National Workshop on Industrial Involvement

Capacity Building

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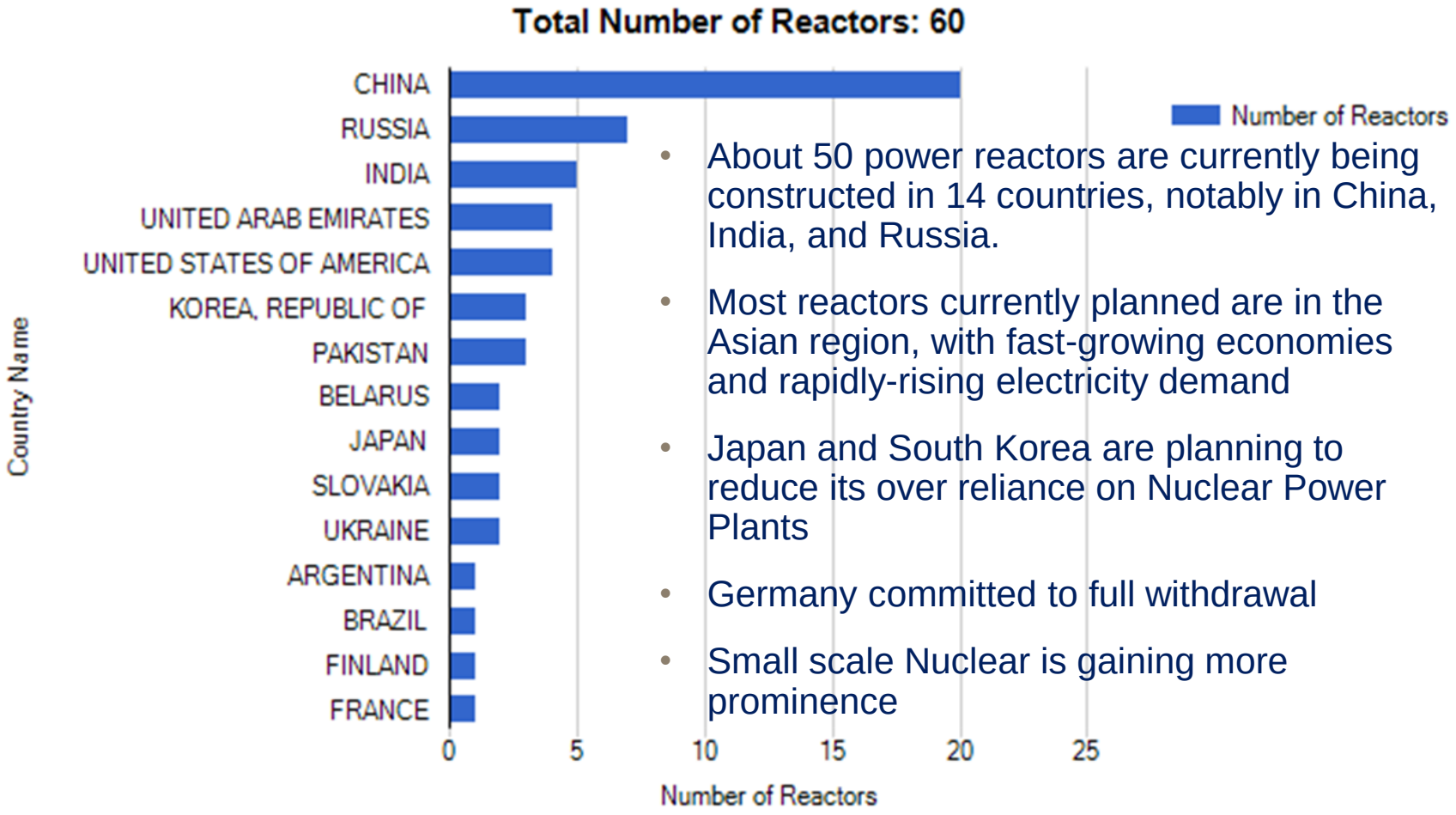
Content

International Nuclear Build Context



- About 50 power reactors are currently being constructed in 14 countries, notably in China, India, and Russia.
- Most reactors currently planned are in the Asian region, with fast-growing economies and rapidly-rising electricity demand
- Japan and South Korea are planning to reduce its over reliance on Nuclear Power Plants
- Germany committed to full withdrawal
- Small scale Nuclear is gaining more prominence

