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Swedish Society for Nature Conservation (SSNC) Partner Visit to South Africa

Hosted by groundWork (gW), Friends of the Earth (FOE), South Africa

28th October to 3rd November 2018

REPORT ON RENEWABLE ENERGY AND FUTURE IMPLICATIONS FOR A JUST (ENERGY) TRANSITION

BACKGROUND

Global warming and fossil fuel depletion, as well as the goal to provide universal energy access, increasingly place the development of sustainable just energy systems at the top of political agendas around the world. The future will most likely mainly be powered by renewable energy sources. However, in order for the energy transition to be economically, socially and environmentally sustainable and just, it calls for a rethinking of how the energy sector should be organised, financed, and which materials and technologies should be promoted. These considerations entail how the raw materials for the energy producing devices are acquired and processed, associated environmental impacts, working conditions, maintenance of the technologies, and how the waste from the energy producing devices is handled. Chemical safety issues are crosscutting all aspects of the transition, as the transition should not just safeguard conditions for egalitarian economic growth and a good standard of living, but also improve protection of human health and environment. To that end, different energy systems have different impacts, throughout their life cycles.

SSNC's Department of Climate and Chemicals has been organising a series of capacity building activities on the transformation of the energy sector from fossil fuels to decentralised renewable systems. For the particular country visit and capacity building process, SSNC is working with its long term partner, groundWork, Friends of the Earth, South Africa who will host SSNC and fellow partners for this exchange.

The activities seek to answer the question: ***"How can we understand and foster an environmentally, socially and just energy transition?"*** The aim is to prime the participating organisations with holistic and life-cycle perspectives, to enable them to better influence a sustainable national transformation of the energy sector.

ACKNOWLEDGEMENTS

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Participants of this visit to South Africa included: groundWork (gW) Friends of the Earth South Africa, Earthlife Africa (EEA), Swedish Society for Nature Conservation (SSNC) Sweden, National Association of Professional Environmentalists (NAPE) Uganda, Centre for Financial Accountability (CFA) India, Ecoaction (Ukraine) and Movimento dos Atinguidos por Barragens (MAB) Brazil

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ACRONYMS

AC	- Alternating Current
AIDC	- Alternative Information Development Centre
EEA	- Employment Equity Act
ELA	- Earthlife Africa
CENFA	- Centre for Financial Accountability
CER	- Centre for Environmental Rights
CSIR	- Council for Scientific and Industrial Research
DBSA	- Development Bank of South Africa
DC	- Direct Current
MAB	- Movimento dos Atingidos por Barragens (Movement for People Affected by Dams)
COSATU	- Congress of South African Trade Unions
DMR	- Department of Minerals and Energy
DOL	- Department of Labour
EU	- European Union
FiT	- Feed in Tariff
FOE	- Friends of the Earth
GHG	- Greenhouse Gas
gW	- groundWork
IEP	- Independent Energy Plan
IRP	- Independent Resource Plan
ILO	- International Labour Organisation
IPP	- Independent Power Producer
IPPPP	- Independent Power Producer's Procurement Programme
IRENA	- International Renewable Energy Agency
IRP	- Integrated Resource Plan
JET	- Just Energy Transition
MEC	- Minerals Energy Complex
NAPE	- National Association for Professional Environmentalists
NEDLAC	- National Economic Development and Labour Council
NERSA	- National Energy Regulator of South Africa
NU	- Nature University

NUMSA	- National Union of Metalworkers of South Africa
OPEC	- Organisation of the Petroleum Exporting Countries
PAIA	- Promotion of Access to Information
PPA	- Power Purchase Agreement
PV	- Photovoltaic
RE	- Renewable Energy
REIPP	- Renewable Energy Independent Power Producer
REIPPPP	- Renewable Energy Independent Power Producer Procurement Programme
SALGA	- South African Local Government Association
SDG	- Sustainable Development Goals
SESSA	- Sustainable Energy Society of Southern Africa
SSEG	- Small Scale Embedded Generation
SSNC	- Swedish Society for Nature Conservation
WECCF	- Women in Energy and Climate Change Forum

DEFINITIONS

Circular Economy: A regenerative system in which resource input and waste, emission and energy leakage are minimized by slowing, closing and narrowing energy and material loops. This may be achieved through long-lasting design, maintenance, repair, reuse, refurbishing, recycling, and upcycling. A circular economy is in contrast to a linear economy which is a 'take, make, dispose' model of production.

Decentralised Energy System:

Energy generated autonomously i.e. off the main grid, including micro-grids that generate energy from renewable sources e.g. solar PV, geothermal, biomass, wind and water.

Decentralised Renewable Energy System:

Further to our group's discussions, this renewable energy system includes the decentralisation of both infrastructure and ownership. This may include the option of being connected to and supply energy into a larger grid.

Decent Work: Employment that respects the fundamental rights of workers including work safety, fair income, personal development, social protection for families, freedom for people to express their concerns, organise and participate in decisions that affect their lives and equal opportunity and treatment for all women and men.

Green Economy: An economy that promotes sustainable development and reduces environmental risk and degradation.

Just Transition: A framework endorsed internationally by the ILO to encompass a range of social interventions needed to secure people's livelihoods when economies are shifting to sustainable production, including climate change mitigation, protecting biodiversity and ending conflict ("Guidelines on a Just Transition towards environmentally-sustainable economies and societies for all", 2015). The Paris Climate Agreement also contains references to a Just Transition, where governments commit to ensure that workers are accompanied in the transformation through the creation of decent work opportunities.

This is by no means a final definition and continues to be redefined through the discussions that unfold around what a Just Energy Transition is. The participating organisations will examine and determine what the essential elements entail and what actions the various stakeholders should take to reach the goal. The final outcome of this process could be a set of policy recommendations.

Gigawatt Hour: Symbol GWh, GW-h or GW h. A unit of electrical energy equal to one billion (109) watt hours, one thousand megawatt hours or 3.6 terajoules.

Kilowatt Hour: Symbol kWh, kW-h or kW h. A unit of energy equal to 3.6 megajoules. If energy transmitted or used at a constant rate (power) over a period of time, the total energy in kilowatt hours is equal to the power in kilowatts multiplied by the time in hours.

Low Carbon Economy: Also referred to a ‘low fossil fuel economy’ or a ‘decarbonised economy’. An economy based on low carbon generated power with a minimal output of greenhouse gases, mainly carbon dioxide, a major contributor to global warming. Low carbon economies may include hydropower which impacts on communities and aquatic ecosystems.

Megawatt: Symbol MW. A unit of power equal to one million watts, especially as a measure of the output of a power station

Microgrid: Also referred to as a ‘mini grid or isolated grid’ refers to a localized group of electricity generators and storage systems interconnected to a localised group of users that can function autonomously or be connected to a national electricity transmission network.

Nanomaterials: Microscopic materials ranging in size from 1-100 nanometres (nm) with large surface areas and higher chemical reactivity than larger sized fractions of the same chemical element.

Renewable Energy: A clean energy source which can be regenerated and includes energy generated from solar, wind, biofuel, biogas, wave, tide, rain and geothermal sources.

Safe Circular Economy: Entails the phasing out of hazardous chemicals from material flows and transparency for chemicals, so that all stakeholders in the lifecycle of the materials and products can handle them safely using proper procedures, including reuse and recycle operations.

