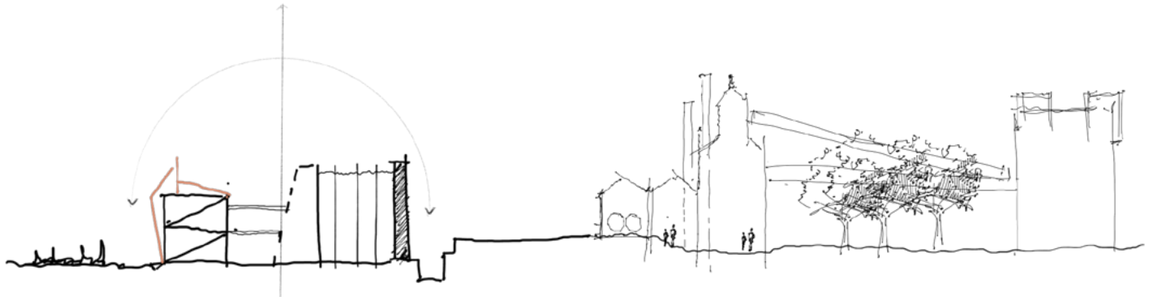
3

Chapter

3- Technical



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)

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

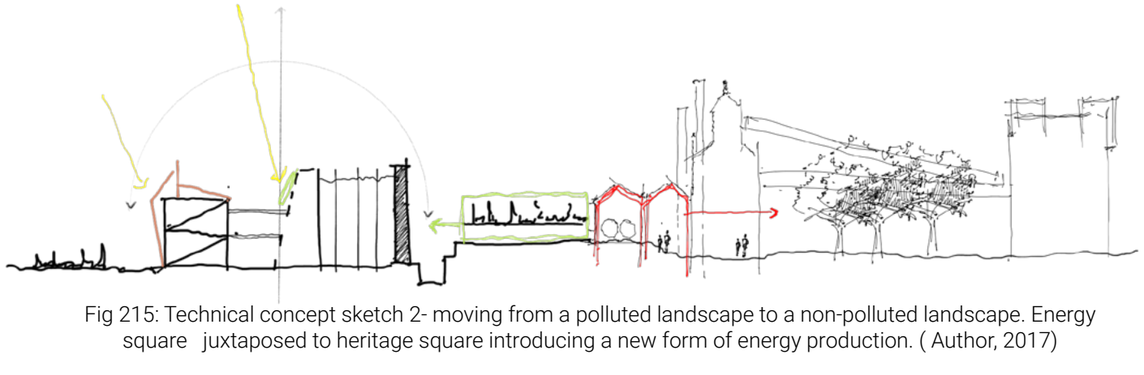


Fig 215: Technical concept sketch 2- moving from a polluted landscape to a non-polluted landscape. Energy square juxtaposed to heritage square introducing a new form of energy production. (Author, 2017)

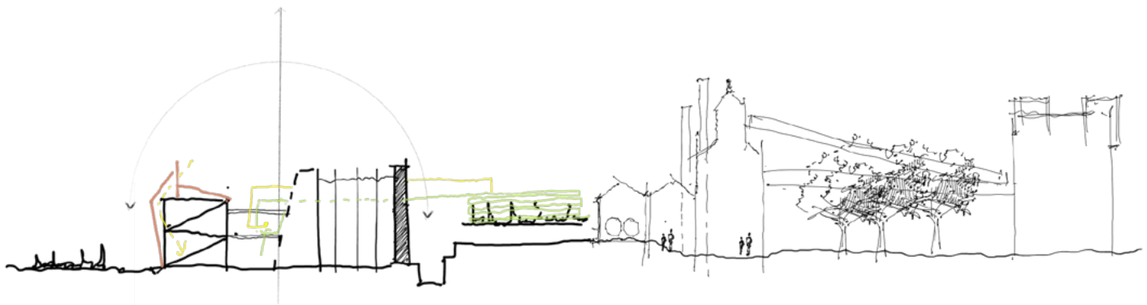


Fig 216: Energy production changing from a synthetic extortion of natural materials to a regenerative closed loop system. (Author, 2017)