Source: IAEA

South African Nuclear Objectives

The objectives of the South African nuclear programme, are:

- Establishment of the nuclear build programme in RSA for sustainable security of electricity supply
- Adherence to international safety standards
- Creation of RSA technology and industrial capacity competitive in world markets
- Developing a largely domestic nuclear fuel cycle
- Nuclear programme economics in RSA competitive against other local electricity generating options
- CO2 reduction objectives in line with SA government policy and anticipated regulation

Source: Nuclear Energy Policy

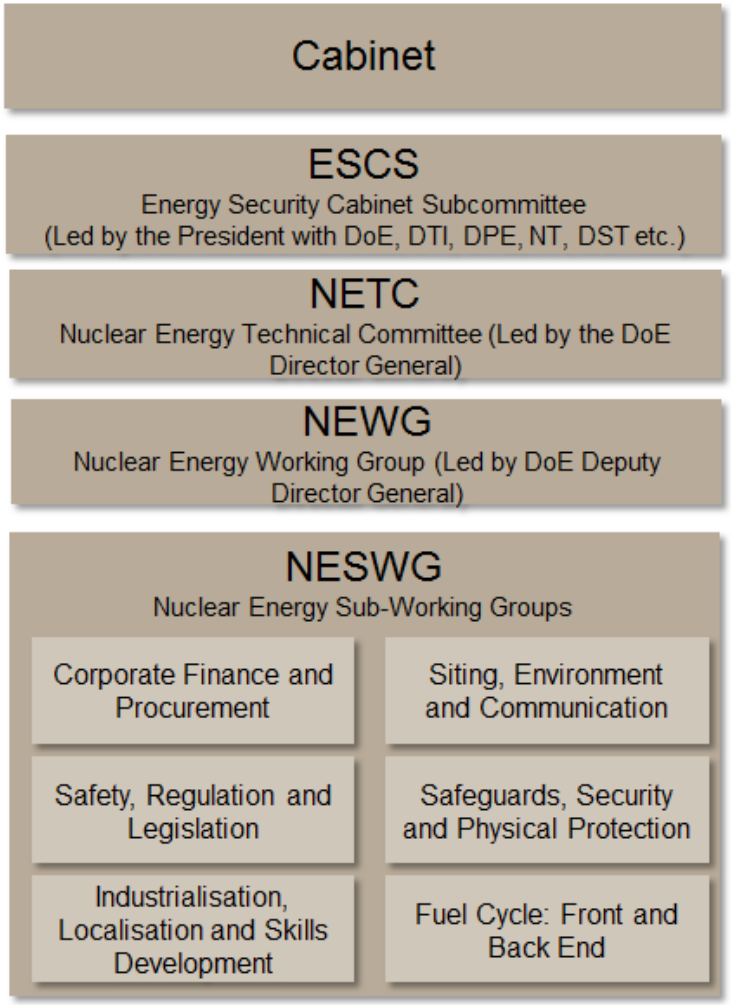
Establishment of national positions

"National policy, strategy and integrated planning for the NNBP will be drafted by the *NETC and its substructures the Nuclear Energy Work Group (NEWG) and Nuclear Energy Sub Working Groups (NESWG) in line with their mandate and established terms of references*.

All organs of state, key to the successful implementation of the NNBP, will be *represented within this structure as is appropriate to their role and responsibilities on the programme*.

Additional key NNBP stakeholders and external advisors may be consulted from time to time.

National policies, strategies and integrated plans will be presented to the ESCS and then to Cabinet for approval."