Watt: Symbol: W. A unit of power. In the International System of Units (SI) it is defined as a derived unit of 1 joule per second and is used to quantify the rate of energy transfer.

CONTENTS

1. Introduction

The German energy transition study tour in 2017 focussed on three pillars of sustainability i.e. economic, social and environmental and included activities such as visiting community based energy systems and mapping relevant SDGs (3, 6, 7, 8, 11, 12, 14 and 15) in the transformation of the energy sector. From this process we saw the need to move beyond this concept by integrating the different aspects of what is required in a Just Energy Transformation (JET) and to understand this transition from another perspective. One that includes a bottom-up approach, a democratically- and locally- owned green economy that sustains the environment, livelihoods and generates decent work while promoting a safe circular economy. This year we examine the South African energy sector to understand how best we can foster a JET that encompasses all these aspects.

Central to the concept of framing the JET process and its evolution is a citizen-driven transformation of the energy sector with a lifecycle perspective. This looks at how the renewable energy sector will be organised with concepts and ideas on how large scale projects could serve the public optimally and if smaller decentralised models are favourable in empowering people and communities. How we create an enabling environment for a renewables industry sector to sourcing raw materials and designing durable, repairable and recyclable products to servicing, maintaining and continuously improving these systems forms part of a circular economy that is integral to a sustainable and just energy transformation movement.

The first steps of putting together a workable JET plan includes an understanding of our current energy mixes and ownership, as well as policies and regulations governing the energy sectors in our respective countries. Similarities, differences and shared challenges will further shape and create the JET picture we would like to move towards i.e. suitable energy mixes and models while enabling us to develop strategies on overcoming these hurdles as a collective. The South African site visits to the Highveld minerals energy complex (MEC), community RE projects, SSEGs and presentations by NGOs, REIPPS and various players in the energy sector during our South African visit opened up many opportunities for these discussions and exchange of country experience in the opportunities and challenges faced by civil society.

2. An overview of our current energy situation

	Population	Area (km^2)	Energy production (GWh)	Main Energy Production Sources							
				Coal	Oil	Gas	Nuclear	Hydro	Solar	Wind	other
Brazil	210,867,954	8,358,140	590,900								
India	1,354,051,854	2,973,190	1,497,000								
South Africa	57,398,421	1,213,090	255,100								
Sweden	9,982,709	410,340	163,900								
Uganda	44,270,563	199,810	2,493								
Ukraine	44,009,214	579,320	157,100								

Table 1: a snapshot of the current main energy production sources for each of the countries participating in the visit

Similarities amongst the countries of the participating organisations Brazil, India, South Africa, Sweden, Uganda and Ukraine include domination by energy producing monopolies in the form of heavily subsidised SOEs or multinational companies mainly in the coal, nuclear and hydro-powered sectors. All these countries import some of their energy inputs e.g. India and Ukraine supplement their coal requirements with imports from South Africa. Brazil, India, South Africa and Uganda have communities that do not have access to electricity, many of them living alongside electricity producers. Countries dominated by coal power generation endure heavily the impacts of health, economic and environmental degradation, as witnessed on the Toxic Tour in the Highveld during this visit and illustrated in the map presented by David Hallowes on South Africa's coal producing regions (Appendix A: Figure 1).

South Africa's history is deeply rooted in the minerals energy complex established in the early 1900's responsible for the apartheid system with low income communities living alongside polluting industries without access to affordable electricity and uncontaminated water, air and soil. 90% of South Africa's energy is generated from coal sources and power generation is monopolised by SOE, Eskom for over 70 years. Access to electricity in South Africa is unevenly distributed. 14% of South African households still lack access to the national electricity grid, while 40% experience energy poverty (either do not have access to the grid, or have access but not being able to afford to purchase sufficient electricity). Following the power supply crisis and load shedding in 2008, the Department of Energy's IPPPP was established at the end of 2010 as an urgent intervention to enhance South Africa's power generation capacity. There are a number of challenges with the programme including ownership and policies that govern distribution.

Sweden's electricity production is mainly from hydro and nuclear sources (Appendix A: Figure 2). The Swedish electricity market was deregulated in 1996, transforming the industry from a government hierarchical system to a governance steering structure. Power trading and several network operators enables competition in the energy sector which is regulated by the Energy Market Inspectorate within the Swedish Energy Agency. This includes monitoring network tariffs. Swedish nuclear power is owned by SOE Vattenfall, Finnish Fortum and German E.ON. Uranium is imported from Australia, Canada, Russia and Namibia. In 1980, the Swedish government decided to phase out nuclear. In June 2010, Parliament voted to repeal this policy.

Ukraine's main electricity sources are nuclear and coal powered plants (Appendix A: Figure 3). Ukrainians live with the legacy of Chernobyl, a major nuclear accident in 1986, with units still not decommissioned. This 30km exclusion zone is utilised to place a number of 'temporary' storage facilities for nuclear waste from operating and other sources. Ukraine's eastern coal territory and Crimea was invaded by Russia in 2014 and the country continues to import nuclear fuel, coal and gas from Russia. Gas now also comes from the EU with some nuclear fuel from Sweden in an attempt to diversify supplies and decrease dependence on Russia.

Uganda's population is largely rural and dependent mainly on biomass (firewood, charcoal and crop residues), hydro and heavy fuel oil thermal energy sources with large petroleum reserves. Uganda is currently vulnerable to oil price shocks with oil coming through the Kenyan Port of Mombasa. Capacity of hydro-electric power has been increasing since 2007 to 692MW this year. Access to the electricity is very low with one of the lowest per capita per year electricity consumptions in the world i.e. 215 kWh compared to sub-Saharan Africa's 552 kWh and the world average of 2,975 kWh (Appendix B: The Energy Situation in Uganda).

India has the largest population and landmass in the group with current installation capacity of 344GW including 700 coal-powered plants with coal imports from Indonesia, Australia and South Africa. Almost 64% of India's energy originates from thermal power sources (coal, oil and gas), of which coal contributes more than 56%. Renewable energy comprises 20% of the energy mix including solar and wind with India's government pushing for large-scale hydropower starting with 31.5GW capacity installed in 2016 and increasing by 20GW per annum. India's SOE National Hydroelectric Power Corporation (NHPC) is funded by Multilateral Development Banks (MDB) including the World Bank (WB). After 70 years of independence, 304 million Indians cannot access electricity.

South Africa recently began using piped gas from its neighbouring country, Mozambique. There are new gas offshore developments off the coasts of South Africa and Brazil (Appendix A: Figure 4). Global gas supplies are expected to increase over the next 16-20 years and is considered a cleaner supplementary energy source in the transition from high carbon to low carbon economies.

Both Sweden and Brazil are dominated by the hydropower sector with drastic environmental impacts from approximately 2000 hydropower units. Brazil's hydro dam developments have displaced 1 million families, 70% of whom were not compensated. The MAB in Brazil have organised themselves as a civil movement to transform the unjust energy structures of society. Despite hydro power being considered a low carbon energy source it is not a socially just or environmentally safe energy option because of its negative impacts on people's land, livelihoods, aquatic life and biodiversity. In Sweden, the construction of new hydro plants has largely ceased due to environmental and political considerations and future activity will focus on modernization and refurbishment of existing capacity. Sweden is experiencing a move towards wind generated energy and some of the issues include the best placement of wind power generators, given the visual and noise impacts on communities, birdlife and the potential wastelands created by windfarms.

