
CESA
Consulting Engineers South Africa
SPOORMAKER
& PARTNERS
MECHANICAL & ELECTRICAL
CONSULTING ENGINEERS
EST 1904
BUILT TO INSPIRE
LEGACY OF ENGINEERING EXCELLENCE
Dr. Andries Nel

# INDEX:

- About the speaker
- Why the construction industry
- Definition of building services
- Noteworthy projects
- The future
- Closing


# ABOUT ME

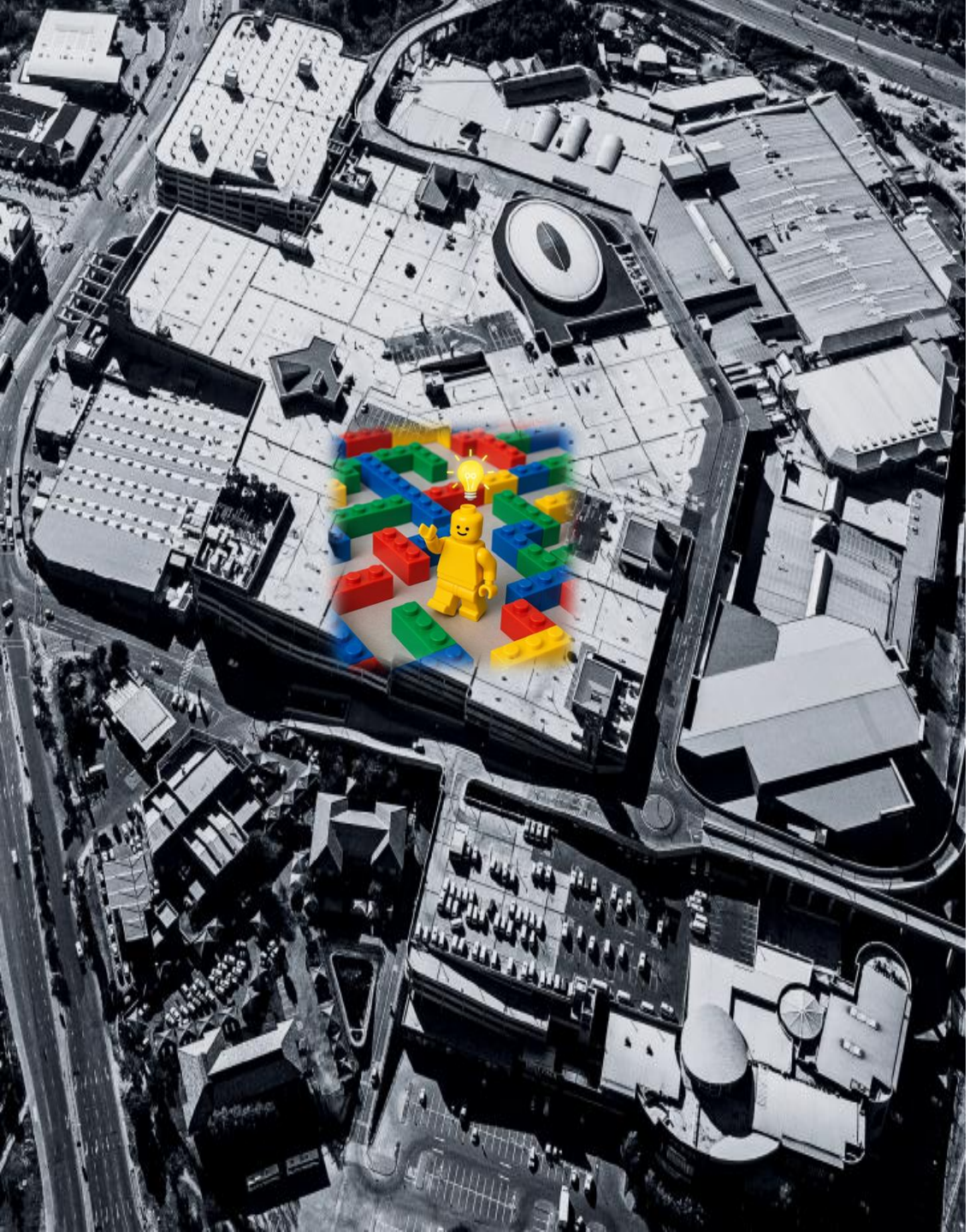
Dr Andries Nel is a registered **Professional Engineer, Project Management Professional** and a **Professional Construction Project Manager.**

