



The World Future Energy Forum (WFEF) 2016

**Achieving Sustainable Energy Delivery in Developing Countries -
Energy Security and Climate Stewardship Roadmap for Zimbabwe.**

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Affordable, Reliable and Sustainable Energy for the Future

About the Presenter

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Presentation Outline

- **Introduction**
- **The Energy Scene in Zimbabwe and SADC**
- **Climate Stewardship & Need for Sustainable Energy Roadmap**
- **Sustainable Development Goals (SDGs)**
- **Renewable Energy (RE)**
- **Demand Side Management (DSM) & Energy Efficiency (EE)**
- **Carbon Capture and Storage (CCS)**
- **Reducing Emissions & Energy use in the Transport Sector**
- **Recommendations**
- **Conclusion**

Introduction

- The energy demand-supply balance in Zimbabwe has been inadequate since 2007, leading to inconveniences such as load shedding, and unreliable utility services.
- Zimbabwe faces the challenge of how to resuscitate and sustain its industrial, manufacturing and agricultural economy, while lessening its dependence on energy imported from other countries and increasing its climate stewardship.
- Over the years, Zimbabwe has not exploited low carbon and renewable energy options vigorously except for Kariba Hydropower Station, other hydro or mini hydro green energy projects have remained undeveloped. There is now a rush to do everything all at once and sometimes outside the System Development Plan (SDP) Parameters!!!!
- Zimbabwe's economic growth and energy security now depend on rapidly accelerating the deployment of cost-effective ways to use the current energy supply more efficiently, diversify energy sources, and lower the carbon intensity of its traditional fossil energy supply.

Background to the Problem

- Emissions at current Coal fired stations still need drastic reductions.
- Our energy intensity is above World average.
- We have no national building codes that incorporate any standards and recommendations on energy efficiency (EE) and renewable energy (RE) for all of the following aspects:
 - Building envelope (insulation, sealing, etc.).
 - Lighting (technologies, control systems, etc.).
 - Heating, Ventilation and Air Conditioning (HVAC) systems.
 - Water heating systems (solar water heating).
 - Indoor air quality.
- Potential energy-efficient technologies are not identified on the market (No certification and labelling of the approved technologies).
- No recommendations have been made on energy-efficient equipment and materials that have been internationally recognized and tested with proper procedures.

Background to the Problem

- Building owners have no access to technical resources to conduct energy audits in their buildings and evaluate the potential cost-effective measures that could be implemented to realize significant energy savings.
- Not enough highly qualified auditors to undertake energy audits have been trained.
- No comprehensive energy audits have been conducted in the Zimbabwean energy consumer sector.
- Relevant players in the EE market (including manufacturers, Engineers, retailers, designers, architects, constructors, property developers, lawyers, financiers) are not aware of sustainability issues. **No Sustainability Thinking! The Green Building Council of Zimbabwe is yet to be launched. No LEED Certification in place etc.**
- According to a Namibian study on EE Baseline Survey under the Renewable Energy and Energy Efficiency Capacity Building Programme (REEECAP), 17% of local architects surveyed were not aware of EE issues in buildings whilst 67% were aware but still not implementing EE measures in their practice.

ZIMBABWE ENERGY COSTUMER CONCERNS

- Lack of Access
- Prohibitive Connection Fees
- Coverage and continuity of service
- Affordability/ Electricity Pricing
- Poor System Reinforcement
- Lack of Capacity
- Blackouts
- Efficiency
- Poor Customer Services
- Vandalism
- Environment/Sustainability

The World at Night! Africa easily the darkest



Earth at Night
More information available at:
<http://seawp.gsfc.nasa.gov/apod/ap001127.html>

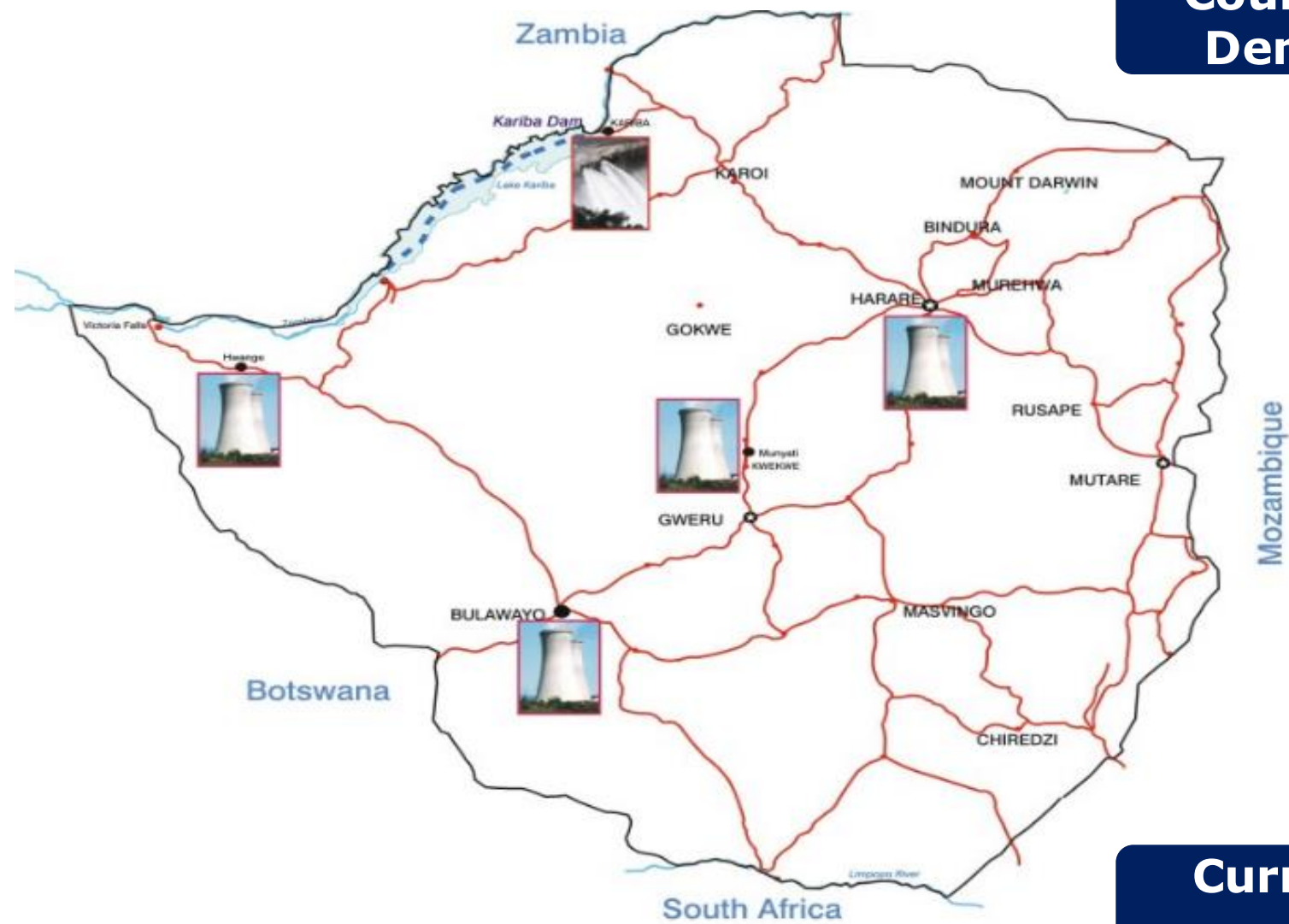
Astronomy Picture of the Day
2000 November 27
<http://seawp.gsfc.nasa.gov/apod/astropix.html>

The Zimbabwe Energy Scene

- According to a recent Zimbabwe Electricity Transmission and Distribution (ZETDC)'s System Development Plan, the power demand forecast is expected to reach about 3000MW by 2020. The current maximum demand is estimated to be 2200MW against an estimated production of ± 1200 MW.
- In order to increase the amounts of reliable capacity to meet the current and projected demand for local use and export, there is need for investment in the energy sector whose critical success factor is the required innovative funding to implement the projects. (Without compromising security of supply and of course consumer rights to affordable, clean and reliable energy).
- The projects must be funded with long term financing with conditions that they are to produce sustainable energy that mitigates against climate change by specifying reduced emissions. The loans must be acquired at primarily concessionary rates. There is need for ZPC and the Independent Power Producers (IPPs) to export some of the power for the purposes of raising funds service the loans and to increase generation capacity.