All these countries are currently dealing with political and debt issues around SOEs, decommissioning aging energy infrastructure and the challenge of disposing waste (generated from the energy sector) in a safe manner. They are all currently witnessing an introduction of the renewables energy sector, mainly from solar, wind and biomass sources that are mainly private-owned or community-based. Each country is faced with its own unique challenges in implementing their RE transitional plans including what their energy mixes should look like in 30 to 50 years, which (centralised or decentralised) models will best serve their needs, converting existing transmission networks to accommodate RE and public perceptions about renewables, particularly worker unions.

Key questions raised throughout the country presentations were:

- **Who does our current energy serve?**
- **What should this energy be used for?** Continued economic growth and consumption, or serving the basic needs of people
- **What is the cost of this energy to people?** E.g. in generating 15GW, other livelihoods such as agriculture are destroyed. What are the health impacts from energy production and energy devices (materials lifecycle)?

Toxic Tour: *Eskom's new coal-fired plant Kusile power station is expected to cost ZAR 118 billion on completion*

Sustainable energy solutions presented by the Doornkop Community embrace renewable energy sources as well as all aspects of living including food production, water conservation, waste management and community support.

3. What should a Just Energy Transition entail?

South Africa's MEC created the world's most unequal society, ruined good land and sweet water, polluted the air, harmed people's health and destabilised communities. The major coalfields are now in decline and big mining corporations are selling up to escape their liabilities. They will leave behind not just hundreds of abandoned mines, but abandoned mining regions (groundWork: Coal Kills, 2018).

As highlighted by 2018 Goldman Environmental Prize recipient, Makoma Lekalakala (ELA), a Just Transition should move beyond energy and jobs. A Just Transition must be for everyone. A Just Energy Transition approach should be community-based, socially-owned and also include food and water. Indigenous lifestyles that promote low-carbon footprints and a need to unpack and understand the various renewable options with practical examples to show how it can work is what is needed. Ensuring that discussions continue to move away from entrenched ideas about energy and how we can create decent safe sustainable jobs through national discourse, not just at the policy level, but on the ground with all of civil society.

It is necessary to explore the various viewpoints and interpretations of a Just Energy Transition and much has been written around the topic in the past three years. One such outlook was presented recently by Project 90 by 2030 in its report: *The Role of Ownership in a Just Energy Transition* (April 2018), which cautions that the definition of a JET is pliable and offers the following three perspectives by Jacklyn Cock (*The Climate Crisis and a "just transition'' in South Africa: An eco-feminist-socialist perspective* (Satgar, V(ed.) 2018) on how a JET may be interpreted:

a) A capitalist variant of the 'green economy' in which natural resources are financialised and reduced to 'natural capital'. The transition to a low-carbon future is a source of new speculative profit and includes conservation of forests and wetlands to promote 'ecosystem services' such as offsetting carbon sinks. This approach is considered pro-market, pro capitalist and neo liberal and does not accommodate the social justice or equity outlook.

b) A moderate version of the 'green economy' considered as a reformist transition involved in building a new energy regime via new RE 'green jobs' to replace 'brown jobs' that will be lost in the fossil fuels sector. It is criticised as being welfarist in its approach in protecting the interests of the vulnerable and depends on an expert-driven technocratic system that continues to see energy as a commodity.

c) A JET that sees the climate crisis as a catalysing force for massive transformative change with new ways of producing and consuming. Such transition should do so in ways that do not replicate the injustices of the past. It calls for a holistic approach that is not only energy related, but informs and guides transitions in other critical areas such as food production, employment, transport, housing and education. A JET is thus part of a wider transition to a just society and rejects the market as a solution to the environmental crisis. It calls for the social ownership of decentralised energy infrastructure and the production and equitable distribution of affordable RE. The four key priorities highlighted under this approach includes: energy democracy, accessibility and affordability of supply, local and democratic ownership of energy infrastructure and compensation for loss of jobs during the transition in the form of alternative work and training opportunities.

Thus a Just Energy Transition with its many considerations is yet to be organically and collectively developed from our joint perspectives, and through this learning process.

4. Renewable Energy models

The main RE models we witnessed and discussed were off-grid and mini- or micro-grid generation and small-scale embedded generation (SSEG).

Off-grid or micro-grid generation sites we visited were community-driven initiatives namely Doornkop Community Forum (with storage) and Nandi Primary School in Soweto (Appendix B). Both community driven projects demonstrated how ownership of energy infrastructure is empowering and can strengthen communities and their ability to create further support and empowering structures and activities that enable the aged and youth as well. Zonke Energy's business model looked at alternative solutions in supplying and upscaling off-grid energy without the 'sale' of energy to communities, but rather the rental of PV with capped energy supply.

Challenges and important considerations with the off-grid models include:

- Funding of RE set-up costs which are high
- Locally sourced and community manufactured RE components e.g. biodigesters
- Theft of PV and other RE infrastructure
- Manpower required to upkeep energy systems, particularly at schools where they are closed during holidays and weekends
- Ability to upscale to serve the wider community
- Suitability of AC or DC power
- Threat of Eskom electrification in the case of DC power
- Municipal or private-owned land
- Access to local funds, infrastructure and means to initiate RE
- Gauging the energy demand and usage

Small scale embedded generation (SSEG) is community driven and originated due increasing electricity tariffs since 2007, along with the decrease in price of PV installation and various financing models to purchase PV made available mainly to middle- upper income groups and business. Ukraine has a similar set-up to South Africa were energy may be produced and consumed but not fed into the grid. SSEG is favourable for business e.g. private hospitals such as Mediclinic invested about ZAR 400m in solar. The incentives are that the commercial rate of return is better than the initial investment outlay – usually over a period of 7 to 20 years depending on the finance model and PV installation. The Brazilian SSEG model is concession-based with different tariffs charges in different areas depending on the companies that operate there.

Challenges posed by SSEG model include:

- finding capital to fund the process as PV set-up costs are initially high
- high and uneven tariff structures across Municipalities e.g. George has high fixed tariff charges
- Various tariffs and license fees including: Storage tariffs, unregistered systems and defensive tariffs, license fees for more than 1MW generators
- Mechanisms for safety and surges
- Policies that prevent energy feed into the grid
- Impacts of privatisation of the grid and profiting off electricity from resale
- Creation of energy slums with high income groups leaving the grid
- Cross subsidising low-income groups who are left to pay for electricity in the grid

5. Government's role in the Renewable Energy Sector

How can government facilitate affordable energy for all? Approximately 60% of South Africans live in poverty with 36% unemployed according to the expanded definition by Merten M. (*Stats SA Poverty Report 2017: Policies fail the People of South Africa*. Daily Maverick, 23 August) which includes people of working age who are unemployed but have ceased looking for work, and those who are working but not being paid. With renewable energy currently being accessible to higher income groups and companies, how will the poor and unemployed in our country be serviced?

Rising coal prices as mines reach end-of-life and insufficient coal supply for power stations by 2040 may result in the stranding of power stations by 2040 (Figures 1 and 2). How will the decommissioning of aging energy infrastructure over the proposed next three decades be facilitated to reduce social, health, environmental and economic impacts while making way for new livelihoods in the growing RE sector?