He holds a **Bachelor degree (B. Eng), Master's degree (M. Eng)** and **Doctor of philosophy degree (Ph.D Eng)** in **Mechanical Engineering** with a specialisation in thermodynamics.

He is currently a Director at Spoormaker and Partners Pty Ltd, a building services design firm within the construction sector.

He has won numerous industry awards including the coveted **CESA AON 2024 young engineer of the year** and been involved with national and international award winning projects.

He also serves as a member of several voluntary industry associations.



# WHY THE CONSTRUCTION INDUSTRY?

Blame it on the Lego! As a young boy I spent hours building cities, not because I had to, but because I had to see how it all works together.

**Back then it was play. Today it is purpose.**

The same curiosity and drive to build something lasting is what led me into the world of consulting engineering and ultimately the built environment.

**Where is the biggest need?**

Stats SA reported the construction sector contributed R109.5 Billion rand to South Africa's gross domestic product.

We face big infrastructure challenges but also big opportunities.

- High impact projects
- Socio-economic development and employment

# WHAT IS BUILDING SERVICES?

**MEPF stands for Mechanical, Electrical, Plumbing, and Fire Protection.**

**It encompasses the design, installation, and maintenance of systems within a building.**

**MEPF engineers ensure these systems work together seamlessly and efficiently, contributing to a building's functionality, safety, and comfort.**

You can dream, create,
design, and build the
most wonderful place
in the world.
But it requires people
to make the
dream a reality.

WALT DISNEY

# NOTEWORTHY PROJECTS

- Commercial office
- Healthcare
- Public and entertainment
- Hospitality and leisure
- Data centres
- The future

# COMMERCIAL OFFICE

# OLD MUTUAL – CONSTRUCTION TIMELAPSE

- GLA: 30 000 $m^2$

4 Rugby/Soccer fields

- 12 Levels office
- 8 Super basement
- 5-Star Green Star rating
- 2 x 1200 kW air-cooled chiller on roof supplying decentralized variable air volume air handling units.