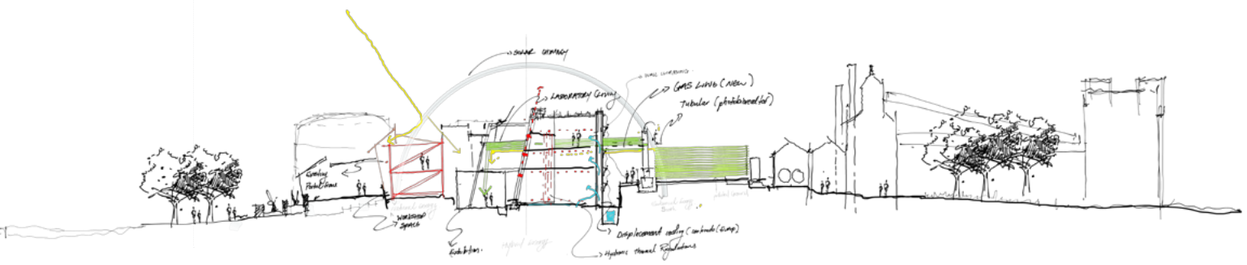
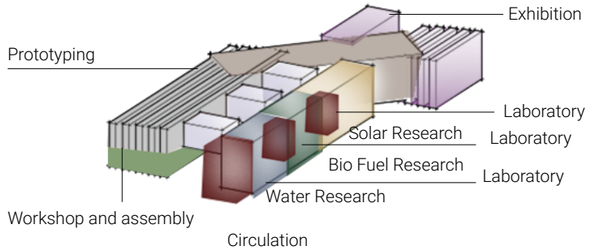
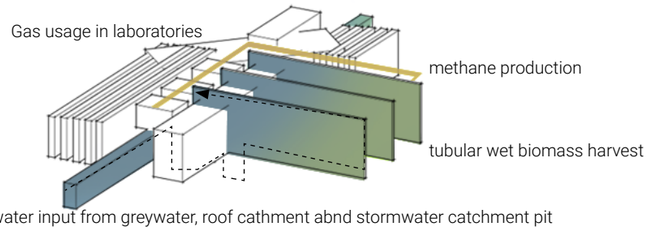


Fig 217: System, technology and structure combined sketch diagram (Author, 2017)

Programmatic and system contamination

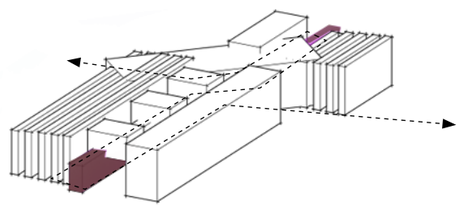


Historical-link process to bind all energy research fields in architecture (systems design)



water input from greywater, roof cathment abnd stormwater catchment pit

Exhibition route from less accesible research to public exhibition



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

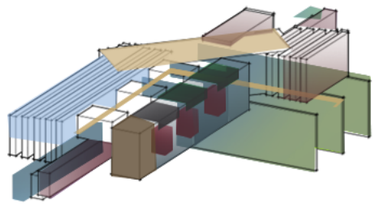


Fig 218: Technical concept diagram (Author, 2017)

Main System

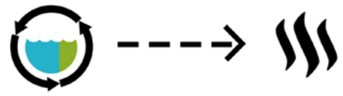
1-Wet biomass to natural gas

Sub systems

2-Hydronic underfloor heating and cooling

3-Evaporative M-cycle Ventilation

Fig 219: Third retort clay render in context (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.)

Fig 220: Bench-Scale Oil and Gas System (Old) (Elliot, n.d.)

Fig 221: Bench-Scale Oil and Gas System (New) (Elliot, n.d.)

