WHAT DOES KOEBERG MEAN TO ME?

Nuclear Application: Electricity generation through the Koeberg Nuclear Power Station of Eskom in South Africa (KNPS)

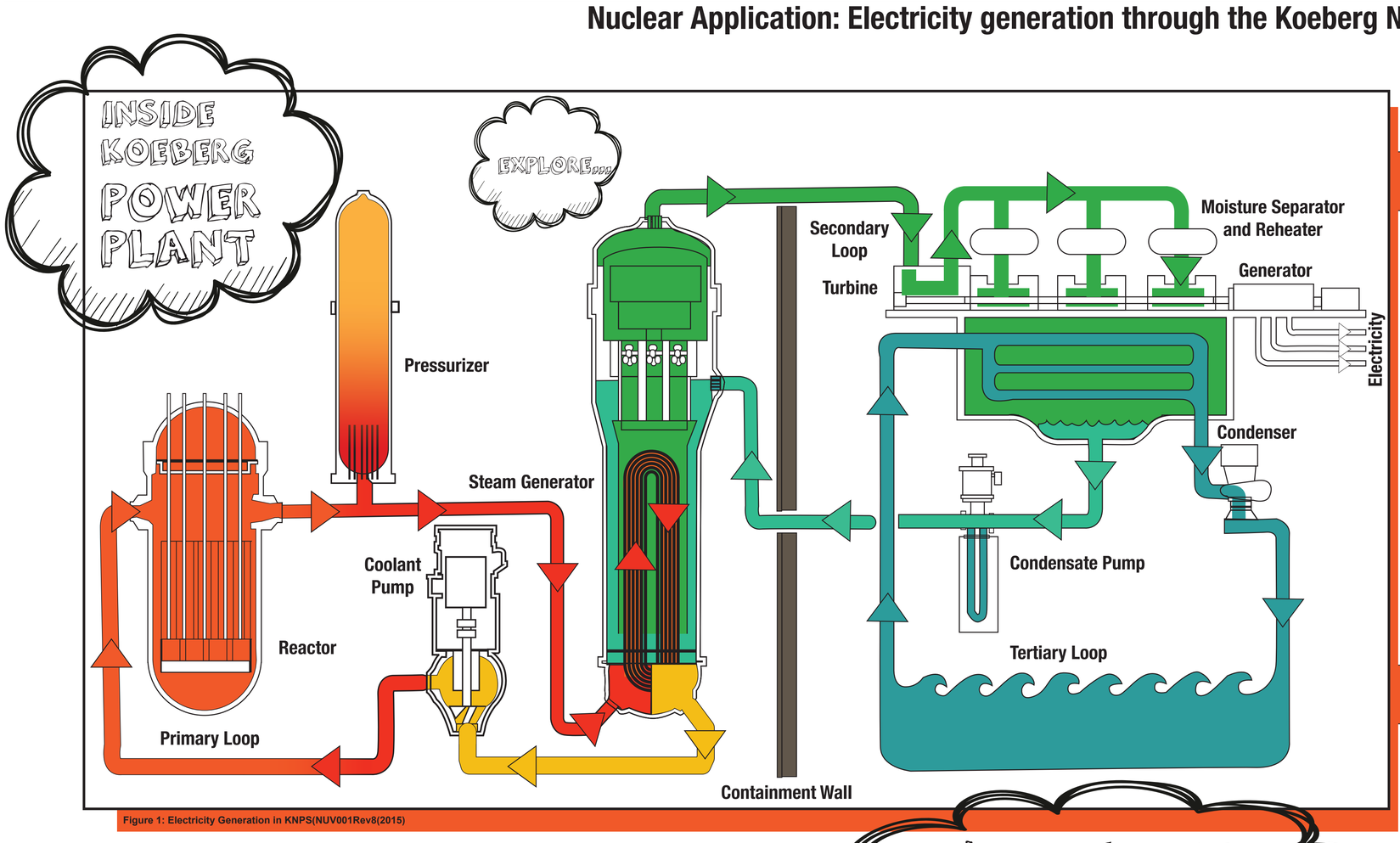

Figure 1: Electricity Generation in KNPS(NUV001Rev8(2015)

