is being wasted; and a 300MW power station, can be avoided through energy efficiency improvements.

Summary / Quantification of Audits to Interim Report

Actual vs Contractual



Executive Summary: Main Findings

- ❖ ***Information and Record Keeping Inadequacies.***
 - Less than 20% had easily accessible data. It typically took weeks to have energy and economic activity information availed to us. Much of this information out of sych, e.g. tones produced and no energy consumed and *vice versa*.
- ❖ ***Lack of Integration between Production information and Energy information***
 - *Communication between those responsible Production and those responsible for energy, if they existed, left much to be desired.*
- ❖ ***Inadequacy in personnel responsible for energy efficiency and management.***
 - *In the majority of cases, there was no person designated as energy manager; engineers or maintenance managers often assumed the role, in addition to other duties.*

Executive Summary: Main Findings (Cont.)

- ❖ **Lack of or Limited Check /Sub-meters.**
 - *The general absence of consumer owned check or sub-meters (especially sub-meters)of concern since this made it almost impossible for those tasking with energy savings would make it difficult to assess energy performance on a unit basis. (The Utility installs Check Meters for very large consumers).*
- ❖ **Limited Awareness of the need for Energy Efficiency**
 - *Management generally aware, but no information passed down to lower levels of workshop or public.*
- ❖ *Communication between those responsible Production and those responsible for energy, if they existed, left much to be desired.*
- ❖ **High Base Load Energy.**
 - *Base load energy, i.e. energy used when there was no economic activity was, while unavoidable, found for some entities to be inordinately high. In some cases this was attributed to non-core activities, which is not good practice.*

Executive Summary: Main Findings (Cont.)

- ❖ **Lack of Energy Efficiency Culture through organisations.**
 - *Example: High consumption security lights, on during day; wrong application of compressed air.*
- ❖ **Inadequate Plant Monitoring Systems**
 - *Observed through observation and our instrumentation cases of process parts operating below par.*
- ❖ **Inadequate Maintenance Practices**
 - *Steam and water leaks and inadequate insulation.*
- ❖ **Aged Infrastructure and Lack of Renewal**
 - *Patently obvious cases of deteriorated, dysfunctional infrastructure were observed; much of it well known to the owners, who for economic reasons could not embark on renewal programmes.*
- ❖ **Power Unreliability and Quality Problems.**
 - *There was **not one** entity who was satisfied with the power supplied by the utility. Load shedding was criticised and so was the occurrence of surges and under voltage.*

❖ ***Barriers to Energy Efficiency***

(i) Limited information availability and lack of awareness of the need to work, live and act in energy efficient ways. Some of the behaviours we noted are attributable to this.

(ii) Financial Restrictions. Almost every entity we interacted was aware of the need to improve process efficiency through plant renew renewal. Lack of financial resources or capital injection proved, however to be a stumbling block.

(iii) "Don't care" situations. We identified initial tardiness from some important players in actively participating in the exercise. An example is the situation involving a landlord and a tenant. The landlord is expected to fund some energy efficiency measures or retrofits which only the tenant has direct benefit.

❖ ***Some Positive Findings***

1. All the entities that we interacted with were keen to engage with us and keen to do all in their power to improve energy efficiency. The number of entities wanting to participate in the audit and willing to furnish us with the required information is increasing. This is a good sign.