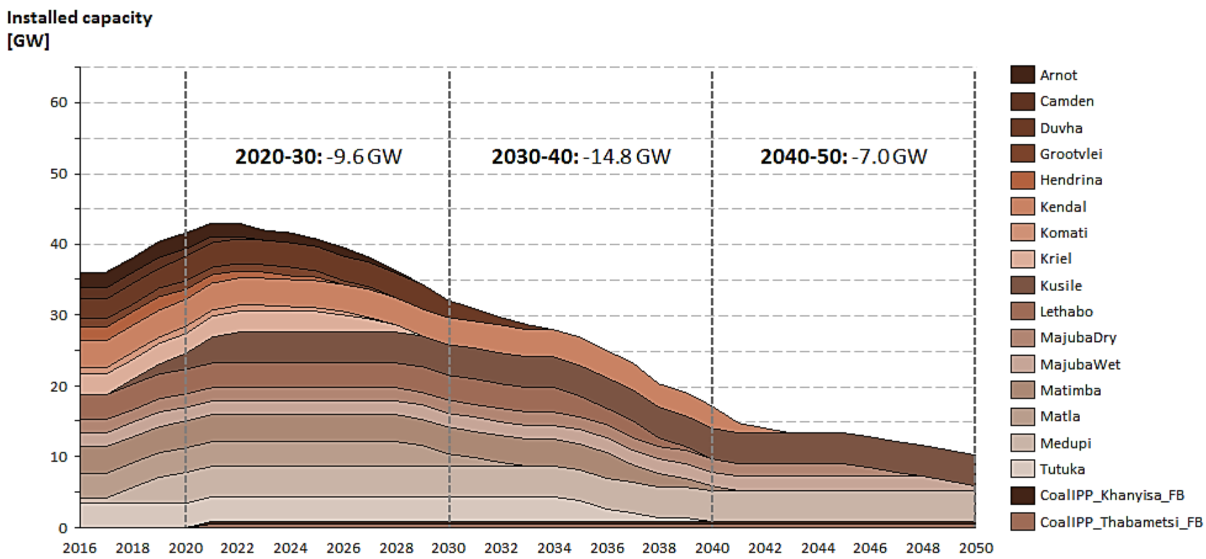


Figure 1: Planned coal decommissioning schedule for South Africa (DoE 2016; Wright et al. 2017)

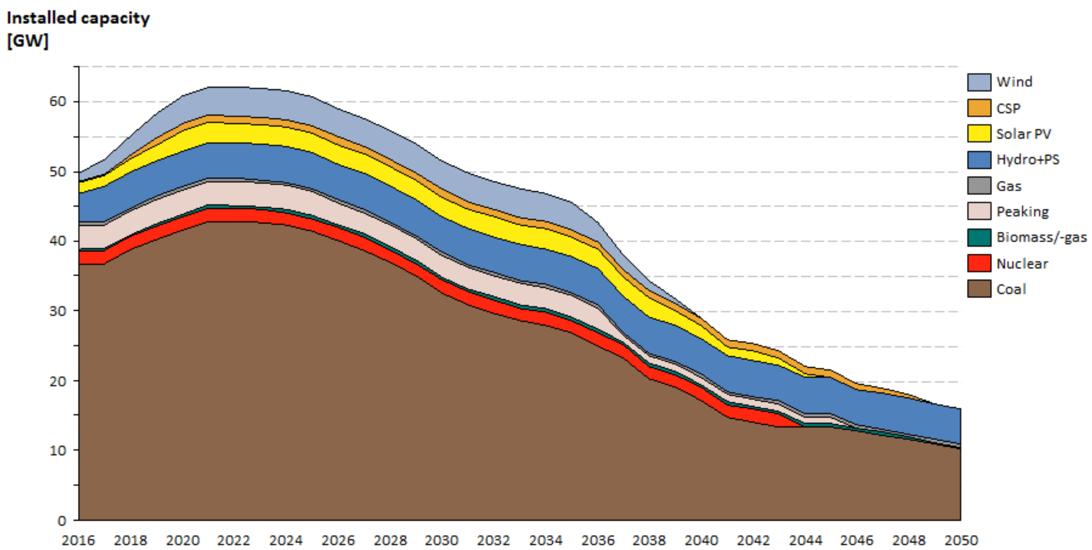


Figure 2: Planned power decommissioning schedule for South Africa (DoE 2016; Wright et al. 2017)

The REIPPP was introduced to pursue a low carbon energy future (in response to South Africa's emission reduction commitments made at the 2009 Copenhagen Accord) with the aim of producing 17.8GW of new generation capacity from RE sources by 2030. They experience many obstacles in supplying municipalities with energy.

Transitioning from Eskom Power: Municipalities

South African municipalities account for over 40% of the current electricity demand and are bound to receiving electricity supply from Eskom only. Transitioning from being passive receptors to active role-players involved in the planning, procuring and supplying of an integrated range of energy services will require changes in many of the policies restricting energy purchasing abilities by municipalities.

This change will directly or indirectly be the result of how South Africa handles Eskom's debt of over ZAR 333 billion. Will this entail consolidation of the energy sector and nationalisation of the energy debt and then reinvestment of any planned investment (allocated to coal-power) into renewables infrastructure with a complete transformation of the structure of the energy sector including rationalising distributors, particularly around metros with the best infrastructure and skills development for RE as well as every household in the country installed with PV, smart metres and two- way conversion? With Eskom not being able to raise sufficient income to ever pay back its debt, the choice should be clear.

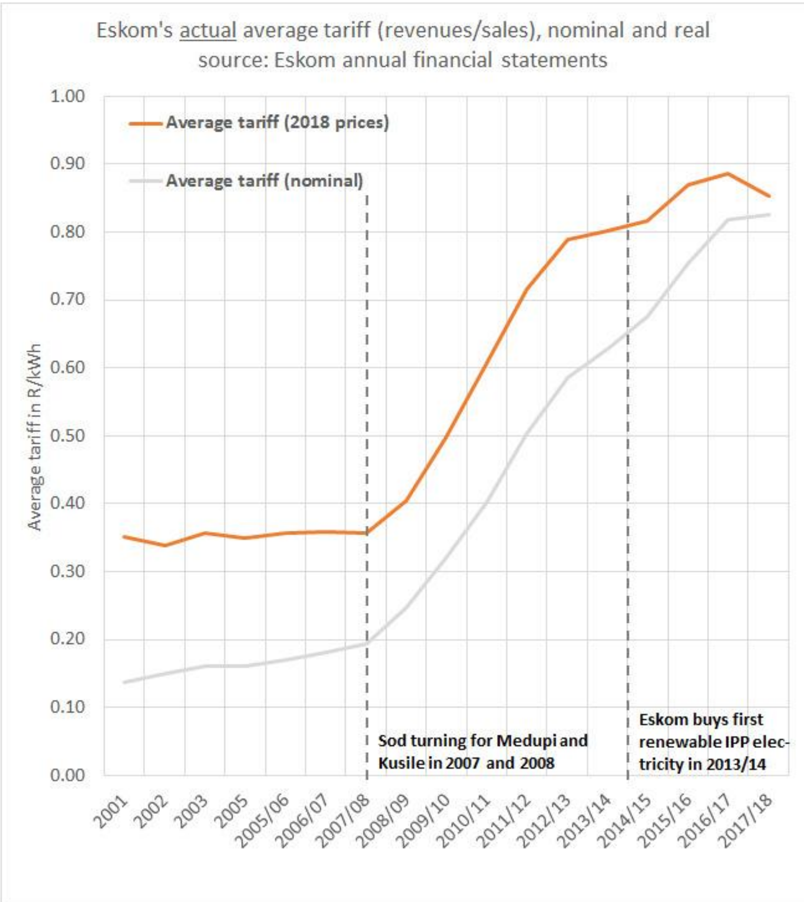


Figure 3: Eskom's actual average tariff based on nominal and real revenues/sales

6. Integrated Resource Plan (IRP)

The IRP was promulgated in 2011 and in 2016 a draft version was published which has been revised and put out once again for public review in 2018. It serves as a guide to build new energy infrastructure and the new energy mix projected until 2050. The revised IRP is based on a least-cost optimisation model i.e. cheapest energy system which transitions towards less carbon intensive energy sources, mainly wind and solar.