# DEPARTMENT OF AGRICULTURE, LAND REFORM AND RURAL DEVELOPMENT

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**GLA: 40 000 $m^2$**

**Ducting length: 10 km**

**Total ducting: 26 600 $m^2$**

**Chilled water piping: 2.9 km**

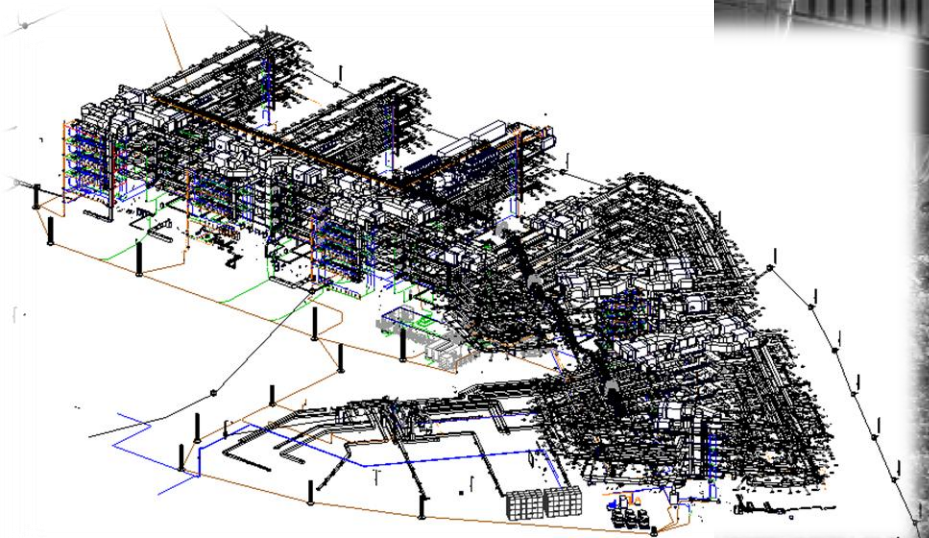
**Cooling plant: 3.8 MW**

**Heating plant: 2.0 MW**

**Water piping: 7.9 km**

**Sewer piping: 6.2 km**

**ICT cables: 11.4 km**




# DEPARTMENT OF AGRICULTURE,LAND REFORM AND RURAL DEVELOPMENT

**MEPF DESIGN:**

- **Variable air volume diffusers**
- **Hot water through heat accumulators and heat pumps**
- **Heat recovery from HVAC desuperheaters**
- **Speaker system tracking the occupants and voice decibel level**

# WHY WAS THIS PROJECT NOTEWORTHY:

- **Scale of the project**
- **Heritage building**
- **Inner city rejuvenation**
- **Heat recovery for hot water generation**
- **Groundwater for irrigation**
- **Green star rating**

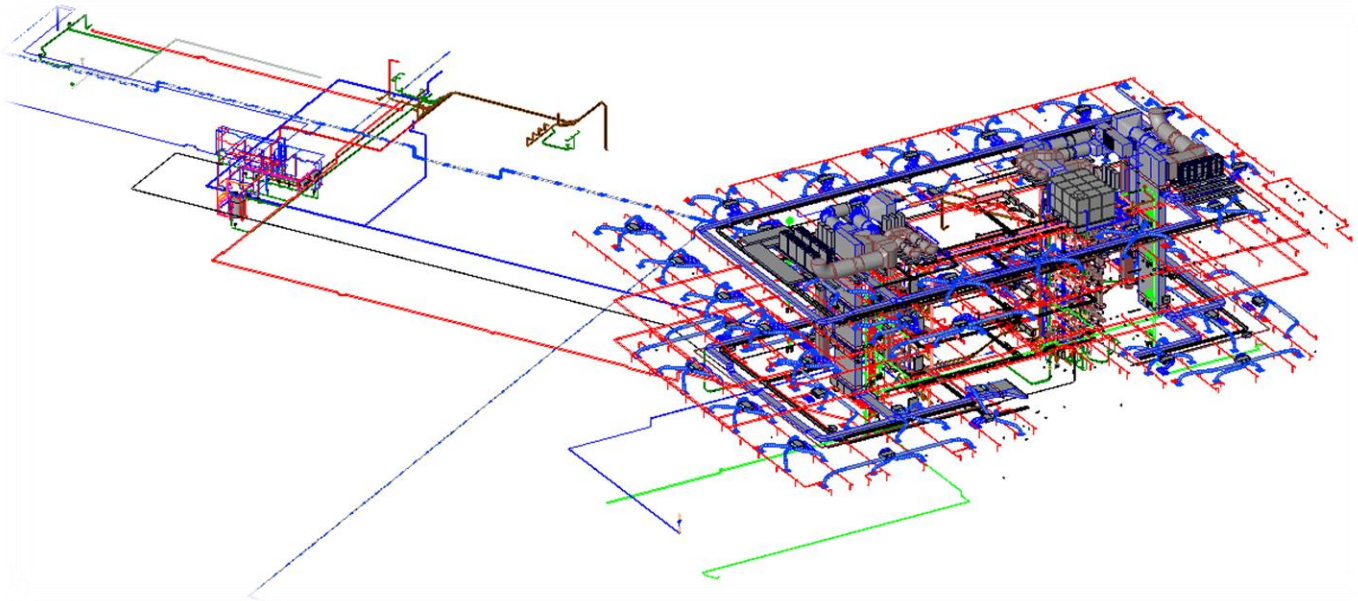

# Waterfall Nexus 1

**GLA: 32 000 $m^2$ precinct**
**GLA Nexus 1: 7 363 $m^2$**
**Precinct built on super basement**
**Two basement levels**
**Four office levels**
**Water piping: 1.3 km**
**Sewer piping: 0.5 km**
**Metering: Tenants and base build**