ELECTRICITY USAGE

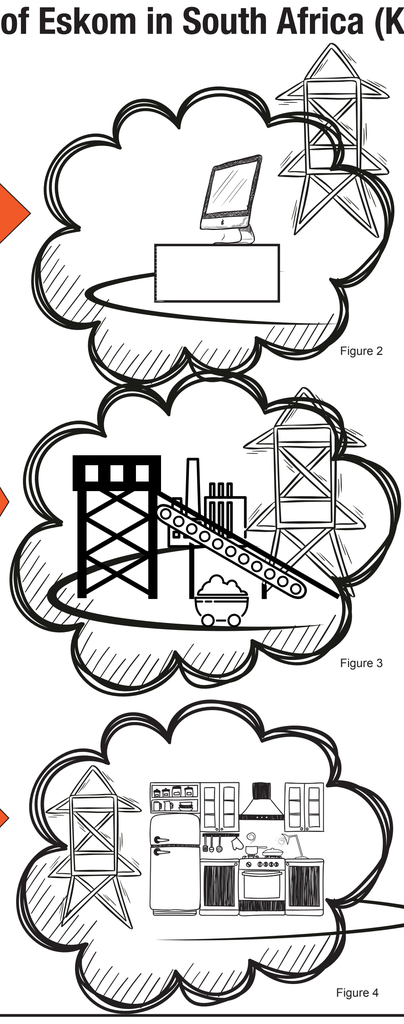

Figure 2

Figure 3

Figure 4

FACTS

Nuclear energy currently provides approximately 11% of the world's electricity needs. Koeberg Nuclear Power Station (KNPS) situated in the Western Cape, South Africa and currently provides approximately 4.4% of South Africa's electricity need as Africa's first nuclear power station. According to the generation division,AX0001Rev(2015) KNPS has a net output of 1 860 MW. The Koeberg Nuclear Power Station is a Pressurized water reactor (PWR), for this reason KNPS ranks high in terms of safety and considered a reliable nuclear power station.

The nuclear fuel used in KNPS is Uranium. The Uranium fuel generates heat through a controlled nuclear reaction process called fission by splitting certain atoms of uranium,water is then boiled into steam that ultimately turns the propeller-like blades of the turbine that spins the shaft of a generator. Inside the generator coils of wire and magnetic fields interact to generate electricity , which is then distributed for various use e.g. domestic or industrial etc.

Where to NOW! Possible Solution

STRATEGY FOR THE FUTURE

The long term strategy is the possible extension of the life of Koeberg Nuclear Power Station.The utility has been engaging with the IAEA and the Regulator concerning putting in place programs and processes to enable possible Long Term Operation. As part of this long term strategy Eskom has embarked on the steam generators project. The project involves the specification, design, manufacturing, removal and installation of the 6 Inconel 600 steam generators (3 per unit).

The current generators are reaching its end of life and are susceptible to primary water stress corrosion cracking(PWSCC).The percentage of cracked tubes per SG varies from 8% to 41% of the total number of tubes. Inconel 600 steam generators are also prone to attack of the tube material due to the chemical conditions of the Secondary Side feedwater leading to inter-granular stress corrosion cracking (IGSCC). Most reactors similar to KNPS has already replaced their steam generators of similar design to the latest technology. KNPS was ,however able to extend the life of the existing generators by implementing an operating regime at a reduced temperature. The latest international experience has demonstrated that SG replacement presents an opportunity to both extend the operating life of the units, and increase their power output through improved heat transfer capabilities.

GENERATION CHALLENGES

The utility Eskom generate approximately 95% of South Africa's electricity and more than 45% of Africa. Eskom uses various technologies to generate electricity, the combination is called the 'plant mix'.The utility is constantly investigating other forms of energy and renewable energy sources that could be used to expand its current energy mix (GX0001Rev(2014).

Nuclear is one of the sources of energy used in South Africa ,while the country can benefit from having more capacity through nuclear generation,there is currently issues that if addressed can extend and secure the current nuclear generation capacity, namely:

- Current Steam Generators are old ,the technology is being phased out by 2020 and consideration of possible thermal power uprates.
- KNPS is reaching the standard 40 years life span of power generating.

BENEFITS

The main benefit will be improved safety of the Koeberg Nuclear Power Station (KNPS)

Indirectly it will lead to:

- Consistent power supply and less need for maintenance.
- Allow for possible future life extension of the plant to 60 years.
- Opportunity for power uprate of up to 10% of additional clean, low carbon power.
- Less dose to workers.
- More personal time for workers and their family.

"Projet Simunye" is planned for planned (2018-2019), Eskom signed the contract with AREVA NP in 13 February 2015 and involves:

1. Design and manufacturing of individual components, assembly of the steam generators, including the shop hydro testing and transportation to the Koeberg site
2. Removal of the old steam generators and the installation and commissioning of the new steam generators. Also includes the disposal of the old steam generators.
3. All engineering and safety studies associated with the installation of the new steam generators

Project Milestones

Milestone 1 Start of critical forging activities at Japan Steel Works in Japan and Creusot Forge in France 5 December 2014 — 1

Milestone 2 Start of manufacturing in SENPEC, China July 2015 — 2

Milestone 3 Safety Case submittal to the NNR March 2017 (one year before installation outage) — 3

Milestone 4 Installation and commissioning of the replacement steam generators in Outages X23 in 2018

March 2018 for Unit 1;
September 2018 for Unit 2 — 4

OPPORTUNITIES!!