Fig 222: Skid-Mounted Gasifier Unit (www.genifuel.co..za)

	Capacity(M)	Water needed	Biomass(algea)	Wet Biomass Total(m)	Capable Month-ly burn(max)	Natural Gas Yield(50% L/g)	Biocrude Oil Yield(40%)	Potable Water yield(10%)
Tubular System A	22	13.2	8.8	22		11	4.4	1.32
Tubular System B	22	13,2	8.8	22		11	4.4	1.32
Tubular System C	22	13,2	8.8	22		11	4.4	1,32
Small Tubu-lar Facade louvre Sol	4,137	2.5	1.6	4,137		2	1.6	
Small Tubu-lar Facade louvre H20	4,137	2.5	1.6	4,137		2	1.6	0,25
Small Tubu-lar Facade Renewable Energy	4,137	12.5	1.6	4,137		2	1.6	0,25
Total	78,411m3	26,4m3		78,411m3	62m3	39m3	18m3	0,25m3

Estimate gas productions (author, 2017) (Elliot, n.d.) (www.genifuel.co..za)

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.

POTENTIAL ROOF CATHMENT AREA

DESCRIPTION	AREA (m²)	RUNOFF COEFF. (C)
Roof structures-and catchpit	1171---------(374)	0,9
Corrugated sheeting	834	0,7
Lawn- Algea	1890	0,08
TOTAL AREA (A)	4195,00	
WEIGHTED C		0,45

ESTIMATED WATER YIELD

Month	AVE RAINFALL , P (m)	CATCHMENT YIELD (m³) (Yield = PxAxC)	TOTAL WATER YIELD (m³)
January	0,13	251,89	251,89
February	0,09	162,88	162,88
March	0,08	149,62	149,62
April	0,05	98,48	98,48
May	0,01	22,73	22,73
June	0,01	15,15	15,15
July	0,00	7,58	7,58
August	0,01	11,36	11,36
September	0,03	47,35	47,35
October	0,07	138,25	138,25
November	0,10	196,97	196,97
December	0,11	204,54	204,54
Monthly Average	0,70	108,90	108,90

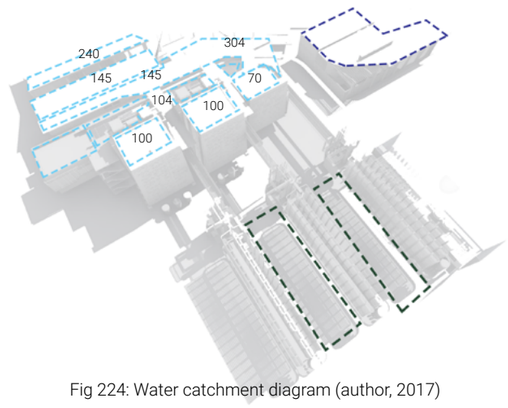


Fig 224: Water catchment diagram (author, 2017)

WATER NEED(MINUS ALGAE FARM)

MONTH	PERSONS	WATER/ CAPITA/ DAY (l)	DOMESTIC DEMAND (m³/month)	IRRIGATION DEMAND (m³/month)
Jnuary	140	2	8,68	166.2
February	140	2	7,84	166.2
March	140	2	8,68	157.2
April	140	2	8,4	157.2
May	140	2	8,68	81.6
June	140	2	8,4	75.6
July	140	2	8,68	75.6
August	140	2	8,68	151.2
September	140	2	8,4	166.2
October	140	2	8,68	166.2
November	140	2	8,4	166.2
December	140	2	8,68	166.2
Monthly average			102,2	141.3

WATER BUDGET

MONTH	YIELD (m³/ month)	DEMAND (m³/month)	MONTHLY BALANCE
January	251,9	181,6	70,3
February	162,9	179,9	-17,0
March	149,6	170,1	-20,5
April	98,5	169,0	-70,5
May	22,7	92,8	-70,1
June	15,2	85,7	-70,5
July	7,6	86,0	-78,4
August	11,4	163,2	-151,9
September	47,3	179,6	-132,3
October	138,3	180,8	-42,5
November	197,0	180,5	16,5
December	204,5	181,6	22,9
ANNUAL AVE.	1306,8	1850,7	-543,9