# Waterfall Nexus 1

**MEPF DESIGN:**

- **Energy efficient VRF HVAC design**
- **Hot water through heat accumulators and heat pumps**
- **Solar thermal hot water for base build**
- **Highly efficient lighting**
- **Water efficient fittings**
- **PV to supplement peak load**



# WHY WAS THIS PROJECT NOTEWORTHY:

- **Sub-metering of water and electricity**
- **PV panels to reduce the peak electricity demand**
- **Net zero carbon L1**
- **5-star green star office v1.1 design and as-built and Interior v.1 certification.**
- **First green star certified building in RSA to also attain an EDGE certification**
- **Nexus showed an improvement of more than 100% in carbon emission reductions**

NET ZERO

greenstar AFRICA South Africa EQUATOR THE BELT FACTORY™
Existing Building Performance v1
5 Star Rating
South African Excellence
VALIDITY AUGUST 2020 - AUGUST 2023
GREEN BUILDING COUNCIL SOUTH AFRICA

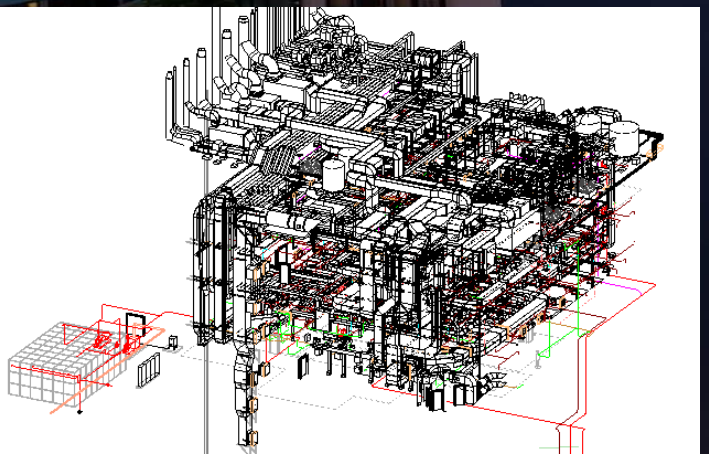
AFRICAN PROPERTY AWARDS Roca LAUFEN 2024 - 2025

AFRICAN PROPERTY AWARDS
AWARD WINNER
OFFICE INTERIOR
SOUTH AFRICA

# Healthcare

# Nuclear Medicine Research Infrastructure (NuMeRi)

GLA: 4 453 $m^2$
Ducting: 2.2 km
Chilled water piping: 2.5 km
Water piping: 2.1 km
Sewer piping: 1.1 km
ICT cables: .5 km