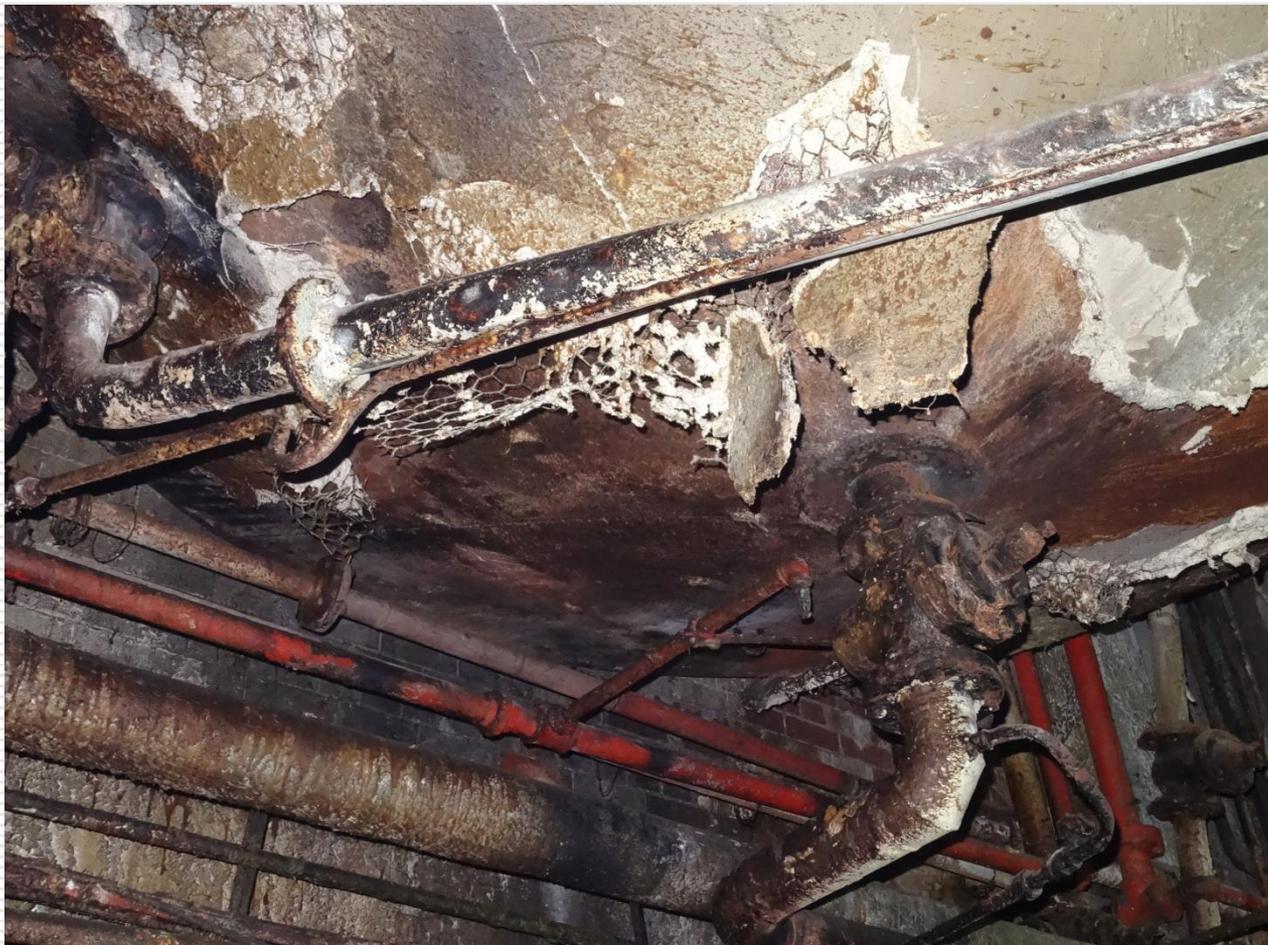
2 We observed positive energy efficiencies such as initiatives installation of improved lighting systems, more efficient plant such as compressors incorporating programmable logical controllers (PLCs).

3 We observed also that even entities that had been audited before by other consultants were keen to have re-audits by us.

4 We observed keen interest from entities wishing to have in-house training in energy efficiency. This included entities that had already undergone our stake-holder energy efficiency training workshop, held from 31 March to 2nd April, 2014.