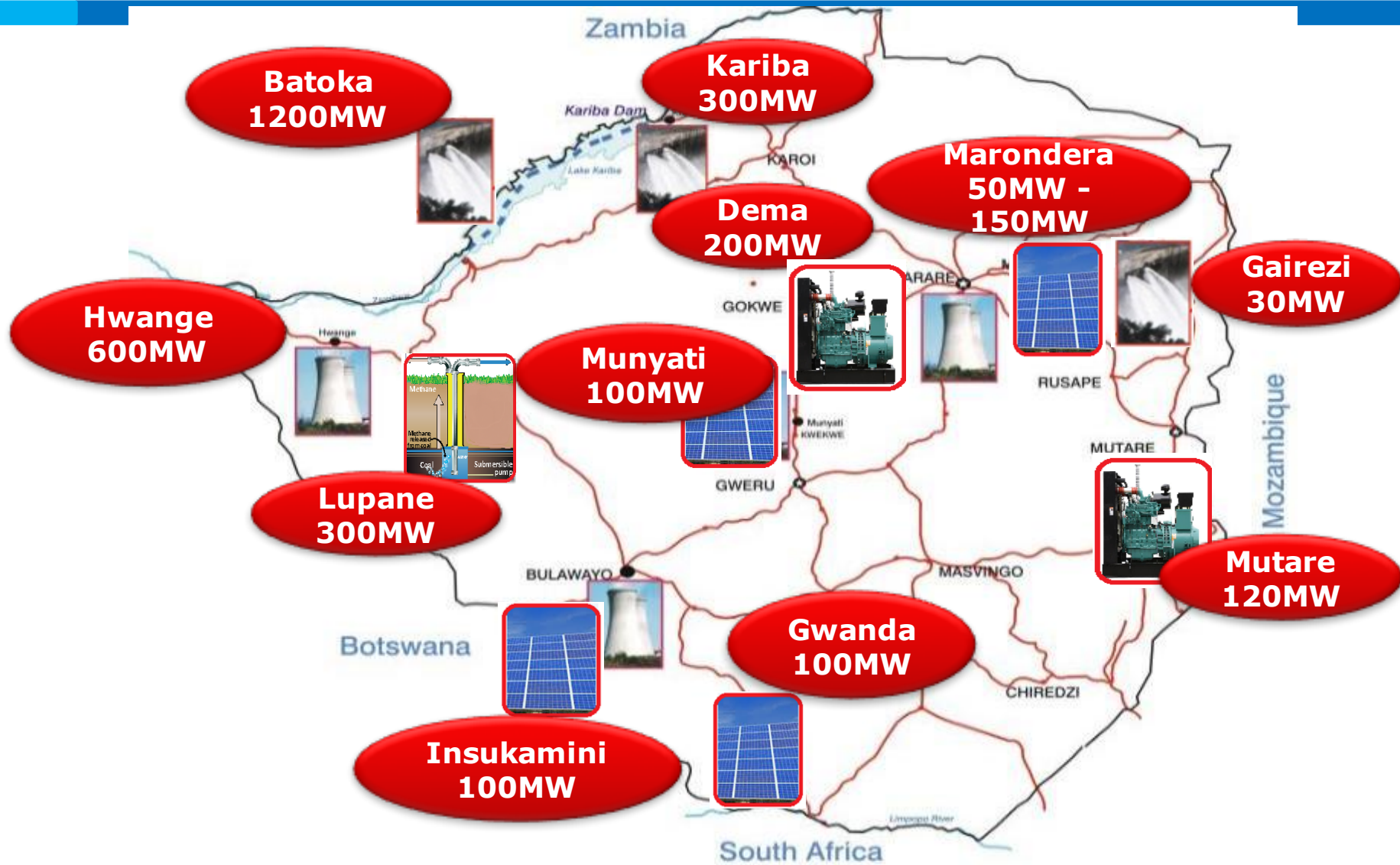
The Energy Scene in Zimbabwe(ZPC Current Plants). Excludes IPPs.

Country's Maximum Demand 2200 MW



**Current Generation
±1200 MW**

NEW POWER GENERATION PROJECTS IN ZIMBAWE



The Energy Scene in Zimbabwe

Zimbabwean Power Projects of Over 30 MW in progress

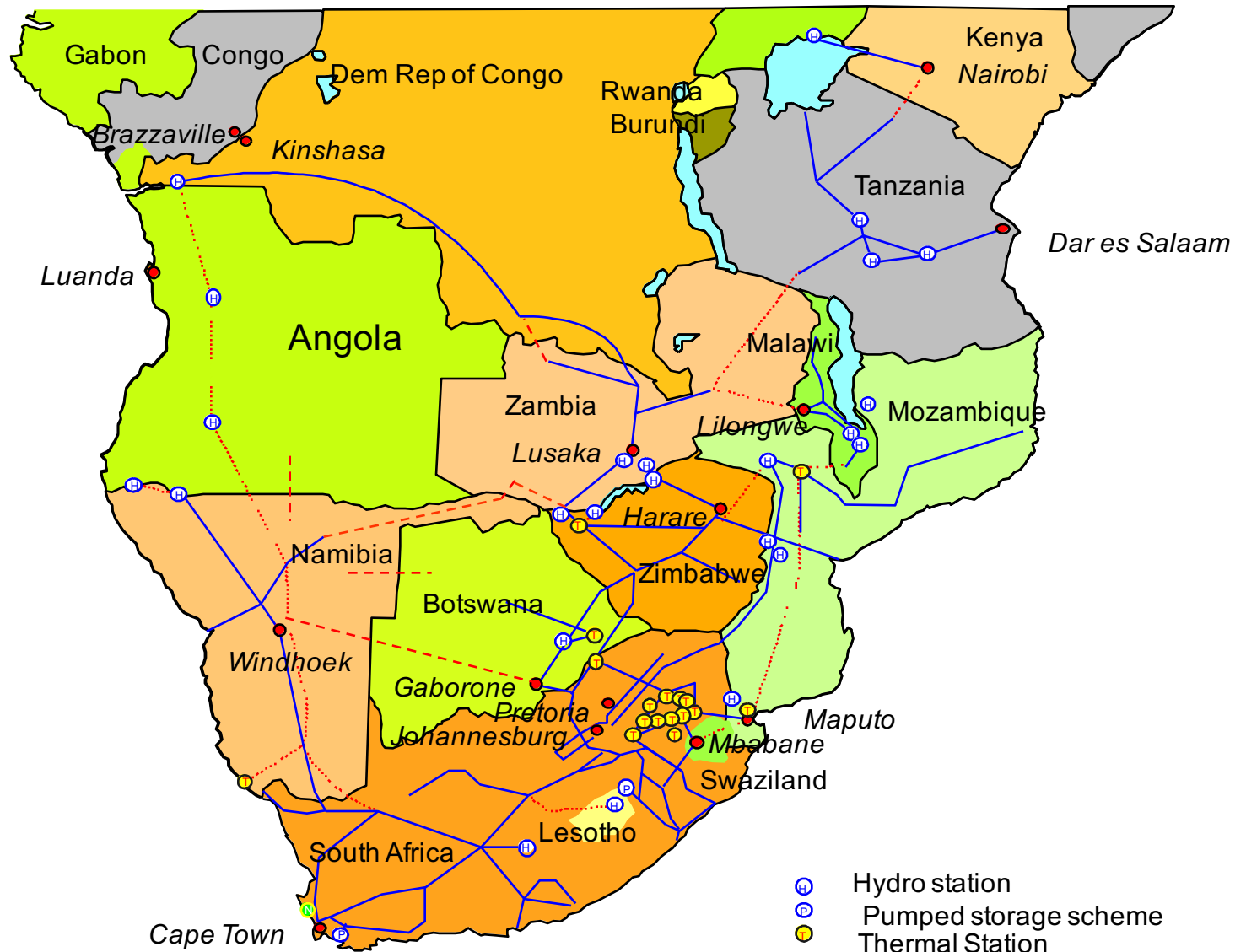
Project	Capacity	Estimated Dates		Project Status and (Implementing Authorities)
		START	END	
Kariba Hydro Expansion Project	300MW	2014	2018	▪ Project in progress . Commenced 10 November 2014 to be completed by 10 March 2018 (ZPC).
Hwange Extension Power Project	2x300MW	2016	TBA after financial closure	• 2 x 300MW of coal fired power plant units at Hwange Power Station. Project includes transmission infrastructure. (ZPC)
Solar Projects	300MW	2015	2017	▪ The tenders were awarded to three contractors. (ZPC). (Munyati, Gwanda, Insukamini site).
Mutare Peaking Plant	120MW	2016	2018	▪ Preparations to award EPC contractor and project managers. (ZPC).
Coal Bed Methane	300MW	TBA	TBA	▪ Funds are required to carry out feasibility studies, additional exploration, reticulation and water treatment. (ZPC)
Harare Repowering	60MW	2016	2017	▪ EPC contract was awarded and working towards financial close. (ZPC)
Bulawayo Repowering	90MW	2016	2018	▪ USD 87 million line of credit offered by the Indian government. (ZPC)
Munyati Repowering	100MW	2017	2018	▪ Award in progress. (ZPC)
Batoka Hydro	1,200MW	TBA	TBA	▪ Feasibility studies. (Zambezi River Authority, ZESCO & ZPC)
Gairezi Hydro Power	30MW	TBA	TBA	▪ Adjudication completed and awarded. (ZPC)
Marondera Solar	50-150MW	TBA	TBA	▪ IPP to start from 50MW to 150MW(De Green Rhino Energy)
Dema Peaking Plant	200MW	TBA	TBA	▪ Preparations to award EPC contractor and project managers. (ZPC)