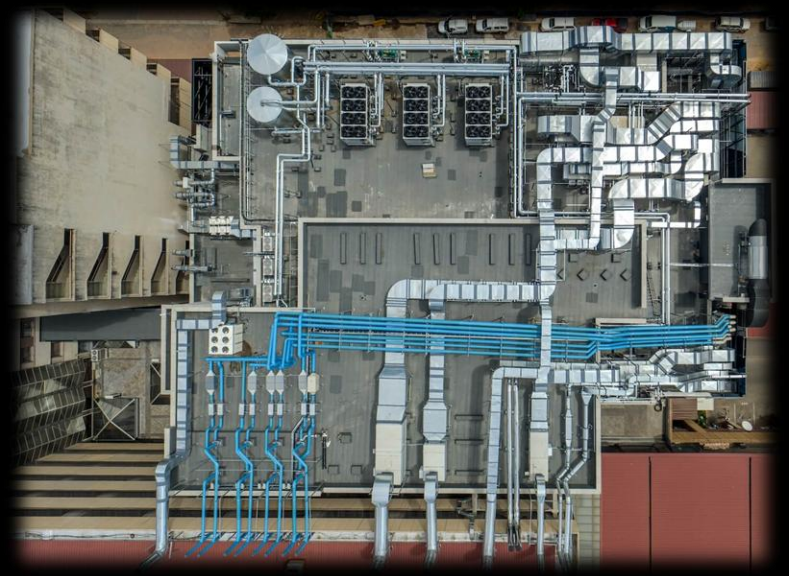


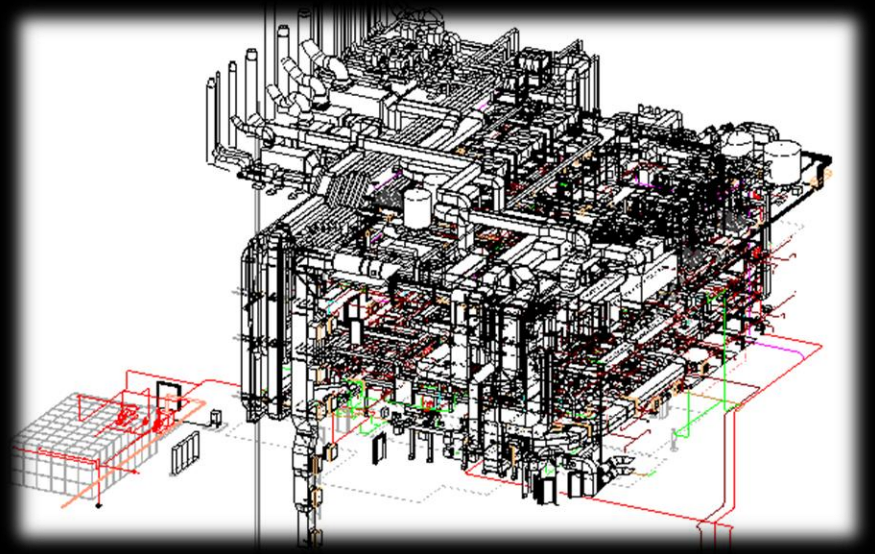
# Nuclear Medicine Research Infrastructure (NuMeRi)

# Nuclear Medicine Research Infrastructure (NuMeRi)

**MEPF DESIGN:**

- 4 Pipe air cooled polyvalent chiller producing chilled water and hot water to the AHUs
- VRF with heat reclaim for office portion
- Each lab has temp and pressure control
- HEPA filtration on fresh air base build





# WHY WAS THIS PROJECT NOTEWORTHY:

- Africa's first ever nuclear medicine research facility
- Cyclotron – Producing isotopes used in radiation therapy
- Consolidated expertise in nuclear technologies that will assist in the treatment of cancer and other diseases