SOUTH AFRICAN NUCLEAR BUILD PROGRAMME

- *Eskom's nuclear programme is a component of a broader national programme* - The Eskom Nuclear Power Plant Programme (NPPP) can be considered to be one of 6 programmes making up the Nuclear New Build Programme (NNBP). Other programmes are the Necsa and NRWDI nuclear fuel programmes, the Necsa CPR/MPR and the enhancement of a national nuclear industrial base. These can be defined as:
  - *Nuclear Power Plant Programme (NPPP);*
  - *Nuclear Fuel Cycle Front-End (NFC F-E) facilities and services;*
  - *Nuclear Fuel Cycle Back-End (NFC B-E) facilities and services;*
  - *Multi-Purpose Reactor (MPR)* – for research and development and the commercial production of radioisotopes, treatment of materials and other commercial applications;
  - *The enhancement of the national infrastructure necessary to support the nuclear power programme;*
  - *The establishment of a sustainable industrial capability and service base to support the nuclear power programme throughout its lifecycle.*
- *Procurement* – In November 2016 Cabinet mandated Eskom to procure the NPPP and Necsa to procure the NFC F-E facilities.
- *Coordination and achievement of national objectives* - Coordination's is required between the mandated organs of state to manage synergies and to ensure the overall achievement of national strategies and planning imperatives (economic development, industrialisation, job creation etc.).
- *The DOE was initially mandated by Cabinet to coordinate the NNBP*

Participation by all key organs of state

“End State” Vision of the NEP for the NNBP; depicting the Industry Development Framework

Uranium Mining

Research Reactor - 30MW

Fuel Plants

Conversion

Enrichment

Fuel Manufacture

Operation & maintenance

Power Plants 11.4GW

Nuclear Manufacturing

NNBP Procurement

SA EPCM

OWNERS SCOPE EPCM

Waste Disposal Facilities

SA Turbine Co.

SA Nuclear Vendor

Training Facilities

Technology and Intellectual Property (IP) Transfer Influences

Factors that will influence the successful transfer:

- Level of government and industry ambition to localise
- Level of ambition of vendor and related supply chain to transfer IP
- Method and implementation of negotiated IP transfer
- The current status of the identified industry and gap.
- Sub system / component identification and the application of a supplier development process into lower tier manufacture (Supply chain management)
- Viability of local manufacture for identified opportunity, including
  - Skills development
  - Materials, manufacturing process (technology), accreditation for nuclear manufacture
  - Volume of materials and components
  - Time frame available to develop local suppliers prior to targeted unit for consistency and quality of supply
  - Required capability and capacity of manufacturing processes