Through the Supplier Development and Localization (SD&L) Programme Eskom wants to achieve maximum and sustainable local development impact through leveraging its procurement spend to accommodate government's local development initiatives and policies.

Training Area	Local or Foreign
ALARA Planning	Foreign
Quality Assurance	Foreign and Local
Construction Management	Foreign and Local
Logistic Co-ordination	Foreign
Commissioning Engineers	Foreign and Local
Project Management/Project Control	Foreign and Local
Outage Planning	Foreign and Local
Mechanical Engineers	Foreign
Welding and Quality Control	Foreign and Local

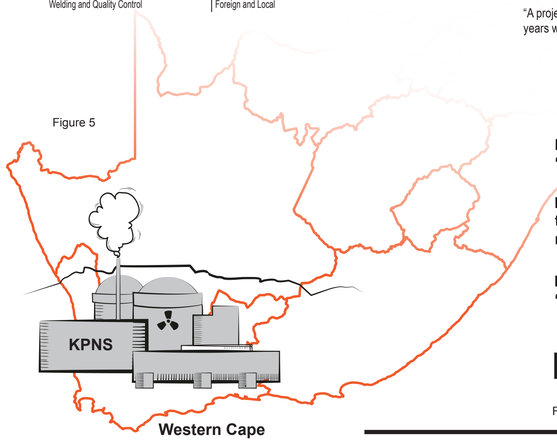

Figure 5

Women involved!

The team, consisting of experienced physicists/engineers, will be involved in diverse assignments in the fields of neutronics, core design, mechanical analysis, thermal hydraulics, Probabilistic Safety Analysis (PSA), etc. This is an opportunity of a lifetime for some of the women involved.**Thando Kana**, is part of the first team off to the AREVA offices in Lyon, France, during March 2015. She is integrated in the AREVA Neutronics team, focusing on reactor core design.The dynamic duo, consisting of **Shirley Movalo** will be integrated in the AREVA Neutronics team in Paris.The team departed recently to start their much-anticipated 12-month assignment.

Last but not least, **Linda Jacobs** (PSA) and **Judith Ncapayi** are part of the team getting ready to break new ground during August and September 2015. The team will be integrated in the AREVA offices in Paris, spending some time in Erlangen, Germany.

"A project like SGR is a once in a plant's lifetime opportunity and a first for Koeberg. No amount of years working at Koeberg will give this experience". **Thando Kana**

Figure 6

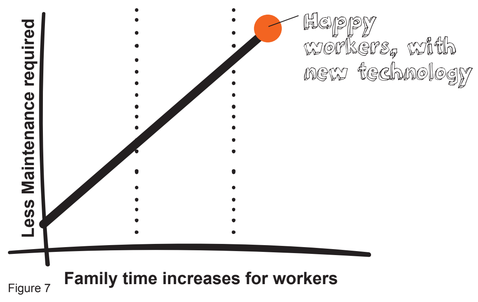

Figure 7

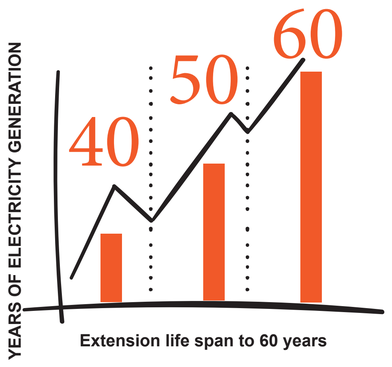

Figure 8

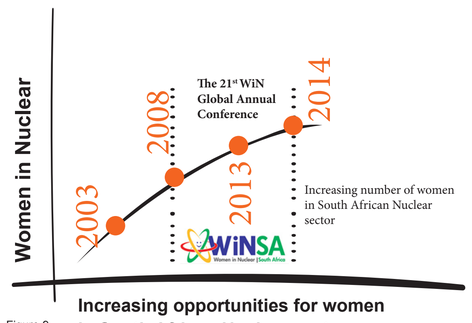

Figure 9

NATIONAL NUCLEAR REGULATOR
For the protection of persons, property and the environment against nuclear damage.
www.nnr.co.za

Author: Ms LG Dladla Chiloane

global WiN Women in Nuclear