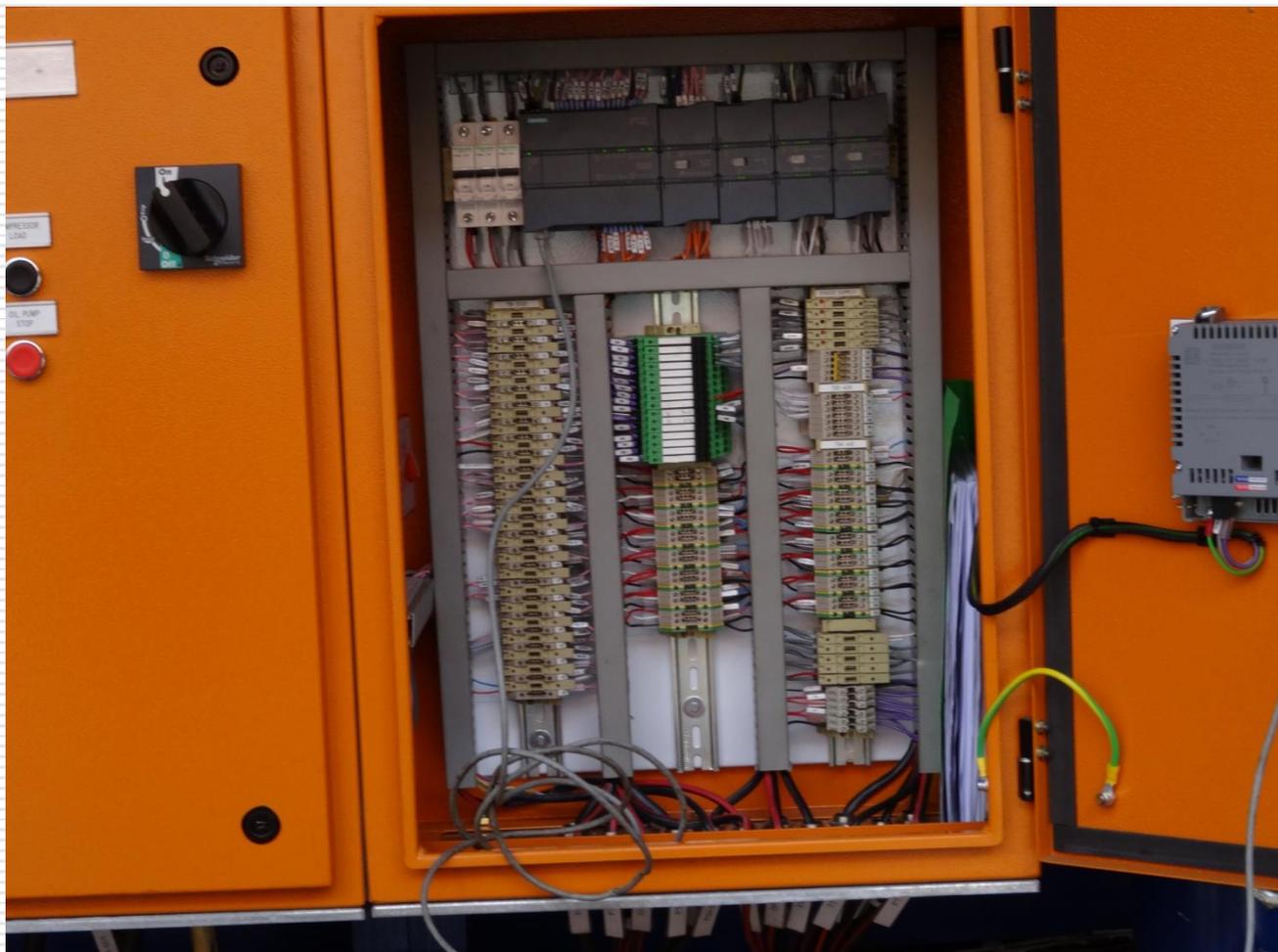
Executive Summary: Main Findings (Cont.)

Aged Infra Structure



Executive Summary: Main Findings (Cont.)

Modernisation in Same Plant



Executive Summary: Recommendations

❖ **Integrated Data gathering system**

- *We recommend that systems should be established within the industry to gather, verify and store data on energy use and corresponding energy consumption. There should be a record of such information not less than once a month.*

❖ **Integrated Production & Engineering Management Information System**

- *The apparent "divide" between production and engineering and financial information systems may be resolved by giving one person to compile the information related to product output, energy and water consumption as well as billing information and to report this information at monthly management meetings.*

❖ **Trained Energy Efficiency Manager (s)**

- We recommend that entities should have trained Energy Managers to attend to energy management challenges and look out for energy efficiency opportunities.

Executive Summary: Recommendations

❖ **Installation of Sub-meters.**

- *The general absence of consumer owned sub-meters of concern since this made it almost impossible for those tasking with energy savings would make it difficult to assess energy performance on a unit basis.*

❖ **Limited Awareness of the need for Energy Efficiency**

- Although, after some difficulty in some cases, we obtained some information on electricity and other energy consumption as well as production data (often in raw form) and electricity bills. We were forced to “throw out” certain “outliers” on that basis that these made little sense from an order of magnitude or common sense point of view. This led us to believe that some of the information was not in synchronism with the other.