Global Supply Chain

Eskom

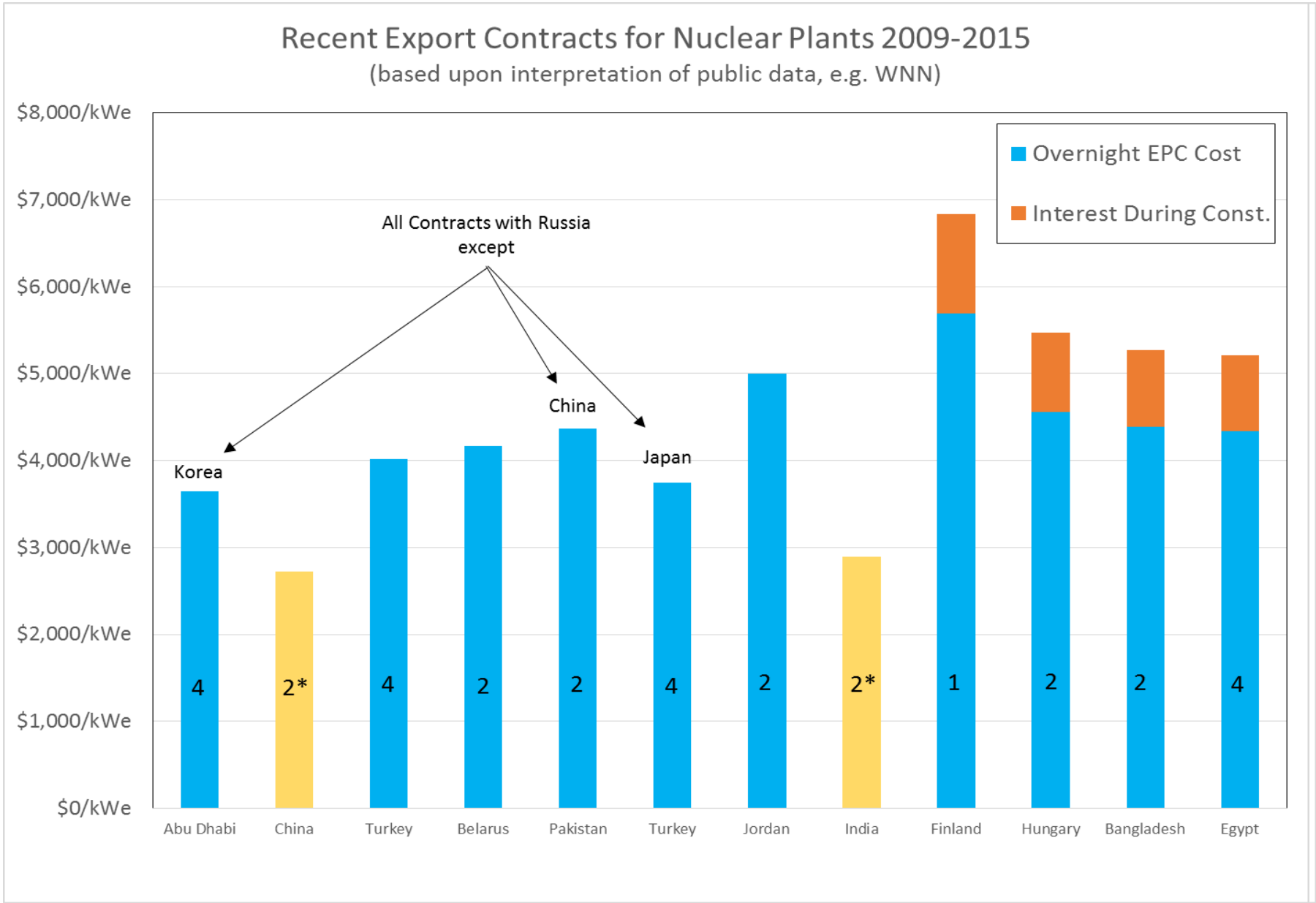
SCE&G
A SCANA COMPANY

AP1000 Domestic Project Suppliers

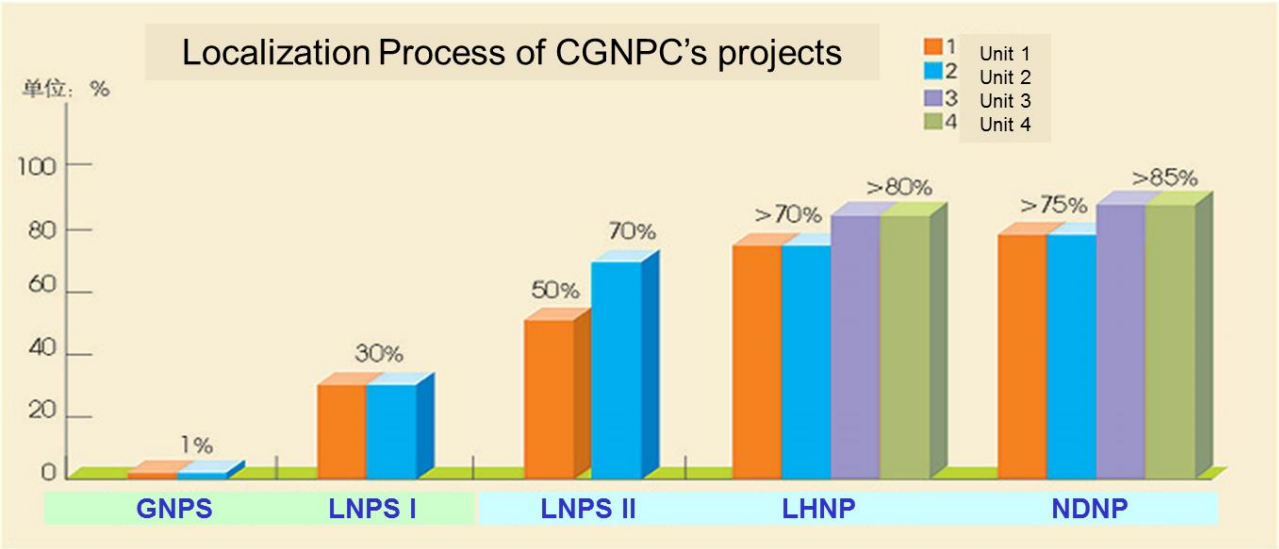
Economic Impact of Nuclear Investment

- Nuclear Capital costs vary dependant on contract model and technology selected, and is cost competitive.
- LCOE (Levelised Cost of Electricity) compares electricity sources on a consistent basis over the lifetime of the assets.
- Nuclear compares well with other base load energy sources – *key issue is the NDR (Nominal Discount Rate)*
- Once constructed, nuclear power plants have very low operational costs (fuel and maintenance costs) – this is consistent with the experience at Koeberg Power Station.
- Nuclear fleet construction programmes internationally has shown the cost benefit of standardised fleet build in reducing costs, while also creating domestic expertise and employment.