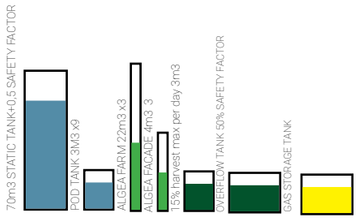


Fig 223: System section diagram (author, 2017)

solar chimney extracts hot air

Coolerado cooling input to research pod

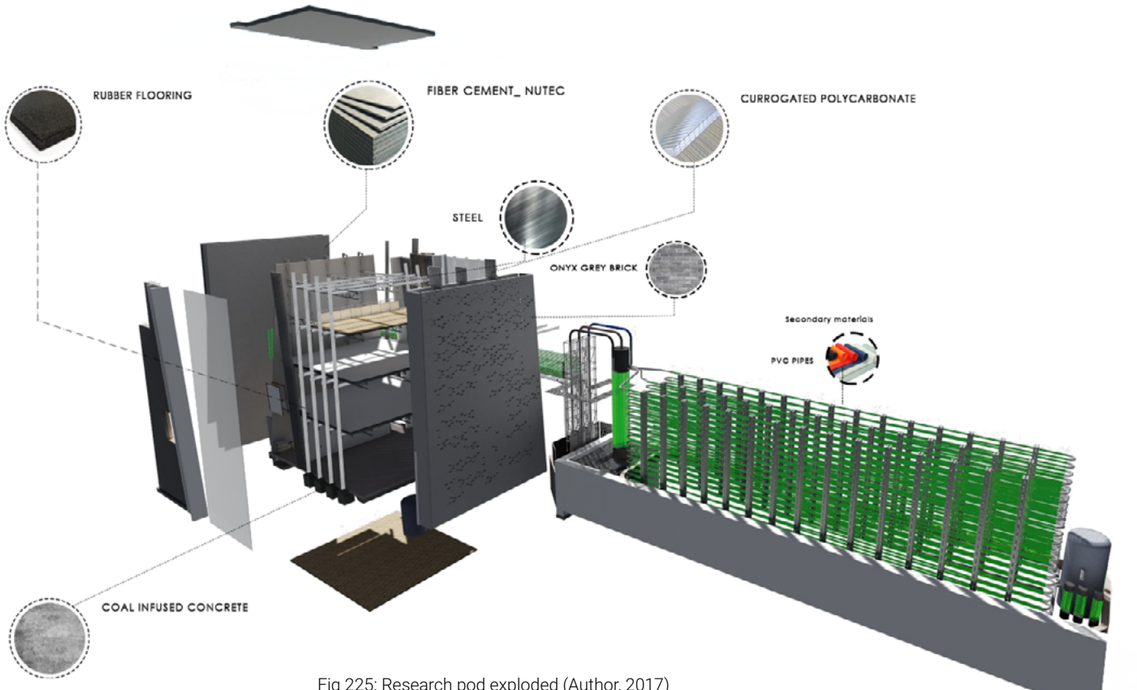


Fig 225: Research pod exploded (Author, 2017)

M CYCLE EVAPORATIVE COOLING

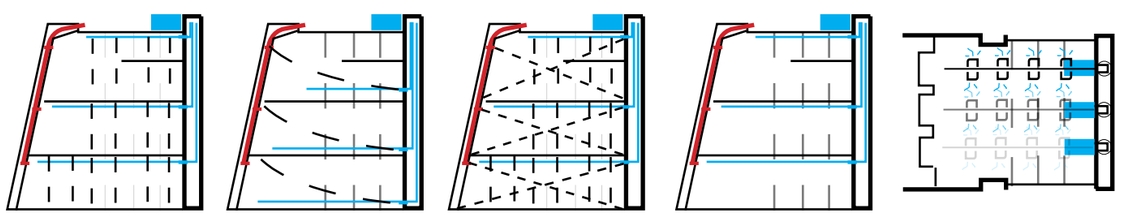


Fig 226: M cycle ventilation variation diagrams (Author, 2017)