❖ **An Energy Efficiency Awareness Program**

- *We recommend that there be at least three approaches to make energy users and occupiers of buildings more aware of the need to act and work in more energy efficient manners. One approach starts at the company corporate level, the others are through programmes by the Utility (ZESA) and Regulator (ZERA).*

❖ **Introduction of Automatic Controls and Investigation in to high base load energy.**

- *Base load energy can sometimes be unavoidable as processes with long start-up times or systems that need to be kept warm and also for any process that supports the production process. Some of the base load energy can be reduced by the introduction of automatic controls (daylight switches, occupancy) especially for lighting..*

Executive Summary: Recommendations

❖ **Company Energy Policies**

- *So far we have not seen evidence of entities that have a formal energy efficiency (i.e. documented) policy. A well thought out energy policy with measures to ensure that it permeates right down to the factory floor would bring enormous benefits.*

❖ **Maintenance Management and Plant Monitoring Systems**

- *It is a well established fact that bad maintenance practice courts energy inefficiency. Leaking valves, damaged insulation, clogged piping, worn out bearings, dirty luminaires do not augur well for energy efficiency. We therefore recommend that entities incorporate formal maintenance planning and management systems which incorporate means to ensure that any prescribed schedules are actually executed.*

Executive Summary: Recommendations

❖ **Training of Maintenance Staff**

- *Several of the entities we interacted could benefit if their maintenance staff of all levels were trained in effective maintenance methods. For many years the Zimbabwe Institution of Engineers (ZIE) has organised courses in this area. These training now earn continuous professional development (CPD).*

❖ **Plant Replacement & Renewal Programme**

- We strongly recommend this for entities that are operating old and inefficient plant. From an energy efficient point of view, this is a good recommendation especially because there will then be an opportunity to purchase equipment for improved process flow as well as individual equipment efficiencies. This applies especially to electric motors when energy efficient varieties are available and, for some applications, variable speed drives (VSDs) can be deployed to best advantage.

Executive Summary: Recommendations

❖ **Enforcement of building standard and industry-wide energy efficiency norms.**

➤ *For energy efficiency to be achieved at a national level, we recommend any policies or directives that would set uniform standards that would promote energy efficiency and that both our places of work and habitat are energy efficient.*

❖ **Regulatory Enforcement of Power Quality Norms**

➤ *The reports we have received and measurements we have carried out ourselves indicate that power quality issues are affecting almost every entity in Zimbabwe. Some of the consequences have been quite drastic, especially loss of production through damaged equipment. We recommend voluntary action by electricity supply authorities that ensures that the electricity supply quality to customers in terms of its reliability, voltage, frequency and waveform comply with international norms.*

Discussion on Some of the Audits: The Steps

❖ **Obtain Baseline Data**

➤ *The purpose of a baseline is to have a reference or pivot upon the effectiveness of any energy conservation measures can be judged. In terms of the International Measurement and Verification Protocol, base years should not be too far into the past. We have used 2013 as a base year. In a few cases where there was incomplete data, we have used 2012.*