Southern African Power Pool (SAPP) Membership

No	Full Name of Utility	Status	Abbreviation	Country
1	Botswana Power Corporation	OP	BPC	Botswana
2	Electricidade de Mocambique	OP	EDM	Mozambique
3	Electricity Supply Corporation of Malawi	NP	ESCOM	Malawi
4	Empresa Nacional de Electricidade	NP	ENE	Angola
5	ESKOM	OP	Eskom	South Africa
6	Lesotho Electricity Corporation	OP	LEC	Lesotho
7	NAMPOWER	OP	Nam Power	Namibia
8	Societe Nationale d'Electricite	OP	SNEL	DRC
9	Swaziland Electricity Board	OP	SEB	Swaziland
10	Tanzania Electricity Supply Company Ltd	NP	TANESCO	Tanzania
11	ZESCO Limited	OP	ZESCO	Zambia
12	Zimbabwe Electricity Supply Authority	OP	ZESA	Zimbabwe
	OP = Operating Member			
	NP = Non-Operating Member			

Southern African Grid

SOUTHERN AFRICAN GRID



GREENING THE ECONOMY BY THE GOVERNMENT OF ZIMBABWE

- **The National Energy Policy and Strategies is in place but could be improved!**
- **Need to launch the Renewable Energy Policy?**
- **Energy Efficiency Findings from SIRDC and ZERA/UZ studies whose key finding was that Geysers consumed 40% of Domestic electrical supply load and if converted to solar geysers a virtual power station of 300MW will be created.**
- **Compare with South Africa's solar water heater programme. The National Energy Regulator of SOUTH AFRICA allocated funds to develop the Solar Water Heating Rebate Programme which included marketing and funding the incentives for consumers. Eskom, has subsidised purchases of registered solar water heaters since 2008. By the end of 2011, more than 122 000 systems were rolled out, resulting in energy savings of approximately 60 GWh/yr (ESKOM, 2011).**
- **Armed with this the Government created the National Water Heater Programme (NWHP) comprising of 5 Ministries, SAZ, Reps from Higher learning Institutions, Research Institutions and the Solar Energy Industries Association. The ZIE and ECZ completely overlooked despite their track record of expertise on sustainability issues locally and internationally.**
- **Aim was to compel all new houses to have solar geysers and refurbish existing ones. (Need for Institutional Frameworks, statutory, financing etc.)**
- **There is need for a Holistic Intervention and Structured Approach to Greening our economy.**

The Way for Zimbabwe to Go for Effective Greening of our Economy

Zimbabwe must focus on three sectors, representing 90+% of the energy consumption

INDUSTRY



BUILDINGS



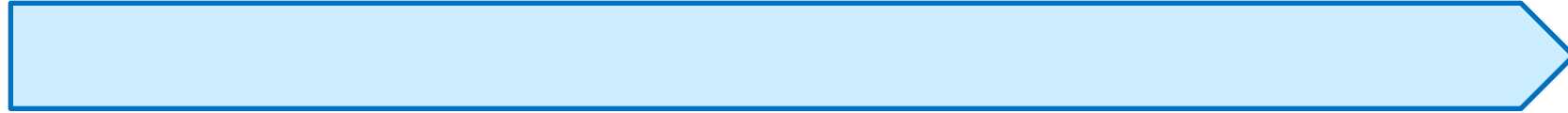
TRANSPORTATION



Guiding Principles

- 1 Form the Zimbabwe Energy Efficient Centre (ZEEP) to focus on DSM and E efficiency
- 2 Energy price reforms must be kept from its mandate and be dealt with by ZERA.
- 3 Design Renewable Energy initiatives while ensuring no negative impact on end users
- 4 Achieve consensus with all involved stakeholders

Need to target the public with general awareness and specialized campaigns to support the launch of the EE initiatives