# LIMPOPO CENTRAL HOSPITAL

+-500 Beds

GLA: 100 000 $m^2$

Water supply piping: 56.8 km

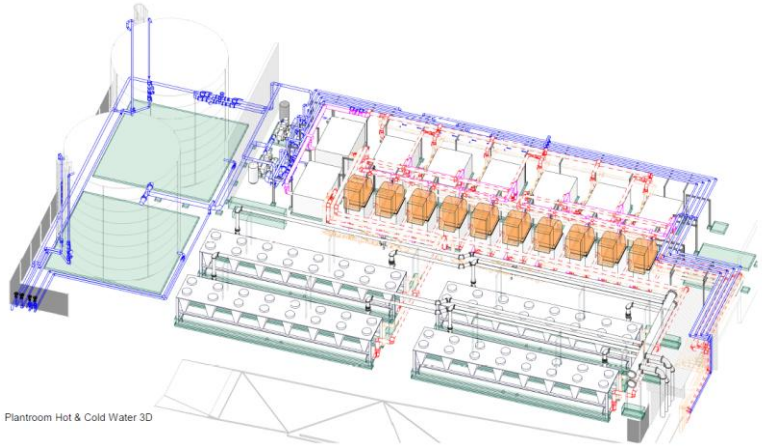
Drainage piping: 29.3 km

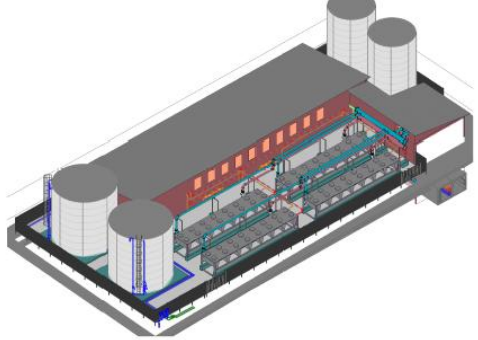
Ducting length: 20.75 km

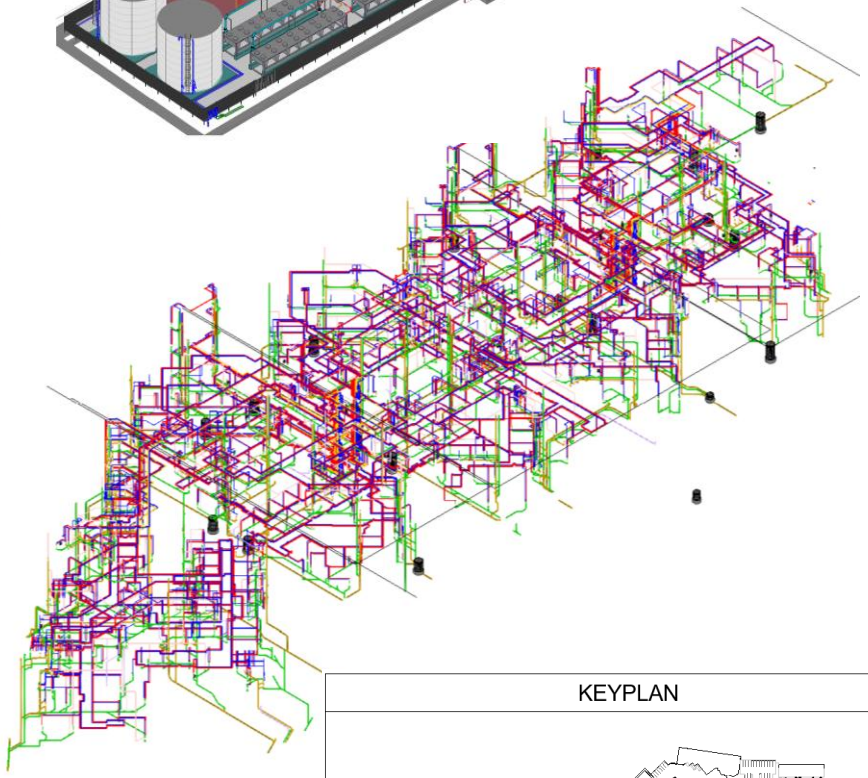
Fire water piping: 11 km

Cooling load: 6 MW

# LIMPOPO CENTRAL HOSPITAL



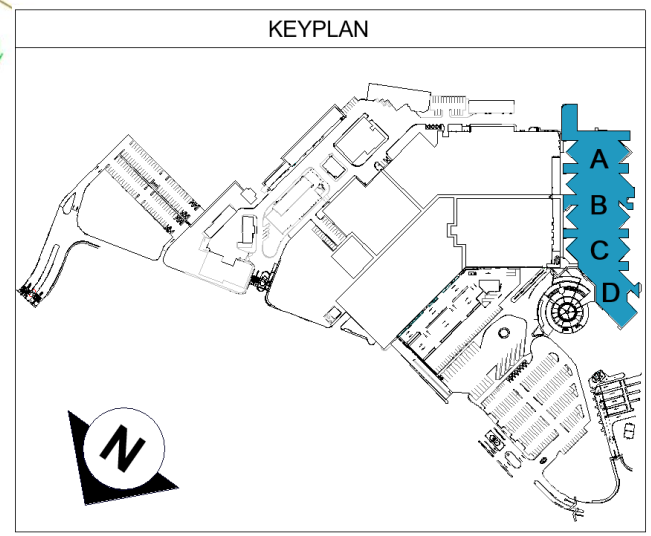


**MEPF Design:**

- **Cold water storage: 0.8 ML**
- **Hot water storage: 44 kL**
- **Hot water preheating: 22 kL**
- **Heat generation: 600 kW**
- **Thermally activated building system (TABS)**
- **Heat recovery from HVAC for hot water generation**
- **Borehole water for irrigation**