The IRP creates a space for ownership of energy but does not cater for transportation. In particular, electric vehicles or modes of transport with the ability to decarbonise road transportation. Energy storage systems are critical in the transition from coal to renewables and this potential capacity is not adequately catered for in the latest IRP and proposes that a new allocation for energy storage be created.

In its current form, the IRP also assumes that the two new coal-fired plants Kusile and Medupi will overcome legal and financial challenges. High costs for grid connection of renewables compared to low costs of coal remains a concern currently. The decommissioning of coal fired plants should be accelerated and such shut downs need to be strongly managed for a just energy transition to take place.

Aging coal infrastructure and developments in the global RE sector have significant implications for future energy generation in South Africa. The cost of energy technologies (solar, wind and battery storage) have dropped significantly and become cost competitive with conventional fossil fuel alternatives creating opportunities to rapidly transition to a low-carbon energy system. For example, between 2009 and 2015 the price of PV panels fell by 80% while the cost of lithium ion batteries dropped by 50% from 2014 to 2016.

The challenge of available installed capacity (Figure 5.) coupled with electricity demand fluctuations and disruptive new technologies mean that the IRP should be flexible in accommodating more energy efficient technologies that are safer and more accessible to communities.

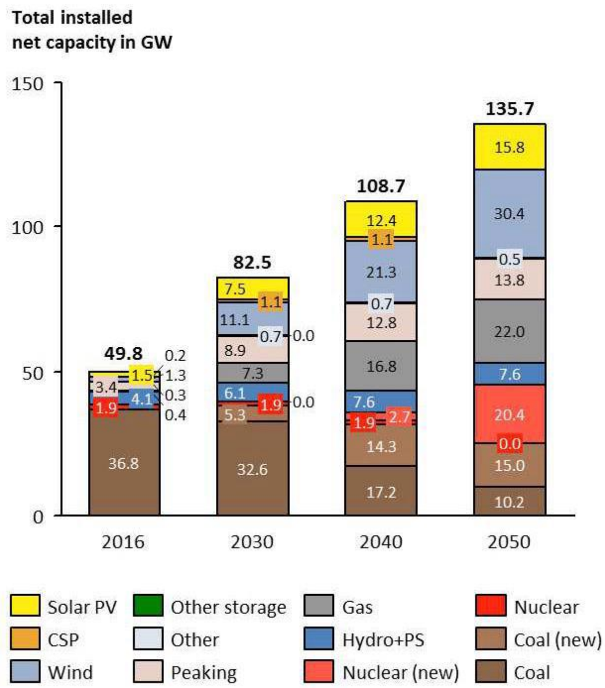


Figure 5: South Africa's total installed capacity with projections into 2050

Points of interest for RE in South Africa and discussions around the IRP:

- Ongoing advances are expected to lead to further RE price reductions and changes in grid-based and commercial supply. Will this accelerate community's access to electricity and RE related jobs?

- PV and Wind Potential: SA could potentially supply the world's energy needs with its landmass and renewable energy resources

- Germany produces roughly 40GW from both PV and wind. The best German site for RE generation will be much worse than the worst (most unfavourable conditions for RE generation) site in South Africa

- RE production fluctuates in periods of lack (sun and wind). South Africa, the Cape in particular receives sun during the day and wind at night so are able to utilise both energy systems effectively as they complimentary.

- Current peak evening tariffs from coal-fired plants may be offset by RE and better energy storage facilities

- High RE set-up costs impact on the transition from fossil fuels and the various financial models that may be used to facilitate this.

- South Africa has some of the world's largest reserves of new technology minerals, mainly located in the platinum belts and associated with the platinum group of metals (ruthenium, rhodium, palladium, osmium, iridium, and platinum). This has many implications for mining and manufacture including ownership, investors and ability to process and manufacture locally instead of exporting to manufacturing giants such as China and then importing the finished product at higher prices.

- Ferromagnetic transition metals (iron, nickel and cobalt) used in batteries for example are high in African countries that are already riddled with conflict minerals and geopolitical wars. How do we protect ourselves with the advent of new RE mineral demands from the price hikes and control of our resources by foreign-nationals and multinational corporations.

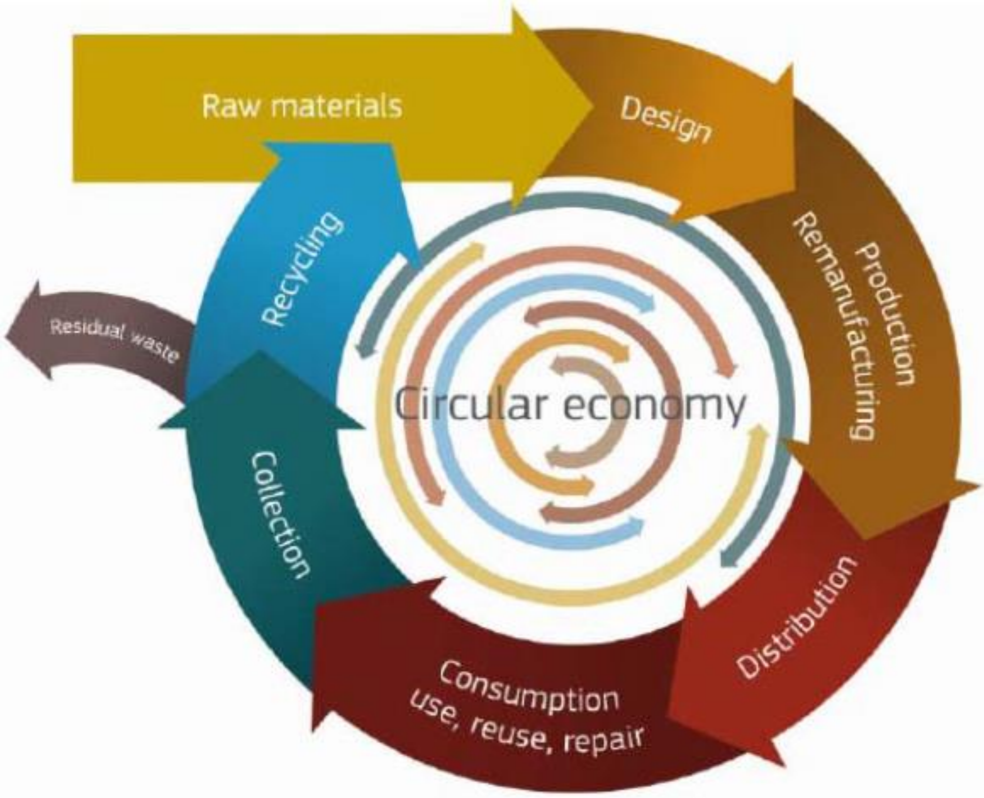
- New technologies and advances in the RE sector and our country's preparedness in terms of manufacture, assembly, supply, maintenance, repair and recycling i.e. our preparedness for the circular economy

7. RE Manufacture and Promoting a Circular Economy

As Andreas Prevodnik points out: Just transformation of the energy sector may include small-scale renewable energy sources, so that all communities can access safe and affordable energy. But, have we thought of which chemicals are in the materials of these devices? Or what happens to the devices once they become waste?