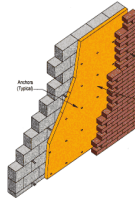


Awareness campaigns

AC



Insulation



White goods



LDVs



Using multiple channels

Press



Mall/ Outdoor



Radio



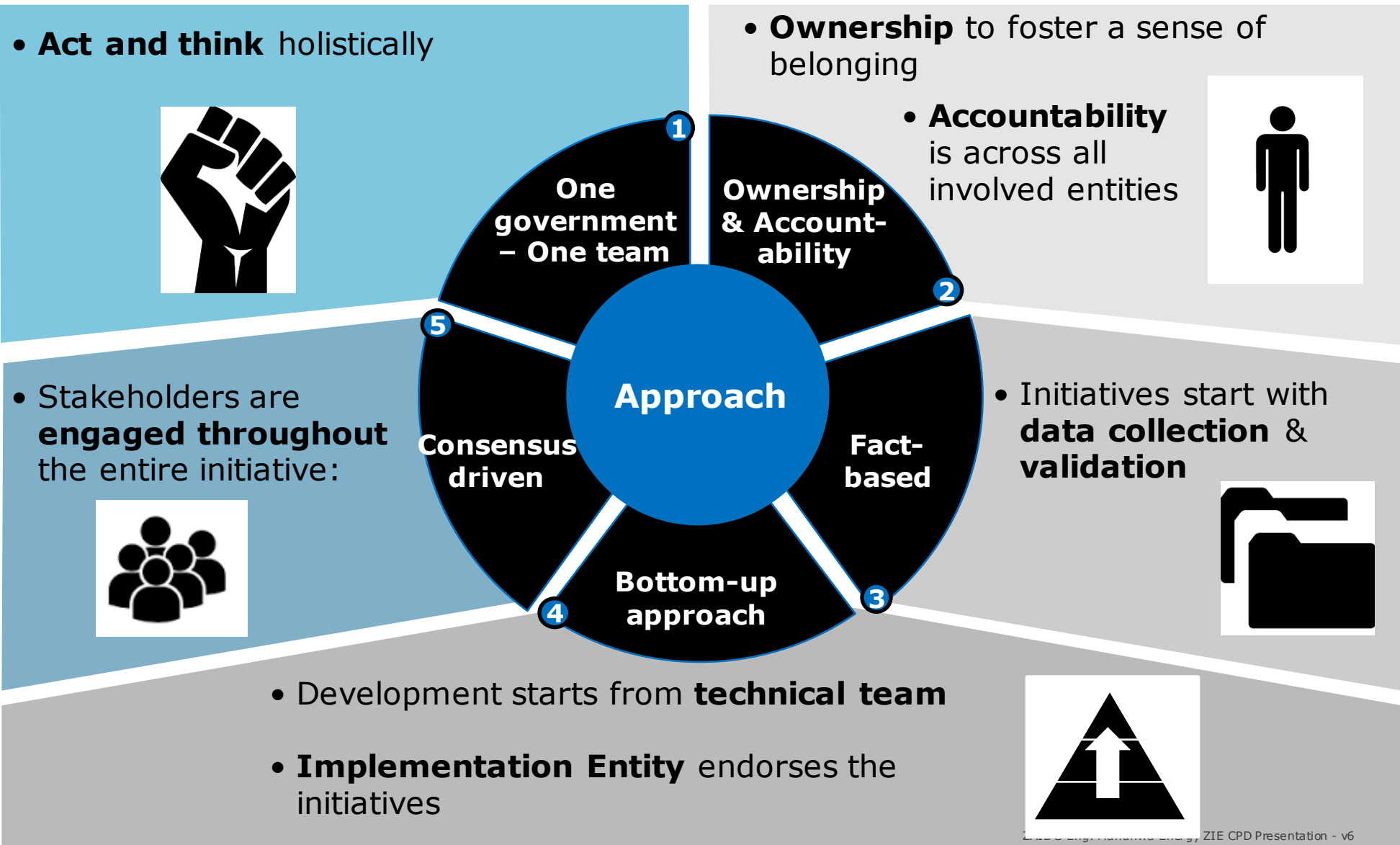
Television



Social Media



Sustainable Energy delivery approach is based on **5 key guidelines**



How to promote energy productivity at the sector level ?

Two main courses to improve energy productivity in Zimbabwe:

- **Restructuring the economy towards non-energy intensive sectors**

Fundamental changes in national socio-economic apparatuses / Zimbabwean context & long term strategies

- **Substantially improving energy efficiency**

Total annual consumption in Zimbabwe for 2030 can be 75% of its projected value in a 'low policy intensity' scenario / as much as 50% with more aggressive 'technical potential' scenarios

Sustainable Development(Integrated Approach)

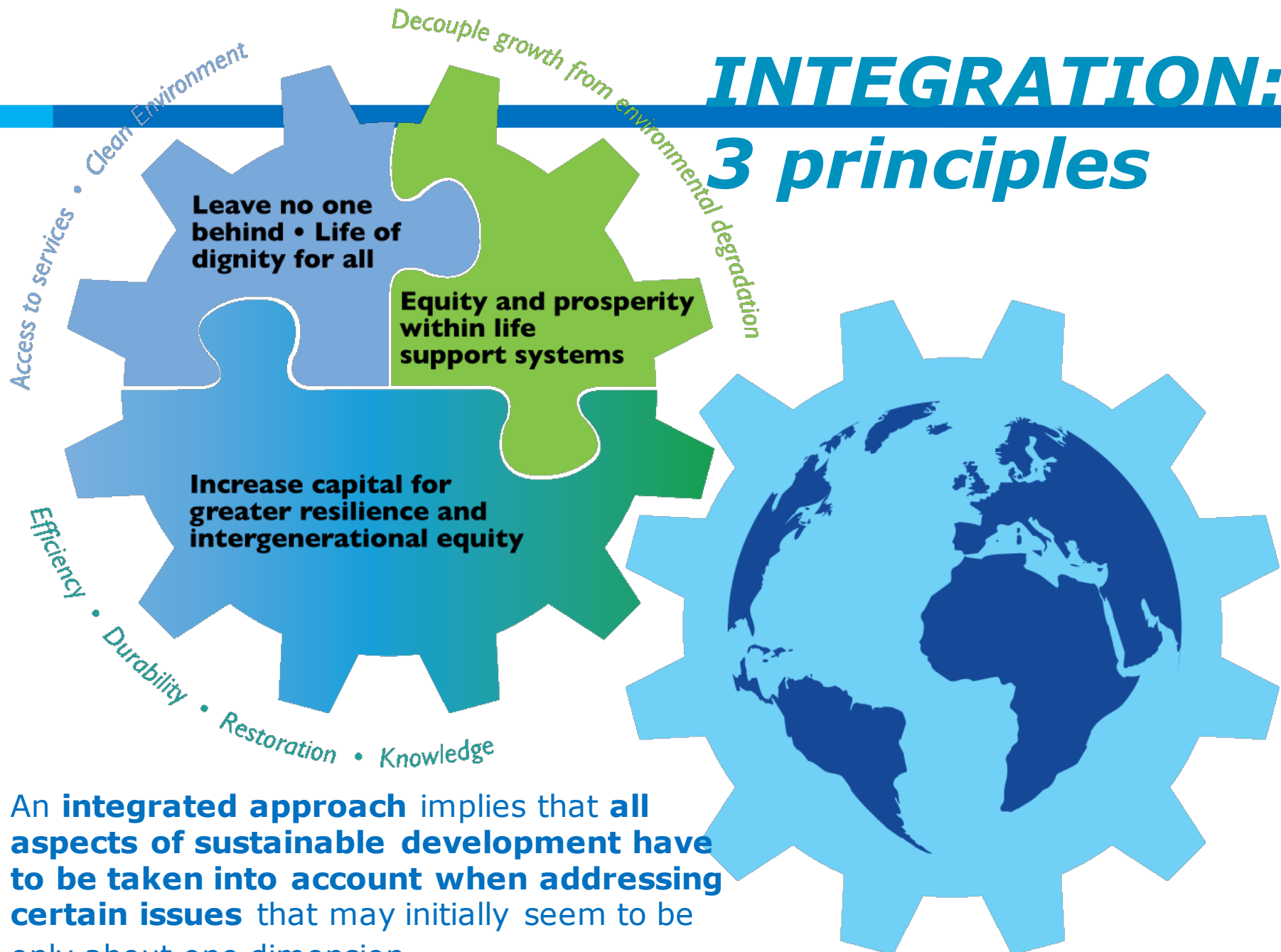
Sustainable Development:is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

An integrated approach provides for **strategic decisions and actions** aimed at meeting the objectives of sustainable development and poverty eradication. UN Secretary-General Ban Ki-moon makes a strong case for integration in his 2014 Synthesis Report on the post-2015 Agenda and SDGs, highlighting the need for a **people-centred** and **planet-sensitive** agenda and stressing:

*"This integration provides the **basis for economic models that benefit people and the environment**; for **environmental solutions that contribute to progress**; for **social approaches that add to economic dynamism** and allow for the **preservation and sustainable use of the environmental commons**; and for **reinforcing human rights, equality, and sustainability**. Responding to all goals as a **cohesive and integrated whole will be critical to ensuring the transformations needed at scale.**"*

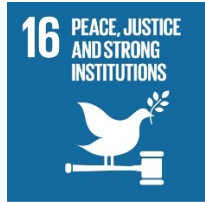
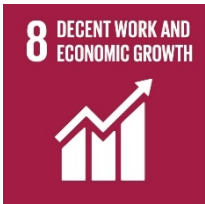
The complexity, magnitude and the interconnectedness of environmental change does not mean that decision-makers are faced with the stark choice of **"doing everything at once in the name of integrated approaches or doing nothing"** in the face of complexity

INTEGRATION: 3 principles



An **integrated approach** implies that **all aspects of sustainable development have to be taken into account when addressing certain issues** that may initially seem to be only about one dimension.