**Block A's**

**Reticulation**



# Public and Entertainment

# FNB SOCCER CITY

GLA: 68 000 $m^2$
Capacity: 94 000 seats
Largest stadium in Africa
3 tiers of seating
230 private boxes
2 VIP suites
4055 underground parking
71 concession kiosks
7 070 tons of steel
300 seater restaurant
Diameter: 320 m
Height: 60m

- 2010 Leaf awards winner
- 2010 VISI award
- 2010 SAPOA award – Stadia
- 2010 SAPOA award - Innovation

# Hospitality and leisure

# Waterfall Courtyard Hotel

**GLA: 32 000 $m^2$ precinct**
**GLA Courtyard Hotel: 10 341 $m^2$**
**164 rooms**
**4 penthouses**
**Protea restaurant**
**Highline restaurant**
**Club lounge**
**Boardroom and co-working spaces**
**Fitness room and swimming pool**

# Waterfall Courtyard Hotel

**MEPF DESIGN:**

- **Energy efficient VRF HVAC design**
- **Variable frequency drive domestic pump set including AI**
- **Hot water through heat accumulators and heat pumps**
- **Cold discharge air from heat pumps used to cool VRF condensers**
- **Water efficient fittings**
- **Water supply piping: 6.3 km**
- **Sanitary drainage piping: 6.8 km**

# WHY WAS THIS PROJECT NOTEWORTHY:

- **4 Star Green star – custom: hotel design V1**
- **Sub-metering of water and electricity**
- **Smart landscaping**
- **Association of Construction Project Managers – national private sector winner 2021**

ACPM
ASSOCIATION OF CONSTRUCTION PROJECT MANAGERS

# Data Centres

# DATA CENTRES

- GLA: 55 000 $m^2$
- Data centre: 30 MW addition
- Building serviced by 120 MVA utility power supply
- Data halls: 12 x 1 000 $m^2$
- Campus critical power capacity: 70 MW
- Conscious designs to reduce water use and improve energy efficiency
- Hyperscale cloud providers – GPUs for artificial intelligence workloads – produce more heat than traditional IT workloads

# DATA CENTRES

**MEPF DESIGN:**

- **Closed loop chilled water using 100% free air cooling i.e. use outside air in winter for natural cooling**
- **VRF with heat reclaim for office portion**
- **Low flow water fittings**
- **Grey water toilet and urinal flushing**

**Scientists discover the way that exists, engineers create the world that never was.**

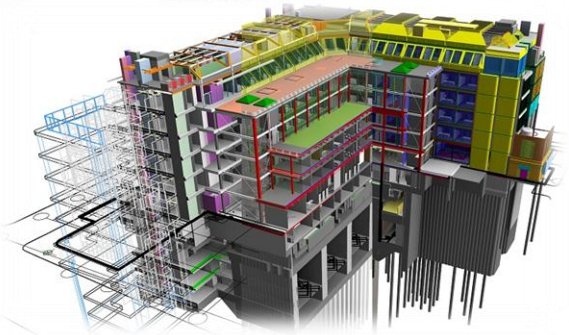
THEODORE VON KARMEN


THE FUTURE

# THE FUTURE

- **Digital twin**

**Dynamic, virtual representation of a physical asset, like a building or infrastructure, that mirrors its real-world counterpart in real-time.**



- **5-D Bim adoption**

**Refers to the integration of time and cost dimensions into a 3D BIM model, creating a 5D model that allows for comprehensive project management**

- **Virtual reality**

**Allowing users to experience architectural designs and construction projects in a fully immersive, 3D environment before they are built**

- **Artificial intelligence (AI)**

**AI-powered tools are enabling data-driven decision-making, improving efficiency, and fostering sustainability in the design and operation of buildings and urban spaces**

**Engineering**
**is the closest thing**
**to magic**
**that exists in the world.**

ELON MUSK

# Thank You.

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