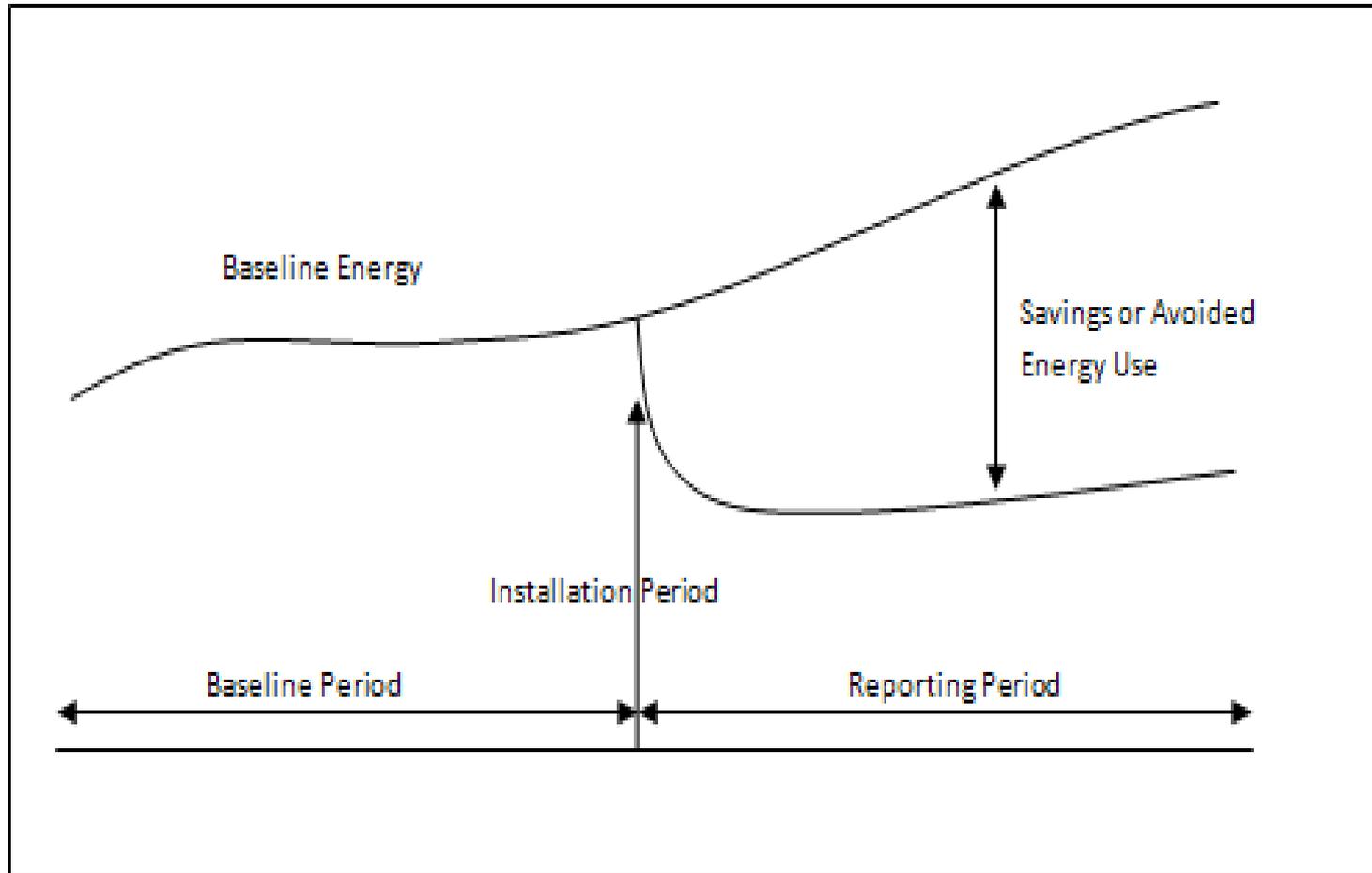
❖ **Identify Key Energy Drivers for Economic Activities**

➤ *Usual "energy drivers "are the economic activities in terms volumes or tones of output. For certain activities, drivers can be hours of operation, or levels occupancy.*

❖ **Produce the baseline equation & determine correlation**

➤ *The above is in line with IPMVP guidelines. The baseline equation allows us to estimate energy savings and an energy intensity (incremental value), **for that entity only**, based on ECMs elected by **that entity**. For national and international benchmarking, however, intensities are **annual averages**.*

Estimation of Energy Savings



Example Audit: Mining

Mining

❖ *Entities to Interim Stage: 2; Entities to Final Draft: 5, Contractual: 3*

a. The sector energy consumption is 19%. To achieve performances near benchmarks, 24% average savings can be made. Based SAPP 2014 figures, there would be 9MW, avoided power station. Since data from 3 more entities is to be collated, the figures still have to be finalised.

b. Information Availability Reliability

Energy consumption data was found readily available in both the production and finance department. Record keeping in this sector was detailed and found to be complete as it included consumption data for all energy sources. Challenges were found in obtaining complete electrical inventory lists in particular lighting and motor inventory lists.

c. Energy Policy

One entity was found to have a policy which was instituted on a group level.

d. Power quality

We found and measured power factor that ranged between 0.78 and 0.99. Volunteers mentioned that power supply affected their operations significantly as power dips and supply affected production targets. Entities mentioned that the ring fenced tariff was limited energy efficiency investments as the premium paid on ring fenced tariffs limited cash flows for energy efficiency investments.