Delivery of Agenda 2030 requires us to have an Action Oriented Outlook to plan for the future!



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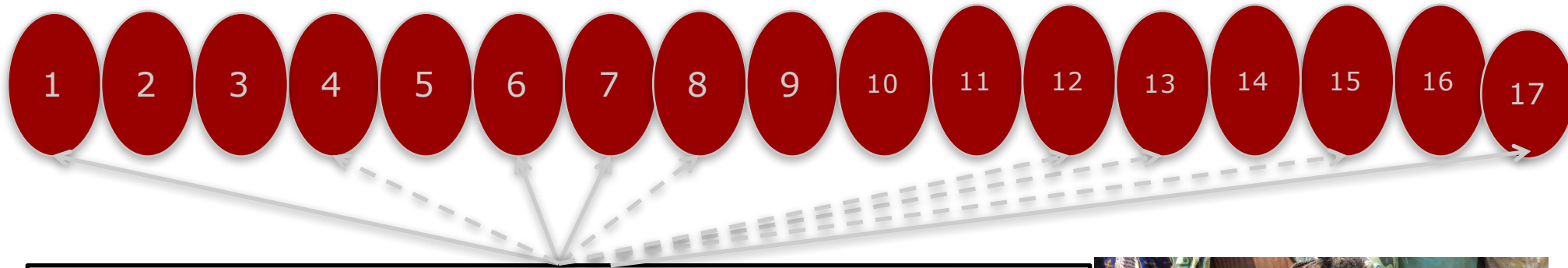
Environmental sustainability for the Sustainable Development Goals in the 2030 Agenda

In September, the 2030 Agenda for Sustainable Development is expected to be adopted at the United Nations summit held in New York. The 17 Sustainable Development Goals build on the eight Millennium Development Goals and aim to end poverty, protect the planet, and ensure peace and prosperity for all.

⊗ = related goal



Sustainable Development Goals

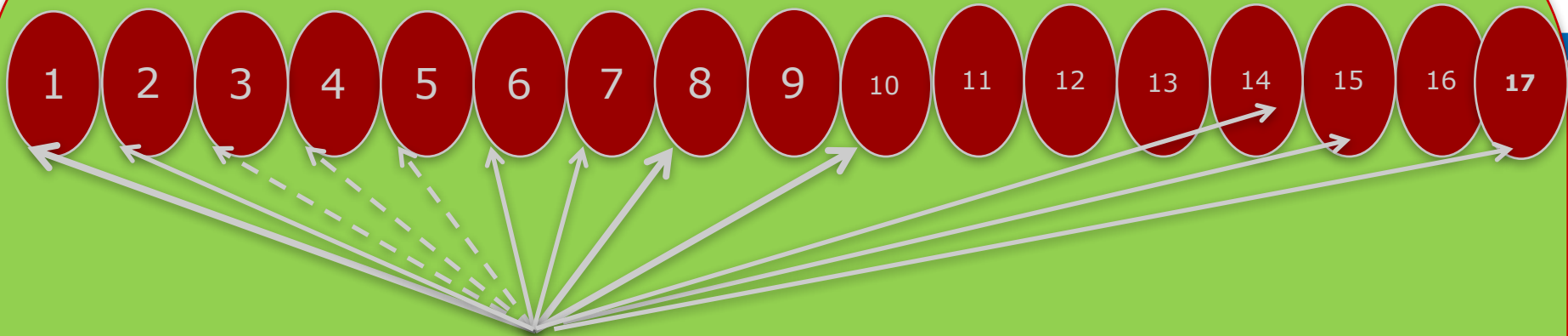


WATER AND ENERGY FOR ALL THROUGH RENEWABLES

- Off-grid energy in remote areas
- Water resource management
- Efficiency of use of water
- Rehabilitation of freshwater
- Reform of wasteful incentives



Sustainable Development Goals



POVERTY ERADICATION THROUGH AN INCLUSIVE GREEN ECONOMY

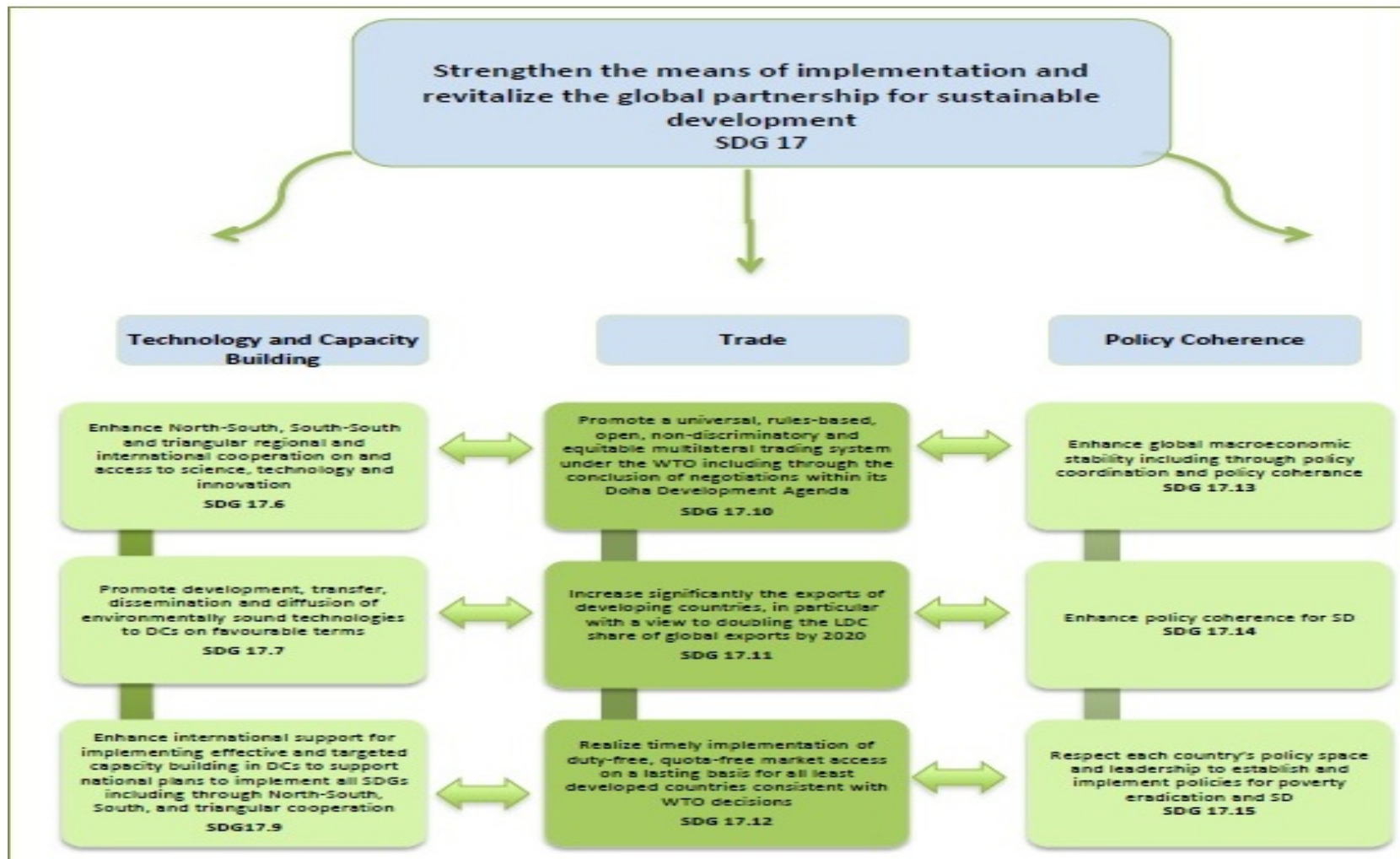
- Redefine poverty
- Redefine economic growth
- Green, decent jobs and equal opportunity
- Social protection and
- Universal services