How do we incorporate a more holistic view of the transition of the energy sector, including a life cycle perspective and the promotion of a circular economy?

The fundamental idea of a circular economy would be to diminish the consumption of products by extending their lifespan through maintenance and repair while maximizing the reuse or recycling of materials once the products reach their end-of-life. Hence, decoupling the economy from continued resource extraction and production, and refining and manufacturing products with additional energy, water and processing chemicals. For example, as noted in the study week, PV properly maintained or parts of it reused could last for 50 years.



In the RE industry, wind and solar devices contain electric and electronic products composed of metals, mineral and plastics. Raw materials obtained from the extractive industries are ores, minerals, coal, oil and gas, which are energy intensive and polluting. Further processing may include the refining of high-grad metals from ores and cracking crude oil in refineries into various fractions, used for synthesis of basic industrial chemicals and monomers (building blocks of plastics).

Industrial chemicals, metals and plastic monomers are the feedstock of manufacturing industries. Multiple supply chains are involved in the manufacture of devices, often international, which implies many transportation steps, before the final product is assembled. When devices reach their end-of-life (10-20 years after installation), they become waste that may contain hazardous materials that end up in landfills. **It is therefore critical that we know which hazardous chemicals are present and in what concentrations, so that they can be separated and destructed safely.**

Hydropower dams require large scale extraction of limestone and sand for concrete. As with solar and wind power devices the materials risk ending up in landfills. The Biofuels industry has implications for the livelihood of and food security of communities. There are also emissions and waste products from the production of crops, refining of fuels and the energy production step.

Yet another potential safety issue with electrical appliances and electronics is the presence of nanomaterials. Their surface area is large in relation to their volume and they may be chemically more reactive and have different physiological qualities than larger size fractions have. These new qualities are explored for increasing the efficacy in energy conversions in PV and storage of energy in batteries.

The small size also means that the nanomaterials cross biologically highly selective membranes, such as the blood brain barrier. Biological hazards and risks with nanomaterials are often poorly characterized, as standardized tests are missing and there are no legal requirements for tests.

SDG target 12:4 is less waste. How can we promote less waste in the JET while promoting RE?

- **Producer Responsibility Schemes**: the producer who places a product on the market can ensure that waste does not end up in the wrong hands or the wrong place and may involve recollection of materials. In the EU, the WEE Directive mandates recollection schemes for electrical and electronic products. If a company recovers parts of the collected materials, or recycles the materials, this could create a sustainable business model and save material and energy costs for the company – which is also a good example of a circular economy.

- Another approach is to **legally regulate the design of the products**, via product specific legislation, requiring durability of the products, reparability, easy dismantling and recoverability and recyclability

- **Substitute chemicals should be proven safer to health and the environment**, by relevant testing. Ideally, means to regulate substitutions legally should be explored. E.g., in the EU we have the RoHs Directive for Electrical and Electronic Products, to which many of the devices for production of renewable energy belong. Regulation of the most hazardous chemicals via this directive has sparked substitutions. Chemicals that are of global concern, may have to be regulated globally through conventions that control globalized supply chains. Hazardous chemicals often associated with RE may be viewed in ChemSec's, Sin List.

The biggest challenge we face in the manufacture of renewables is understanding the full impact on human health and the environment, the transparency required in the life cycle of products and presence of chemicals that cannot be substituted. A circular economy approach is one of continuous improvement, that continuously identifies problems and continuously seeks to address them

8. Discussions and knowledge gaps

Discussions and presentations around the JET during the visit demonstrated the need to:

- Simplify and popularise the JET
- Involve communities so that they can contribute in a meaningful way
- Include worker unions that protect jobs generated by the fossil fuel industry
- Have more practical living examples that demonstrate how the process can work
- Include up-scalable models
- Train communities to replicate or up-scale pilot models
- Promote energy efficiency of homes and infrastructure to minimise energy usage
- Create a zero-waste economy
- Understand the advantages and disadvantages of each RE option (solar, wind, biogas etc) from a lifecycle perspective
- Make informed decisions about the appropriate energy mix
- Look at energy ownership models: not only community owned, but also models where municipalities
- See how community governed projects fit into the larger picture, such as existing grid infrastructure, or in the absence of such into the regional or national energy strategy plans.
- Deal with issues of tariffs from large-scale grids cross-subsidising other services, such as water supply
- Promote a circular economy approach
- Utilise old mining towns, infrastructure and skills to build RE manufacturing capacity
- Include transport in the JET
- Strategize on dealing with governmental hurdles that block the JET

From the week's visit many questions were raised. They form a good framework for exploring our knowledge gaps and to research information that is currently available before we take our next steps.
These included:

- How do we overcome our challenges in moving the JET forward?
- How do we incorporate the JET into the IRP and other government policies?
- How do we promote public/ community ownership of energy in our countries?
- Which are the best energy models to adopt?
- Which are the best RE options for our respective countries, and how is it best applied given the country context i.e. with or without a pre-existing grid?
- Do we fully understand the impacts of establishing a RE economy?
- How do we finance the JET?
- What do we consider as being affordable and accessible energy for all?
- How do we enable an RE manufacturing environment in our countries?
- What are the waste materials generated from RE and how do we minimise its impacts?
- How do we integrate a circular economy way of thinking into the JET?
- Who will lead the JET movement and how will we organise ourselves and influence it?
- Which country do we visit next that can demonstrate how a JET can work for us?

9. Way Forward

This partner visit to South Africa explored many arenas of the JET from looking at their countries' various energy mixes, future plans for electrification and obstacles to providing safe affordable energy to all communities to what a JET entails to how it may be rolled out to best serve the needs of communities to ownership and on- or off-grid options to the training of communities in upscaling pilot projects and recycling materials to the impacts on people's health and the environment, particularly with new RE technologies. We will continue these discussions with inputs from participants into the first quarter of 2019 which will inform the topic for the next session. This is part of a four year process, at the end of which we hope to formulate a set of general and concrete suggestions for actions for the various stakeholders, taking into account the different needs and perspectives from communities/contexts in different countries.

10. Reading list and Weblinks

- groundWork. 2018. *Coal Kills: Research and Dialogue for a Just Transition*.
- Project 90 by 2030. 2018. *The Role of Ownership in a Just Energy Transition*.
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- groundWork, Friend of the Earth, South Africa and Earthlife Africa Jhb. 31 March 2017. *Comments: Integrated Energy Plan (IEP) and Integrated Resource Plan (IRP) 2016*
- CFA. May 2018. Briefing Paper: *Big Push for the Development of Hydropower in India*
- CFA (India). 2017. *Coal vs Renewables: Finance Analysis*.
- MAB (Brazil). Pamphlet: *Movement of the People Affected by Dams*
- AIDC. 2016. *One Million Climate Jobs: Moving South Africa forward on a low-carbon, wage led and sustainable path. And cartoon booklet: Climate Jobs for a Just Transition*
- AIDC. 2013. *Green Economy: The Long Suicide. Different Worlds of Green Jobs & Climate Jobs* (Abridged).
- OMerten, M. 2017. *Stats SA Poverty Report 2017: Policies fail the people of South Africa*. Daily Maverick, 23 August.
- Earthlife Africa*. Sustainable use of Natural Resources to Improve Resilience on South Africa "a Grass Roots Women's Initiative" Activity Tool Kit for Schools*
- Energy Research Centre, CSIR and IFPRI. October, 2017. *The Developing Energy Landscape in South Africa: Technical Report.*
- Zonke Energy (Hendrik Schloeman). November 2018. Presentation: *Taking Power to the People.*
- Kamese N Geoffrey (NAPE). 2018. Partner Country Report: *The Energy Situation in Uganda*
- GreenCape. 2017. *Small Scale Embedded Generation in the Western Cape*.
- South African Local Government Association (SALGA). January 2018. *Renewable Energy Scenarios for Municipalities in South Africa*.

