3- Technical

3.1 Technical Concept
3.2 Systems
  3.2.1 Wet biomass to natural gas
  3.2.2 Water
  3.2.3 Ventilation | Thermal regulation
  3.2.4 Shadow analysis | SBAT rating

3.3 Site plan
3.4 Axonometric system site plan
3.5 Plans
3.6 Sections
3.7 Details
3.8 Perspectives and conclusion
3.9 Conclusion
3.10 Bibliography
3.1 Technical Concept

Programmatic and system contamination

Exhibition route from less accessible research to public exhibition

Historical-link process to bind all energy research fields in architecture (system's design)

Technical concept sketch 1 - moving from a stereotomic to tectonic structure comprising out of grey brick reflecting the old retorts changing to steel frame, and then to timber frame (Author, 2017)

Technical concept sketch 2 - moving from a polluted landscape to a non-polluted landscape. Energy square juxtaposed to heritage square introducing a new form of energy production. (Author, 2017)

Energy production changing from a synthetic extortion of natural materials to a regenerative closed loop system. (Author, 2017)

The third retort as a place of contextualised energy research engaging with the public in a didactic narrative

Fig 214: Technical concept sketch 1- moving from a polluted landscape to a non-polluted landscape (Author, 2017)

Fig 215: Technical concept sketch 2- moving from a polluted landscape to a non-polluted landscape. Energy square juxtaposed to heritage square introducing a new form of energy production. (Author, 2017)

Fig 216: Energy production changing from a synthetic extortion of natural materials to a regenerative closed loop system. (Author, 2017)

Fig 217: System, technology and structure combined sketch diagram (Author, 2017)

Fig 218: Technical concept diagram (Author, 2017)
Main System

1-Wet biomass to natural gas

The appropriate system selection is crucial for the response to the heritage site as its very existence flourished through a linear system. Proposing a wet biomass to natural gas process places the third retort and the first two retorts in a healthy dialogue with each other. Both of them produces gas, but the new wet biomass to natural gas is in a closed loop system, an accurate reflection of regenerative theory, a system where the soil is no longer polluted, but the 'plant area' is raised above the polluted landscape. The hydrothermal gasification cleans all contaminated water as the high pressure and heat kills dangerous pathogens. The system recycles CO2 as nutrients, gives potable water and crude oil as a byproduct. The system exposes itself through the architecture to edify it as a didactic device, to start a dialogue and teach people that is using the space.

2-Scale

According to Genifuel "Hydrothermal Processing systems have been built at six sizes in a steady progression of scaling up. This experience gives high confidence in further scale-up. The largest currently operating system is a pilot plant which processes 1 metric t/d of wet feedstock. The next system will expand this scale 2x to 3x (depending on feedstock) in late 2015. Larger systems are planned in 2016" (www.genifuel.co.za).

3-Feasibility

This process will be used as a theoretical system design informant to add value to the architecture as didactic device. Therefore the production is for building use, as well as for Restitutive Park, to tie in with the legacy of giving out free byproducts on site. This system will be used to do further hands on research on site with regards the different research fields. (Elliot, n.d.)
The table above shows the estimate calculations of the algae farm. Keep in mind that these are only estimates and works on a theoretical upscaling of a proven and tested process. These numbers also reflect a system working 24/7 - 7 days a week. This is not possible due to maintenance reasons as the Third Retort does not use this process for a large-scale production but rather as another didactic tool, designed to expose the different research fields through a process. Research is the main program. This process gives an opportunity for research on many samples of water, Co2, waste, biomass, bio-crude oil and natural gas. After the gas supply needed by the Third Retort and Restitution Park has been provided for (used in the laboratories, heating of water, cooking, generators, etc) the excess gas will be given out freely to the public in true tradition of the Old Johannesburg Gas Works.
3.2.3 Ventilation and Thermal Regulation

3.2.4 Shadow Analysis and SBAT

Fig 225: Research pod exploded (Author, 2017)

M CYCLE EVAPORATIVE COOLING

Fig 226: M cycle ventilation variation diagrams (Author, 2017)

HYDRONIC UNDERFLOOR THERMAL REGULATION

Fig 227: Hydronic underfloor heating implementation into research pod diagram (Author, 2017)

Fig 228: Shadow analysis of the Third Retort (Author, 2017)

Fig 229: SBAT rating before intervention (Author, 2017)

Fig 230: SBAT rating after intervention (Author, 2017)
Site plan

Site plan

Axonometric system plan

Fig 231: Site plan (Author, 2017)

Fig 232: Axonometric system plan (Author, 2017)
Fig 233: Systems flow (Author, 2017)

Fig 234: wet biomass to natural gas diagram 3 (Author, 2017)

Fig 235: Combined system plan (Author, 2017)
Section 2

Fig 240: Section 2 (Author, 2017)
Hydronic pipes feed at 200mm spacing. Vermiculite screed into 50 mm floor heating cast.

Hydronic pioneer bolts (thread up). Place using 15mm nickel cadmium prefabricated knee-brace. Bolted into galvanized steel girder truss to be 10m x 0.8m pre-welded hot dipped from natural gas separate control unit at 200mm spacing.

Reinforced concrete girder truss. Bolted to structural support high, hung from natural 1200mm x 3000mm folding door with heavy duty Aluglass Bautech Varifold. Classic Oak natural wood finish system.

Impact sound reduction of 19 dB (tongue and groove) of EN 660-2 for abrasion resistance. Traffic 19dB acoustic heterogeneious vinyl sheeting class T requirements.
channel by means of a self drilling screw 152 X 152 X 6.1MM H-section beam
R-Value 3.5 Ceiling board fixed to cold rolled Lip
5000 x 1200 x 135mm aerolite insulation
20 mm 5mm thick cold rolled Lip channel purlin
fixed to cold rolled Lip channel purlin 100 x 50 x
1.7 x 1.9 m aluminum zinc coated I.B.R sheeting

Timber glue laminated beam
seat connected to main GLULAM laminated purlin rests in beam
GLULAM  50 x 156mm  timber

152 x 152 x 6.1 mm H-section column

Concrete and corten steel together
50mm Diameter bolts to be used to fix sleeves to prevent concrete cracking.
Tail to suit. Pre-drilling required to fit to civil engineer’s specification and detail to
suit climate conditions.
Timber laminated beam
GLULAM 114 x 400 mm

Photovoltaic panel hybrid system
with battery station

Openable window

Corrugated polycarbonate roof

powder coated adjustable louver

Standard CORR-LINE steel roof
in accordance with SANS 10087.

Gas pipe class 1 or 0, 7mm}

Fig 246: Perspective 1 poster (Author, 2017)

Fig 247: Perspective 2 poster (Author, 2017)
Architecture, created through the lens of didacticism, gives many opportunities to deal with the spatial legacies of post-industrial sites. It will contribute in changing the way we experience space and give another layer of meaning to place. Didactic architecture proves that a new architectural typology can be achieved where process and architecture coincide in the urban context to deal with immediate environmental issues. It also provides spaces where constructive engagement with the public is encouraged.

Didactic architecture has the possibility to be applied on different types of sites and areas with the aid of a contextual theory. Didacticism as architectural driver gives an opportunity for architecture to perform beyond its utility.