Dinka women in Abyei. Photo credit: M. Niamir-Fuller 1981

Means of Implementation – Global Partnerships

**Figure 1 – Means of Implementation and Global Partnerships:
SDG 17 Targets Most Relevant to Trade**



Renewable Energy Options for Zimbabwe

- **Renewable Energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind , water, tides, waves and geothermal heat.**
- **Renewable energy resources exist over wide geographical areas.**
- **Renewable Energy Sources are generally from**
 - 1. Solar Thermal Energy**
 - 2. Solar Photovoltaic Energy**
 - 3. Wind Energy**
 - 4. Hydrogen**
 - 5. Tidal and Wave Energy**
 - 6. Hydropower (Sometimes limited to Small and mini-hydros)**
 - 7. Geothermal Energy**
 - 8. Biomass and Biofuels**
 - 9. Future Developments**

Those underlined are abundant in Zimbabwe and many African Countries.

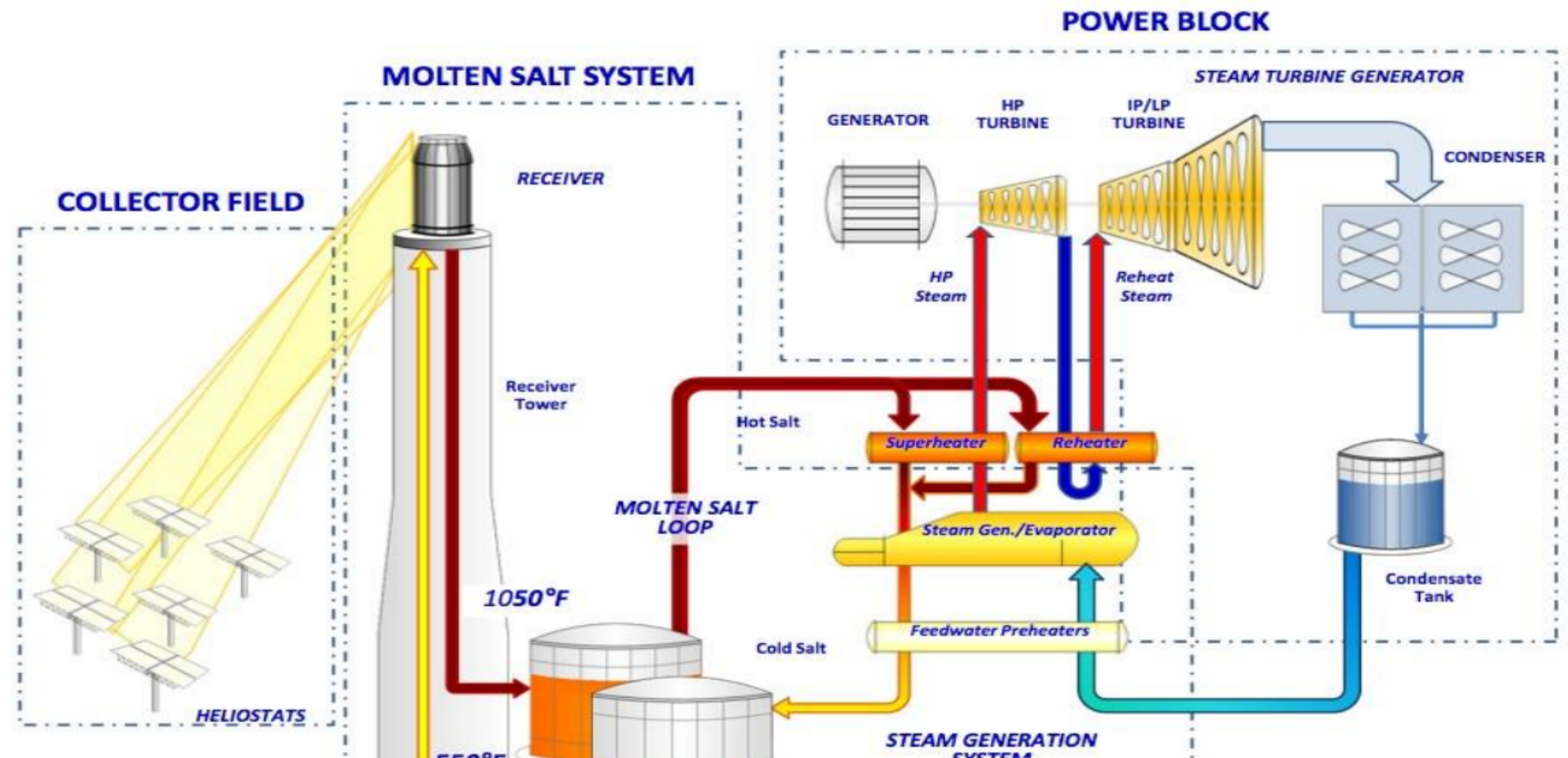


Example of a Solar Farm (PV Technology)



An Example of a Solar Power Tower (Using solar collectors – heliostats to heat water or salt to turn turbines)

How a Power Tower Works



Energy Efficiency & Demand Side Management

- Energy market dynamics are challenging.
- Energy intensive firms survival depends on adroitly managing the purchase and use of energy through DSM operational strategies such as:
 - peak shaving or demand control,
 - load shedding,
 - fuel switching,
 - abnormal situation management,
 - interruptible energy supplies,
 - real-time optimization.
 - temporary production curtailment by shutting down marginal plants
 - accelerating maintenance turnarounds

Regulatory mechanisms & Framework for energy savings and efficiency.

The Zimbabwe Energy Regulatory Authority (ZERA) is a statutory body established by the Energy Regulatory Authority Act [Chapter 13:23] of 2011. The Act mandates and empowers the Authority to regulate the procurement, production, transportation, transmission, distribution, importation and exportation of energy derived from any energy source.

The short-term and long term energy needs for residential, industrial, commercial, and governmental customers should be met in an optimum manner that assures a reliable, safe, clean, and affordable supply.

POSSIBLE REGULATORY INTERVENTIONS

- Establishment of an independent energy regulator (Ideally ZERA should be independent with some countries giving it power to report to Parliament or OPC)**
- Mandatory appliance efficiency standards by an independent regulator**
- Compulsory Demand Side Management programmes by utility and its customers**

Regulatory mechanisms & Framework for energy savings and efficiency.

The Energy Regulator:

- Guarantees the **promotion of competition and efficiency and ensures adequate quality standards in the electricity and gas** sector.
- **Major activity fields:**
 - Tariff setting
 - Definition of service quality standards
 - Definition of technical and economic conditions for access and interconnection to the networks
 - Advice on market structure and promotion of competition
 - Settlement of disputes and complaints
 - Definition of technical and economic regulation, administration, monitoring and enforcement of the White Certificates Mechanism for the promotion of end-use energy efficiency

Regulatory mechanisms for energy savings & efficiency.

The measures below are in use in developed countries to induce behavior. Zimbabwe could as well consider some of them for they have been used with great success.