Nuclear Export Contracts Placed since 2009

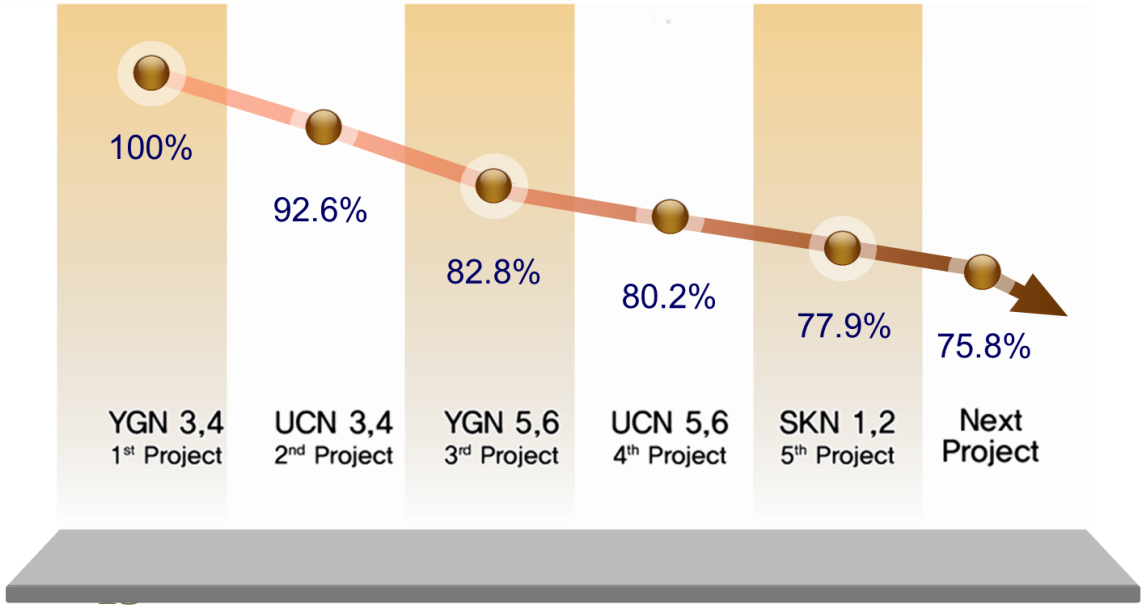


Impact of Standardised Fleet Build



Chinese CPR1000 component localisation over sustained fleet build

S Korean OPR cost reductions in a mature industry due to standardised design



Establishing the Funding Model

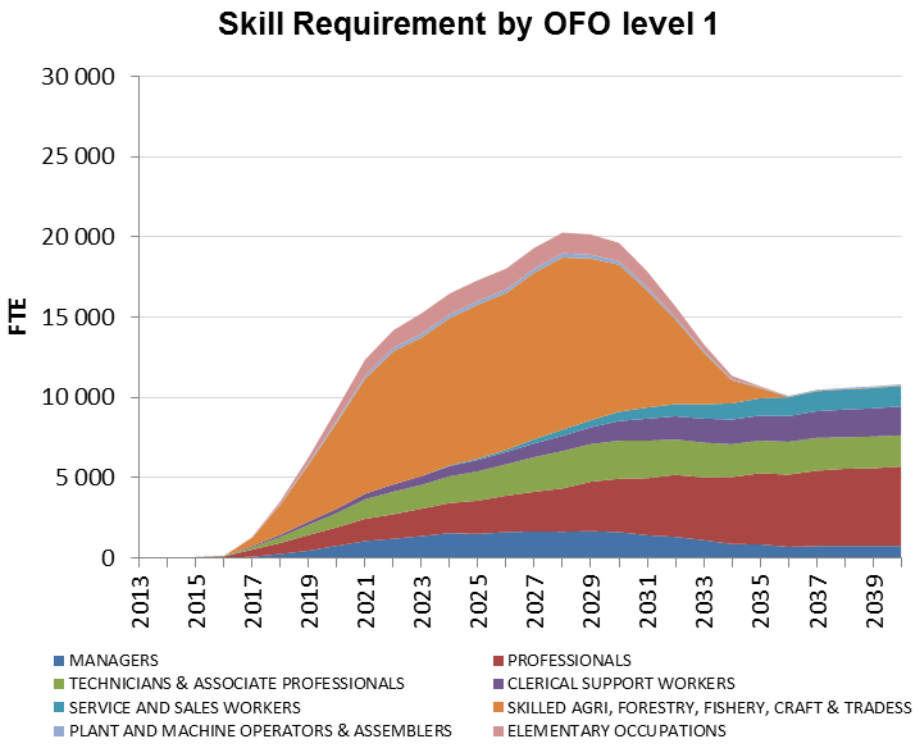
- **The Funding Structure:-** Nuclear build funding proposals coalesce on a model incorporating to one degree or another a combination of the following:-
  - Participation of an equity partner (International utility or an energy intensive user or group thereof)
  - Government Equity Injection
  - Development funding institutions
  - Export Credit Agency loans
  - Local funding