SSNC	www.naturskyddsforeningen.se/in-english/about-us
groundWork	www.groundwork.org.za/
Earthlife Africa	earthlife.org.za/
Life After Coal	https://lifeaftercoal.org.za/
Urban Earth	www.urbanearth.co.za/team/
Sustainable Energy Africa	https://sustainabledevelopment.un.org/
Mike Levington	www.sairec.org.za/speakers/mr-mike-levington/
AIDC	http://aidc.org.za/
GreenCape	www.greencape.co.za/
iShack	www.ishackproject.co.za/
Specialised Solar Systems	specializedsolarsystems.co.za/
Zonke Energy	www.zonkeenergy.com/; www.zonkeenergy.com/JabulaProject.php
Parkhurst smart grids	www.htxt.co.za/2016/08/11/what-parkhurst-did-next-smart-grids-solar-power-and-a-virtual-neighbourhood-watch/
Movement of the People Affected by Dams	https://www.mabnacional.org.za
Chemsec Sin list of chemicals	https://chemsec.org/sin-list/

APPENDICES

Appendix A

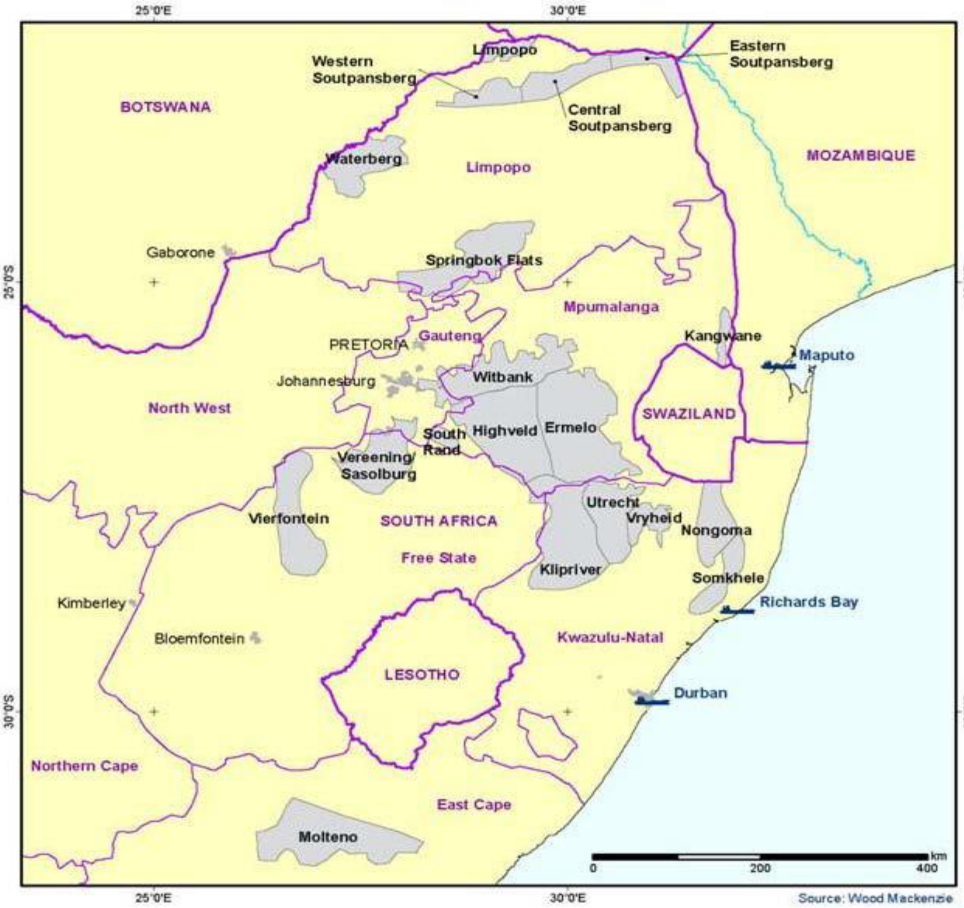

Figure 1: Map indicating South Africa's coal producing and energy generating regions

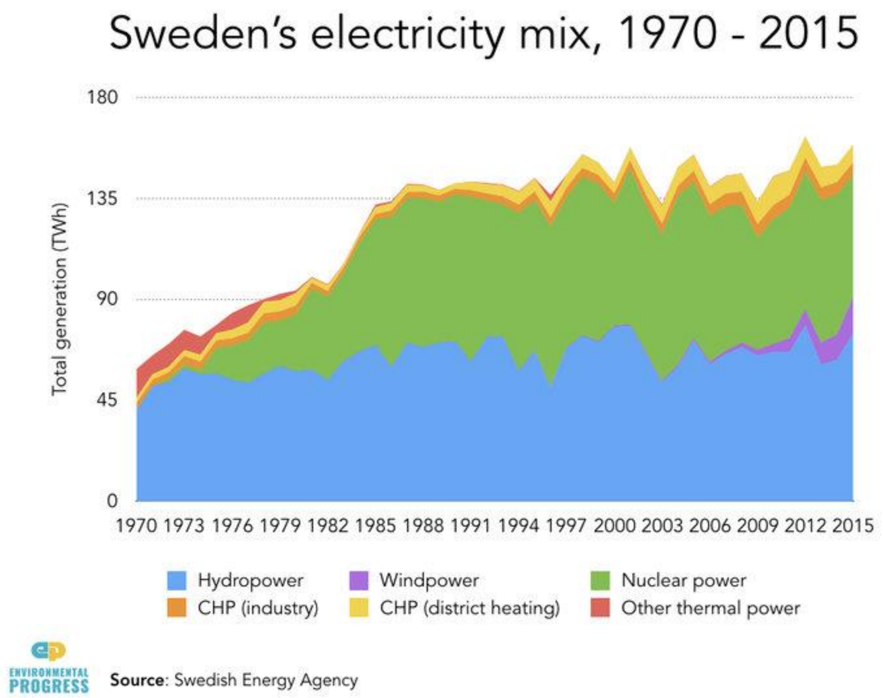

Figure 2: Sweden's energy mix showing dominance of hydropower, historical nuclear power component and introduction of wind power