HYDRONIC UNDERFLOOR THERMAL REGULATION

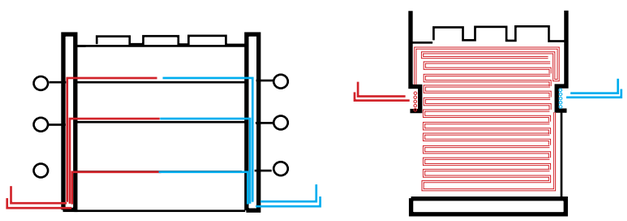


Fig 227: hydronic underfloor heating implementation into research pod diagram (Author, 2017)

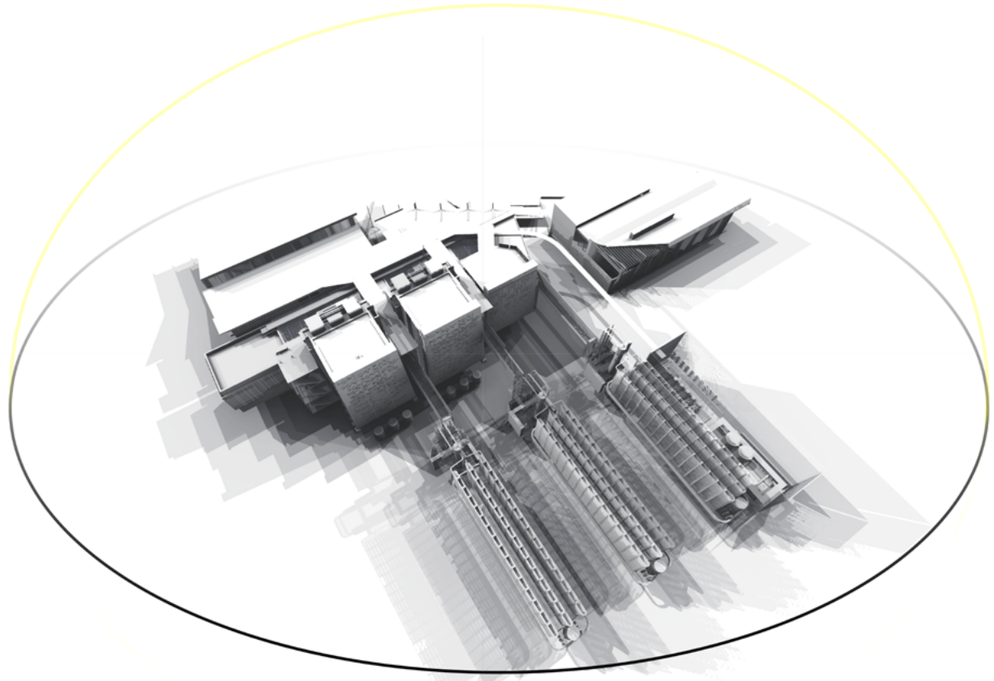
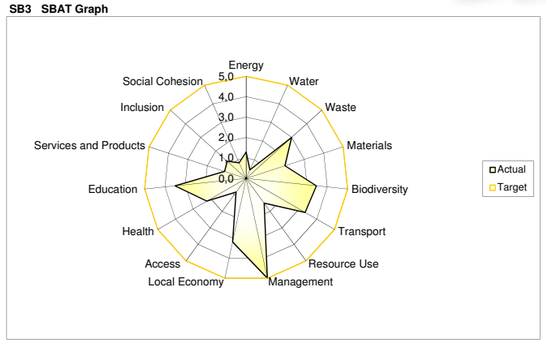


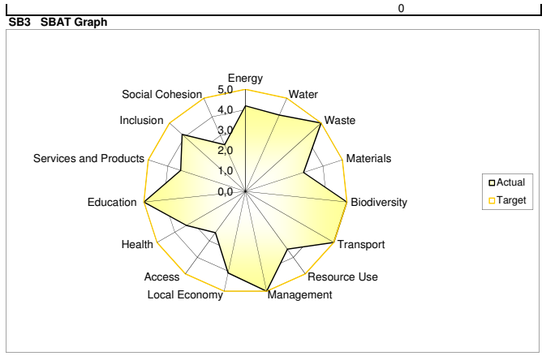
Fig 228: Shadow analysis of the Third Retort (Author, 2017)