- **The Model Development Process:-** The mix of the above funding mechanisms will depend largely on the bid proposals and subsequent negotiations and as such is a dynamic aspect of the bid process.

Development of the funding model is an iterative process matured through key stakeholder participation in the bid management process. A stakeholder invested working group should be used to facilitate this function.

Skills requirements for fleet of NPPs

Deploying 8 large Reactors at 18 month intervals



Skills (OFO Level 1)	Max month FTE
Managers	1 687
Professionals	4 946
Technicians & associate professionals	2 368
Clerical support workers	1 802
Service and sales workers	1 267
Skilled agri, forestry, fishery, craft & trades	10 727
Plant and machine operators & assemblers	264
Elementary occupations	1 296
Total at Peak of SIP01 (2028)	20 282

Skills peak in 2028 at ~16 902 FTEs. Pipe fitters, clerical support works, electrician and fitter – welders will still be in the highest demand between ~1 350 and ~1 325 total FTEs respectively.

Considerations
The time required to train
address possible critical skill shortages,
Work force levelling and peak managements

Mobilization and demobilization across various sites
Work force mobility (moving from project to project with minimal periods of unemployment between projects.

Note this does not include industrial skills requirements

Do these skills exists ?

Capacity Initiatives including SED and CSR

SED & CSR Category	NNBP Initiative	Status
Education	Create excellence in education through initiatives such as the Technology Research Activity Centre (TRAC), Bursaries, Nuclear Debates, Take a learner to a Nuclear Plant and Teacher Incubation.	TRAC operational in 30 schools with more than 2000 students impacted. 2018 Nuclear debates concluded. 31 bursaries awarded
Supplier Development and Localisation (SD&L)	Small, Medium and Micro Enterprises (SMME) Incubation.	New Generation Mindset Incubator running in the Eastern Cape . Incubation programme terminated at the end of the contract.
Skills Development	Training of 150 young people over 3 years. About 100 artisans and 50 trade certificates.	Programme terminated. .
Health Care	Health care mobile clinic to provide basic care in remote areas.	Concept phase.
Infrastructure	Construction and/or upgrade of existing school infrastructure such as school halls, classrooms and libraries.	In progress.

Characteristics of an Intelligent Customer

The holder of a nuclear site licence needs to have intelligent customer capability within its organisation. This capability should have the attributes necessary to:

(a) Understand the safety requirements of all its activities relevant to safety including those of its contractors and to take responsibility for managing their safe operation.

(b) Understand its duties under the law with respect to safety.

(c) Set, interpret and deliver safety standards relevant to its nuclear operations.

(d) Have sufficient breadth and depth of knowledge and experience to understand the safety envelope of its plant(s) and the nuclear safety hazards represented.

(e) Understand and support all aspects of the safety case/report and the facility operation over the full facility lifetime – including, where necessary, decommissioning and disposal.

(f) Knowing where and when to seek advice and on receipt of this advice understanding the implications for safety.

(g) Maintain and develop the corporate memory with an ability to readily extract nuclear safety related business intelligence.

(h) Ensure adequate numbers of suitably qualified and experienced staff are available to make safety judgements.

Thank you