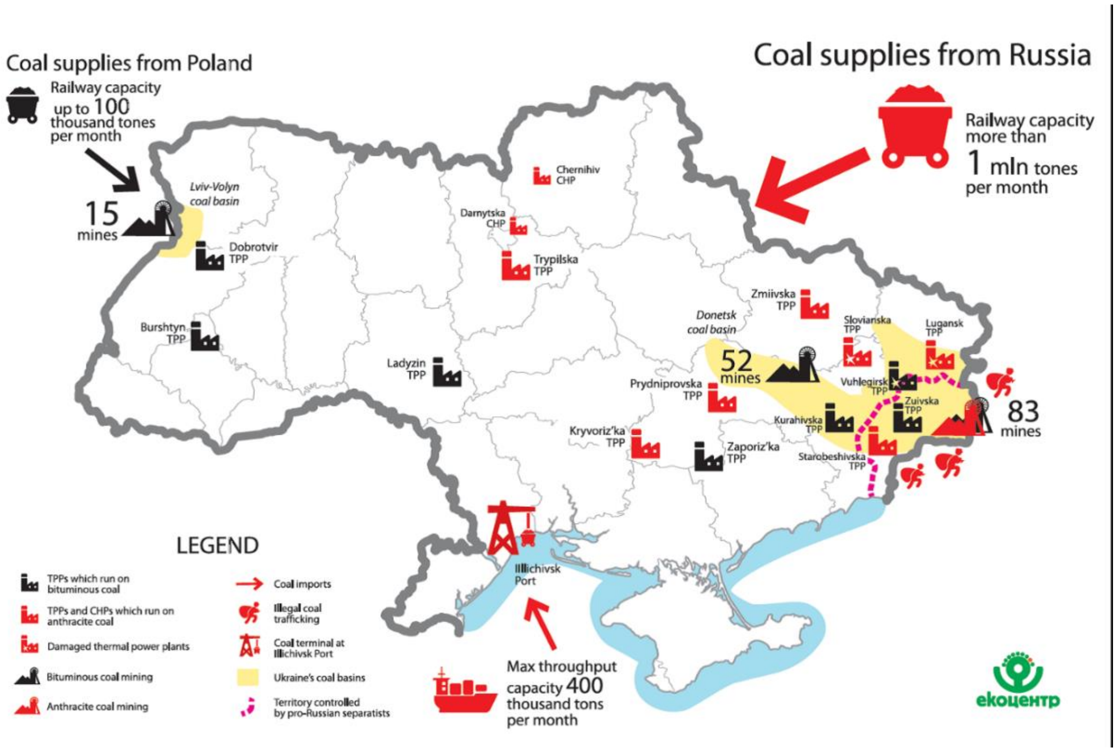

Figure 3: Ukraine's energy sector showing Russian invasion of Eastern areas containing coal mines and power plants

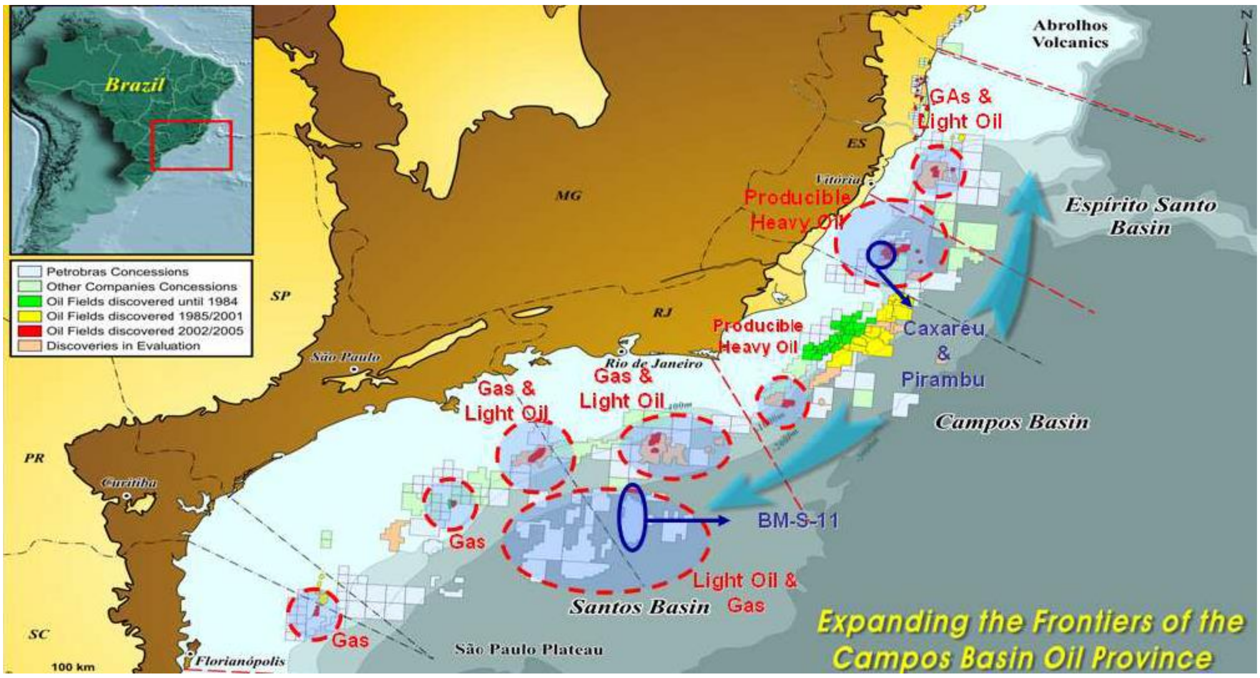

Figure 4: Map showing Brazil's recently discovered oil and gas fields (source: Petrobras, 2007)

Appendix B

Project Name: Sustainable Use of Natural Resources to improve Climate Change resilience in South Africa “Grass roots Women's Initiative”

Introduction: Earthlife Africa Johannesburg is an environmental NGO that seeks a better life for all people without exploiting other people or degrading their environment. The Sustainable Energy and Livelihoods Project (SELP) is a project of Earthlife Africa Johannesburg, focussing on the sustainable use of natural resources for sustainable livelihoods within communities.

The OXFAM supported this initiative as the host of the funds, from European Union (EU) and Earthlife Africa- SELP (JHB) is an implementer in partnership with GenderCCSA, which focused in Limpopo & Western Cape, whereas Earthlife Africa-SELP, focused in Gauteng (four Municipalities).

Reason for the project:

The country’s climate and energy context reflect and perpetuate South Africa’s persistent poverty and growing inequality.
- As in other developing countries, people living in poverty in South Africa are particularly vulnerable to the impacts of climate change.
- Around 70% of the country’s poorest households live on small-scale farms or manage small household gardens to supplement their food security.
- Many women especially in rural areas dependent on natural resources for their livelihoods and climate change is constantly threatening this because it impacts the availability these resources.
- Under these conditions their capacity to access resources in order to adapt to the change in climate is also Impaired; it is on this premise that makes women key role players in the adaptation activities.

“The Earthlife Africa is currently facilitating a women's movement: Women, Energy and Climate Change Forum (WECCF) which is a group of women coming from community based organisations in Gauteng engaged in a broader mobilisation and advocacy on climate and energy issues.” it is on these reasons that WECCF, is sitting at the best position to implement this project.

Project sites

All these project sites have similar systems i.e. Solar PV systems, Biogas system, Rain water harvesting tanks & Sustainable Agriculture garden

1. Nandi Primary School- Soweto (City of Joburg Metro)- where we went to visit

2. Motsewapele Primary School- (Emfuleni District Municipality)

3. Khangezile Primary School- (Ekurhuleni Metropolitan Municipality)

4. Mphethuto Primary School- (Mogale City Municipality)