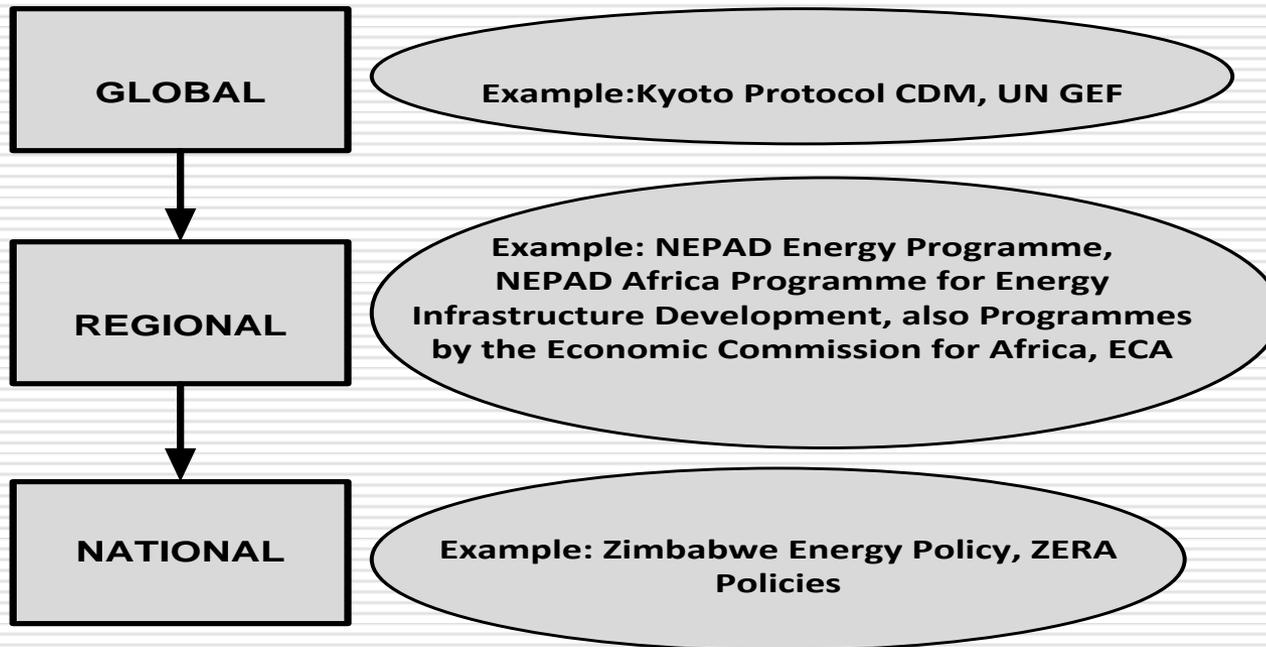
e. IT

Data was provided in the form of electronic monthly reports which included production and consumption data. All the mines audited had PLC and Scada systems in place which monitored plant performance which includes input consumption and processed ore.