SBAT rating



SB4 Environmental, Social and Economic Performance	Score
Environmental	2,0
Economic	2,8
Social	1,8
SBAT Rating	2,2

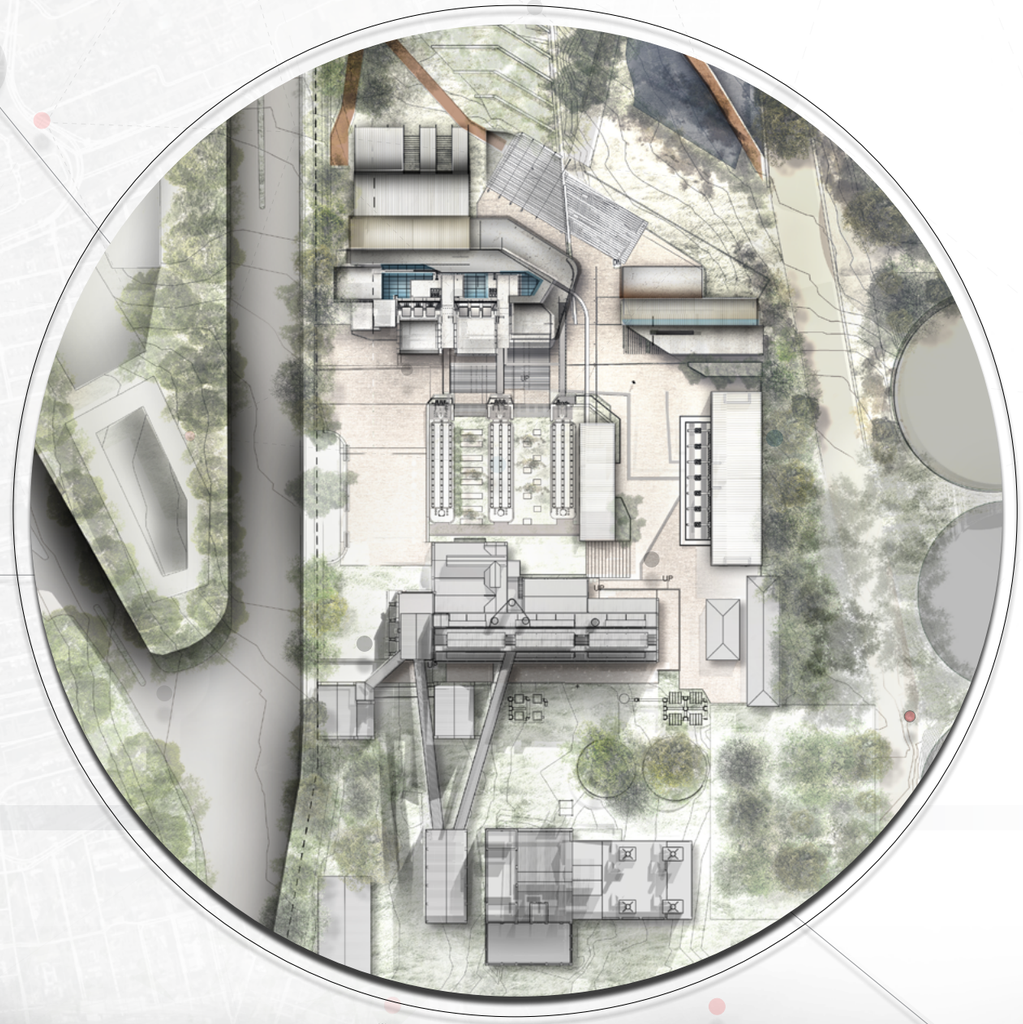
Fig 229: SBAT rating before intervention (Author, 2017



SB4 Environmental, Social and Economic Performance	Score
Environmental	4,3
Economic	4,0
Social	3,7
SBAT Rating	4,0

Fig 233: SBAT rating after intervention (Author, 2017)