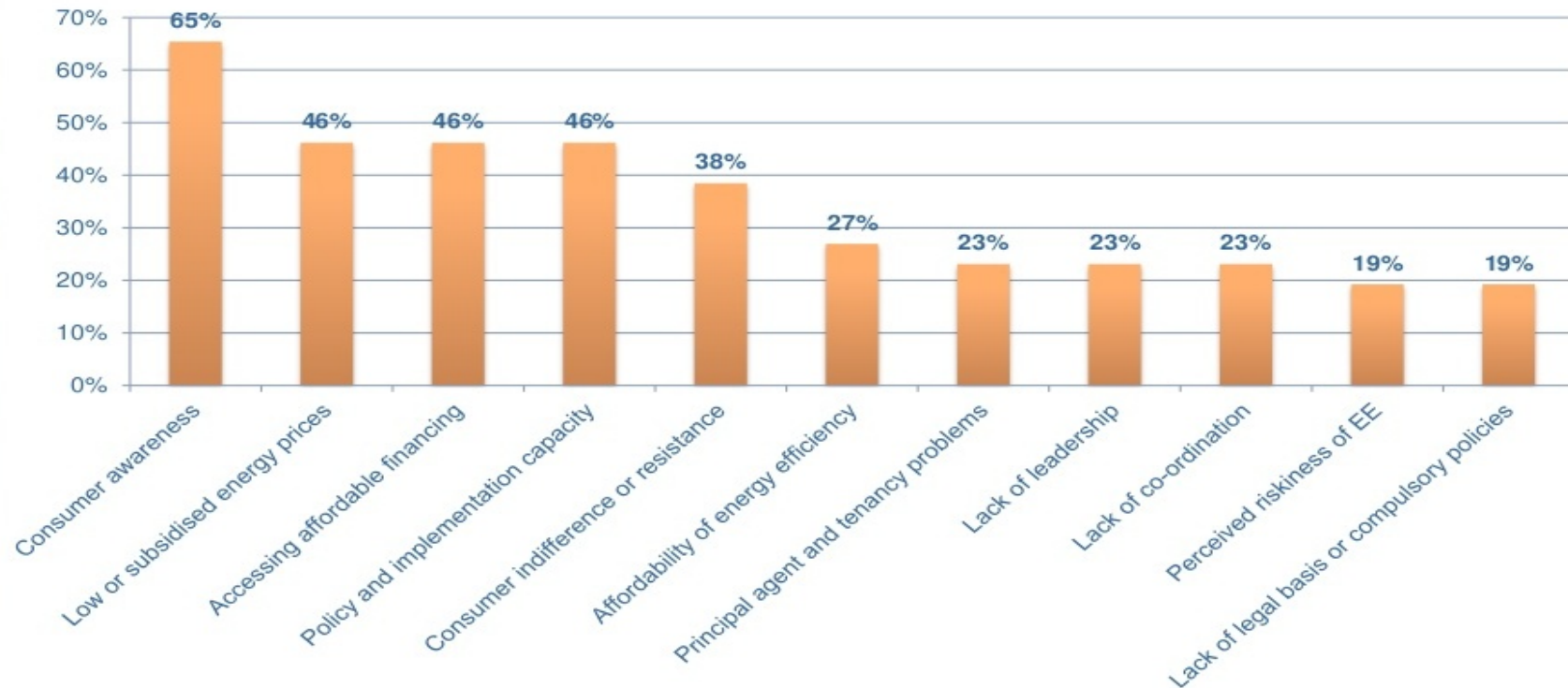
- Optimal and economic pricing of electricity
- Compulsory energy audits and returns to regulator and utility for rebates and other incentives
- Energy penalty tax
- Congestion pricing
- Energy cost labeling
- Renewable technology labelling and certification

Multiple benefits of energy efficiency

- **Providing a more economical solution for satisfying additional energy requirements and electrical capacity,**
- **Improving people's health and well being (reducing pollution and improving comfort),**
- **Improving competitiveness of local businesses: lower energy bills + improvement of employees working conditions + higher "consumers" satisfaction (their comfort as space occupants)**
- **Generating a significant number of Jobs: directly through jobs associated with the implementation of EE measures / indirectly through increased disposable income**
- **Reducing the financial burden of energy subsidies on state budgets & mitigating the financial impacts, on end users, of eventual energy pricing reforms / Alleviating energy poverty**
- **Protecting the environment by reducing pollution and GHG emissions**

Energy Efficiency (EE) Challenges & Barriers

IEA survey of energy efficiency barriers



End-user awareness, low energy prices, financing, and implementation capacity are commonly cited

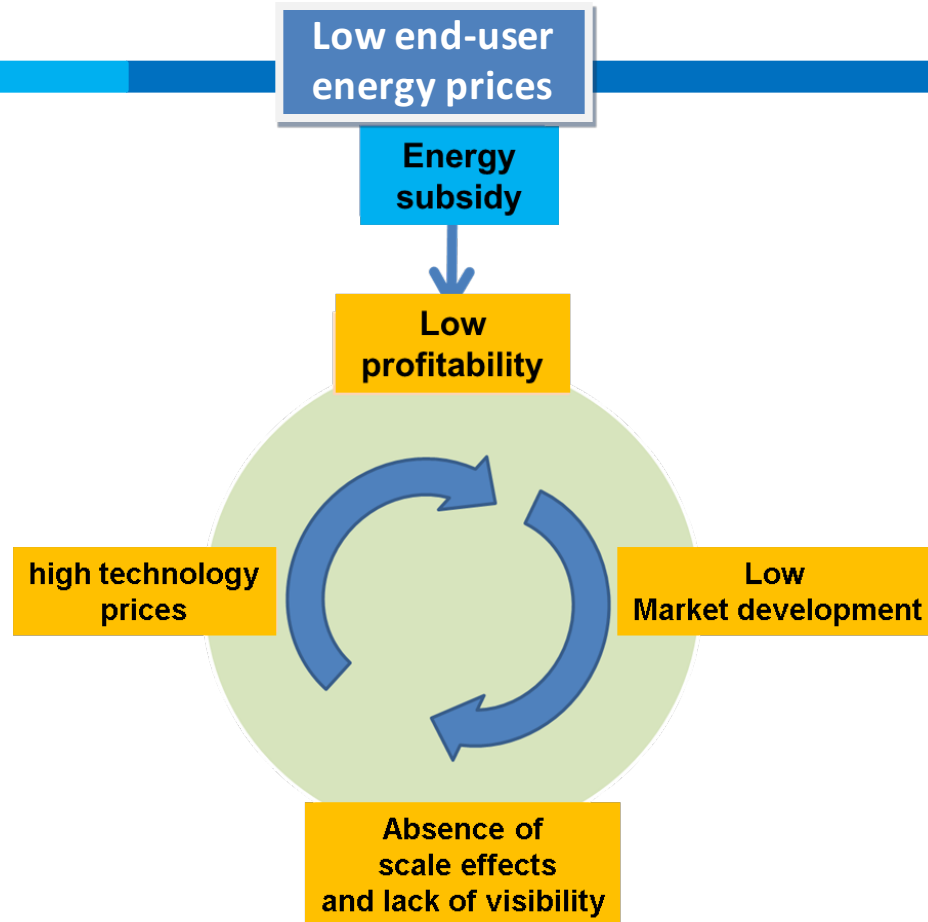
EE Challenges & Barriers

- Low conventional energy costs at the end user level (due to explicit / implicit subsidies)
- Lack of proper assessment of energy resources being wasted
- A limited capacity for enforcing regulatory policies and monitoring their implementation
- Issues related to Institutional coordination
- Lack of data sets on energy consumption patterns in all economic sectors per energy source and for each of the main end uses,
- Lack of adequate human and financial resources dedicated to EE

Some suggested ways to meet the challenges & overcome the barriers.