Policy Instruments

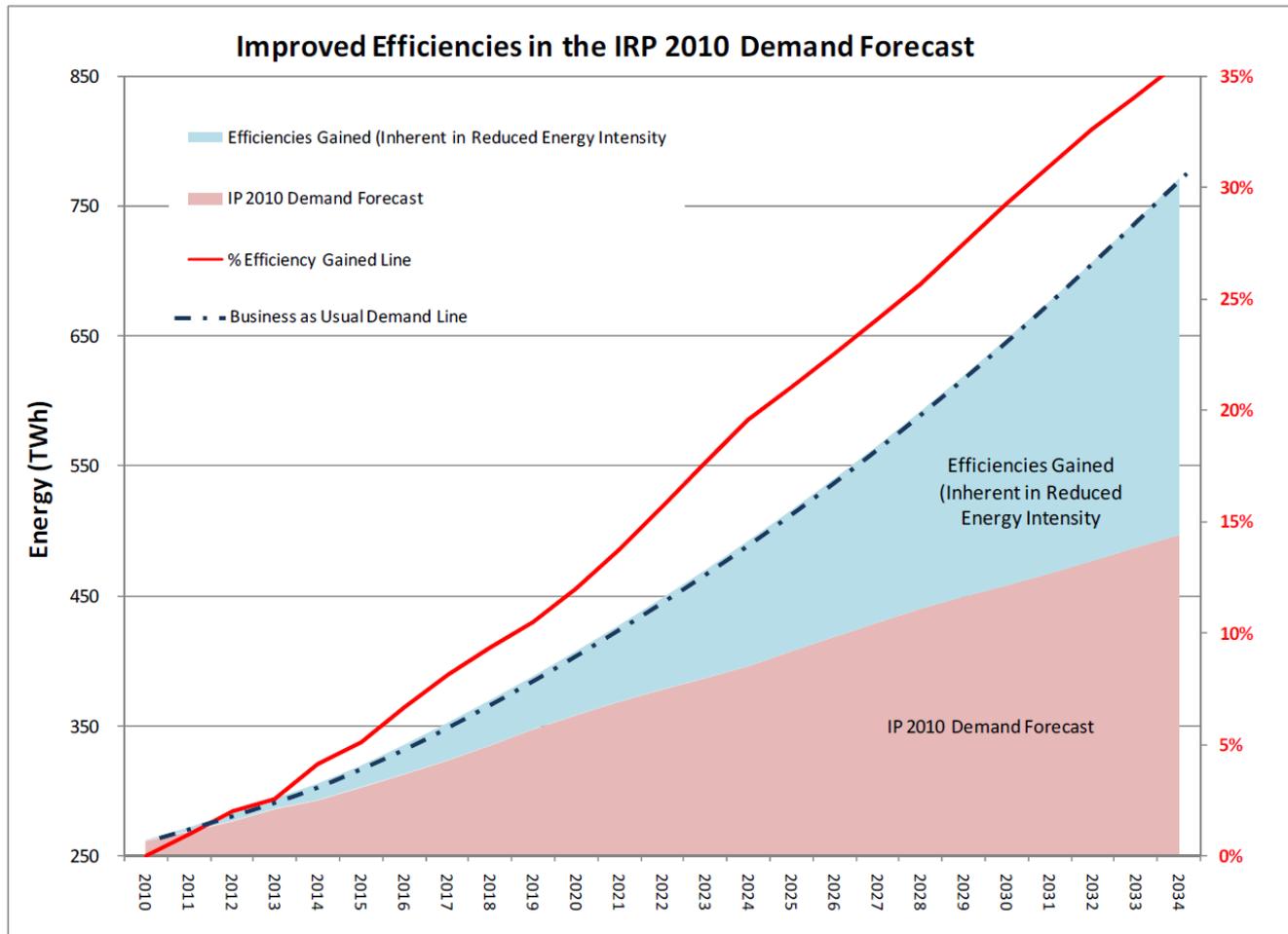
Policy Frameworks for Promoting Energy Efficiency

Policy frameworks and economic dictates guide us; indeed compel us to be energy efficient manner. Therefore Zimbabwe's Energy Efficiency Policy Frameworks should not only take a cue from the broader Zimbabwe Energy Policy but also its international obligations