- **Rationalize energy prices at the end user level**
Auditing & assessment of energy pricing system / means & pace for reform
- **Develop appropriate implementation instruments for EE solutions**
Policies / institutional frameworks / effective implementation instruments
- **Put in place a reliable energy information system**
energy consumption patterns / design, monitor & evaluate EE implementation
- **Put in place an adequate capacity development programme**
Policy makers, public institutions, utilities & private operators
- **Design and implement public awareness raising programmes**
- **Reinforce regional & Sub-regional cooperation on related issues**

Breaking the barriers at the end-user level



- Awareness and technology information
- Supply side support and technology transfer
- End user protection

Fair sharing of benefits between State and end users

- Displace end-user energy subsidy to EE investment support
- Establish a Win-Win situation to create the market

Remove financing access barriers

- Facilitate access to financing
- Encourage third-party financing, with public-private mechanisms

Super-ESCOs can be a viable solution

Consider energy efficiency a national strategic choice

- Assess EE potential in the different sectors
- Identify barriers & opportunities
- Develop & adopt ambitious EE strategies & targets
- Develop / enact policies & regulation
- Develop & reinforce institutional framework
- Make EE accessible to stakeholders and end users
- Develop appropriate implementation mechanisms
- Built human capacities / job opportunities in EE fields

Structuring EE policy instruments

- **Statutory or framework laws**

Objectives, context, targeted sectors, accountabilities & expectations of stakeholders

- **Policies, programs, regulations and standards**

Operational policies & measures, applications & modalities by sector / subsector (consultative & participative involving public & private stakeholders)

- **Market development strategies / marketing programs and mechanisms**

Competitive supply of EE technologies & EE services / effective demand by consumers (no significant changes can be reached without them)

- **Public support instruments**

including technical and financial

- **Instruments for related institutional and human resources development**

capacity building, technology transfer / industrial capabilities and skills / R&D

Some of the EE opportunities requiring immediate attention & comprehensive national plans of actions:

- **Improving the effectiveness of the electrical energy supply systems (Achieving a diversified energy supply with coal)**
Production, transmission & distribution / co & tri-generation / DSM
- **Improving EE in existing and new buildings**
building energy codes, upscale EE in the existing building stock
- **Developing / enforcing energy labeling and minimum energy performance standards (MEPS)**
Appliances, artificial lighting & commercial cooling/AC equipment & Systems
- **Up-scaling EE in the industrial sector through Energy Management Systems training such as auditing, ISO 50001 awareness and implementation.**
- **Up-scaling EE in the transportation sector**

Energy efficiency initiatives support economic diversification and co-benefits for climate change mitigation

Energy efficiency initiatives (e.g. standards, regulations, product testing / control, incentives, ESCOs, district cooling)



induced effects



1

More business opportunities in existing markets

- Replacement / retrofits of capital stock of inefficient equipment, buildings and industrial plants
- Increased demand in existing markets due to regulations

2

Creation of new sectors/industries

- Opening and fast-tracking of new markets / industries (ESCOs, district cooling, testing labs) by establishing National Companies
- Creation of high quality local jobs



Economic diversification and co-benefits for climate change mitigation

Carbon Capture and Storage (CCS)

- A comprehensive strategy for the transformation of the Zimbabwean energy system also requires large-scale deployment of advanced coal technologies with carbon capture and storage (CCS) in order to address adequately both climate and energy security concerns.
- The development of advanced coal technologies combined with CCS could significantly lower the emissions associated with utilizing Zimbabwe's abundant coal resources.
- CCS also can be deployed with natural-gas processing, biomass fermentation and gasification, and other industrial activities.

Carbon Capture and Storage (CCS)

- There are urgent calls from energy experts for demonstration of a wide range of CCS technologies in the SADC region by 2018, integration of CCS into all new coal power plants by 2020, and a long-term goal to transition Zimbabwe and SADC's entire fleet of coal plants to CCS by 2050.
- There is need to develop a legal and regulatory framework for CCS or enhance as needed, statutes and rules to have a comprehensive statutory and regulatory framework for CO₂ transport and storage in place by 2018.
- The need for groundwork for a geologic storage utility for carbon sequestration operating a national or inter-jurisdictional, geologic basin-wide scale at the level of the Southern African Power Pool (SAPP).

Reducing Emissions & Energy use in the Transport Sector

- The task of reducing emissions and energy use in the transportation sector has been described as a three-legged stool:
 - 1) reducing the carbon intensity of fuels,
 - 2) increasing the fuel efficiency of vehicles, and
 - 3) creating conditions that reduce the need to drive.
- The focus is on the first of these strategies, emphasizing the need for accelerated development and Zimbabwe's deployment of sustainable biomass-based fuels such as ethanol.
- The transportation objectives with recommendations to achieve better fuel mileage, mileage-based insurance pricing, more-efficient driving, improved freight efficiency and expanded transportation choices, including passenger rail, transit, bicycling and walking. The idea is to commit to "create a uniform, Zimbabwean low-carbon fuels policy — implemented as a standard, objective or incentive."
- Deployment of low-carbon fuels in Zimbabwe will require a coordinated strategy for addressing multiple issues related to production and supply, distribution infrastructure, vehicle technology, and consumer vehicle and fuel choice.

Recommendations

- There should be **baseline studies** to provide a basis for evaluating a variety of initiatives that focus on energy consumption in all sectors aimed at **transforming building practices** and energy efficiency in new and existing residential and non-residential buildings, specifically for targeted intervention.
- The initiatives may include but are not limited to, **energy management practices, appropriate building codes** and performance standards, appliance labelling, awareness raising, capacity buildings and energy auditing services.

Conclusion

- *The short-term and long term energy needs for residential, industrial, commercial, and governmental customers should be met in an optimum manner that assures a reliable, safe, clean, and affordable supply. Access to energy should be recognized as a basic social right for all citizens of the world.*
- *DSM and Energy Efficiency should be part of our business culture in order to improve our bottom-line, conserve our environment and be good corporate citizens. Energy is a mission-critical commodity that must be managed to reduce the exposure to risk for an enterprise.*
- *An enterprise energy management system can mitigate this risk by providing the data, information, and knowledge required about the cost, reliability and quality of the power supply. International and local funding must be mobilised to develop green energy, the financial deals must be coupled with Technology Transfer, Research Engineering, Design & Development through Multi-sector Private Public Partnerships (PPPs).*
- *The Sustainable Energy Roadmap and Climate Stewardship should consider strategies for capturing the enormous opportunity for Zimbabwe to build on its historic strengths and reclaim its position as a manufacturing powerhouse and a place of innovation and meaningful work. This will be the basis for a new low-carbon digital economy.*

Conclusion

- *The Sustainable Energy Roadmap with climate stewardship must align the climate change and energy policies and strategies and should further identify any legislative or regulatory changes necessary for implementation, together with any financial, funding, or incentive mechanisms needed to best position Zimbabwe to meet the energy challenges of the future.*
- *We have the opportunity to improve and expand our electric grid, reduce our dependence on foreign oil, and mitigate environmental impacts of conventional energy sources. Zimbabwe has the human, intellectual and natural capital to lead this new energy revolution. Still, the challenges we face are real.*
- *Zimbabwe is a major producer of agricultural, forestry, and energy-intensive industrial products, and is therefore highly vulnerable to the volatility of petroleum and electricity pricing. There is need to embrace advanced coal technologies with carbon capture and storage (CCS) in order to address adequately both climate and energy security concerns. Its reliance on electricity generated from conventional coal-fired plants also makes it very CO₂-intensive in its overall emissions profile at a time when the world is transitioning to a low-carbon energy economy as demonstrated by the signing of the Agenda 2030 which gave birth to the sustainable development goals in December 2015*

What is your Carbon Footprint?





Thank you...