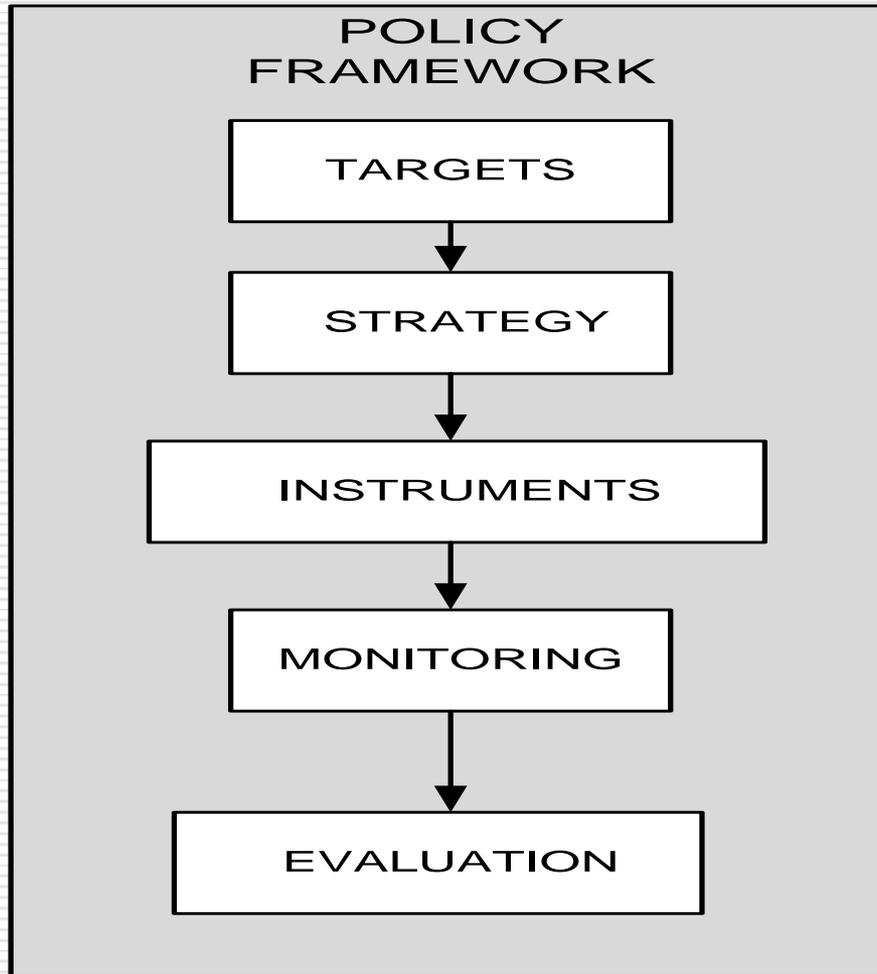


Policy Instruments: RSA Example

Policy Frameworks for Promoting Energy Efficiency



Policy Making: Frameworks and Related Activities



Policy Instruments: RSA Example

Policy Frameworks for Promoting Energy Efficiency

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| South Africa 1998: Enabling Process: White Paper on Energy Policy | |
| Department of Energy : (1) Policy to support the Energy Efficiency and Demand Side Management (2) Program for the Electricity Sector through the Standard Offer Incentive Scheme (2010) | |
| Policy Design Cycle | |
| Targets: >>>>>>>>> | National Energy Efficiency Improvement Target, 12% by 2015 |
| Strategy: >>>>>>>>> | South African Energy Efficiency Strategy (2005) |
| Instruments: >>>>> | ESKOM DSM, Government 12L Tax, CDM and other International Initiatives |
| Monitoring | |
| Evaluation | |

Policy Instruments: ESKOM DSM, (part of IDM)

Eskom DSM, which evaluates it technically and financially. If deemed to be cost-effective, Eskom funds the ESCO (Energy Services Company) to implement the project(s). The new funding model is based on international best practices while still focused on the unique South African context. ESKOM's contribution is 50% (Funds from Regulator).

(i) Industrial or Commercial users will gain:

- Free upgrades or retrofits
- Savings on monthly electricity accounts

(ii) An ESCO can enjoy:

- Financial benefits via implementation and maintenance of the project(s)

(iii) Eskom and their clients will benefit from:

- Capital expenditure deferral of building generation capacity and transmission and distribution lines
- Lower electricity price increases
- Less pollution emissions
- Less water consumed"

US Initiatives

| | | |
|-----|------------------------------------------|----|
| 2 | Buildings | 5 |
| 2.1 | Building codes | 7 |
| 2.2 | Appliance Standards | 12 |
| 2.3 | Labeling and Education | 14 |
| 2.4 | Financial Incentives | 14 |
| 2.5 | Research and Development | 19 |
| 3 | Transportation Sector | 20 |
| 3.1 | Fuel Efficiency Standards..... | 21 |
| 3.2 | Labeling and Consumer Education..... | 24 |
| 3.3 | Incentives..... | 24 |
| 3.4 | Technical Assistance | 26 |
| 3.5 | Urban Planning and Behavior Change | 28 |
| 3.6 | Research and Development | 29 |
| 4 | Industrial Sector | 30 |
| 4.1 | Incentives..... | 30 |
| 4.2 | Technical Assistance | 33 |
| 4.3 | Research and Development | 34 |
| 5 | Power Sector | 35 |
| 5.1 | Incentives..... | 36 |
| 5.2 | Research and Development | 41 |

Conclusions / Summary

- ❖ Progress has been good and we will be doing more audits to improve credibility.
- ❖ Information gaps are quite serious and there needs action by all stakeholders.
- ❖ Energy efficiency awareness needs to be intensified.
- ❖ The sector from supply & consumer side is under-invested.
- ❖ There needs to be more encompassing Policy Frameworks.
- ❖ Power Quality problems are quite serious.

Information and Data Sources

- >Energy Savings Toolbox An Energy Audit Manual and Tool by Canadian Industry Program for Energy Conservation (CIPEC)., industry and the Office of Energy Efficiency of Natural Resources Canada
- >M&V Guidelines: Measurement and Verification for Federal Energy Projects, US Department of Energy, Office of Energy Efficiency and Renewable Energy.
- >International Performance Measurement and Verification Protocol, Energy Valuation Organisation (IPMV) the current published version is Version 12.
- >ISO 50001 version 11, Energy Management Systems South African National Standard (SANS) 204 Energy Efficiency in Buildings.

End!



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