3.3 Site plan



SITE PLAN 1:1000

Fig 231: Site plan (Author, 2017)

3.4 Axonometric system plan

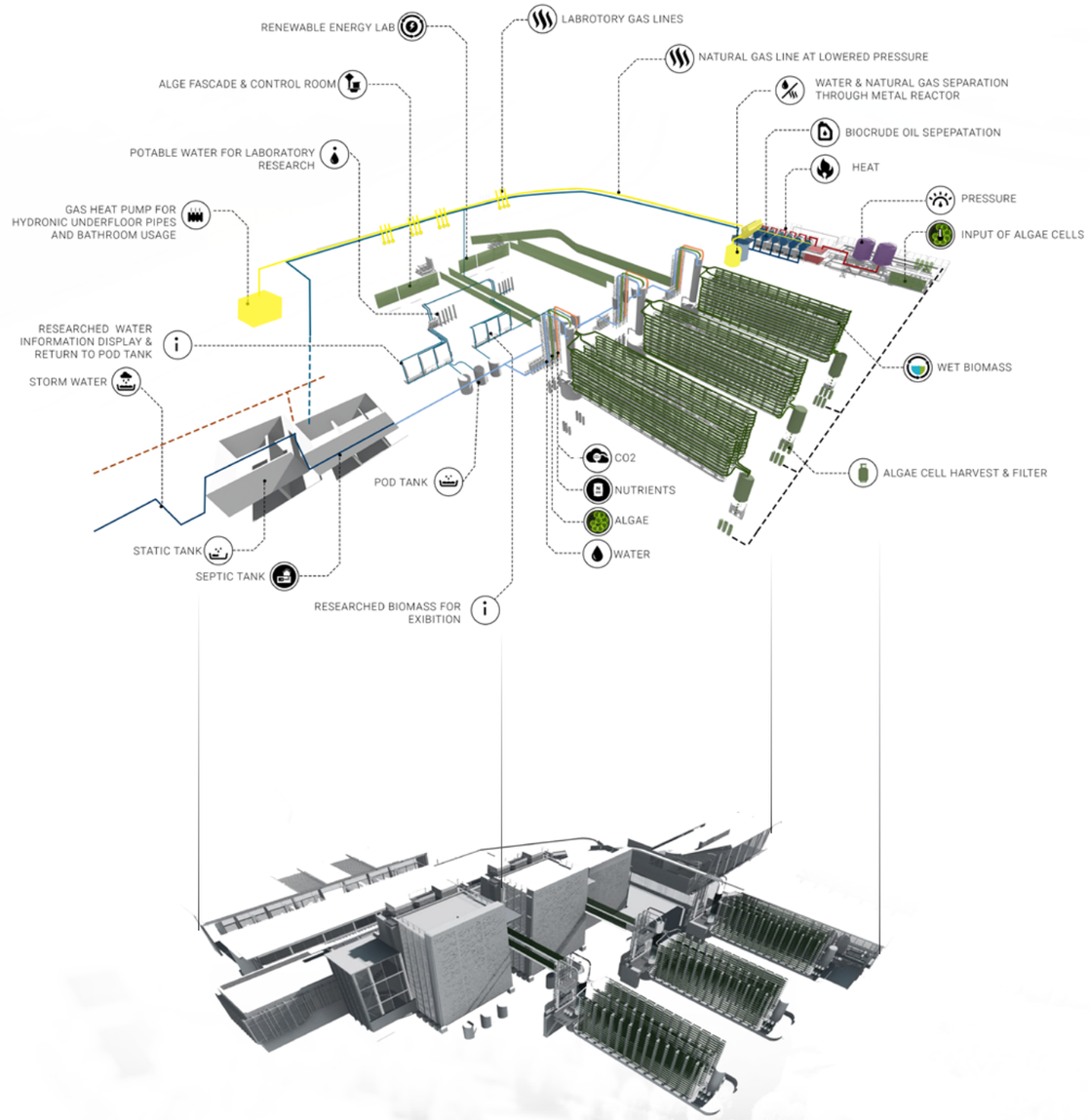


Fig 232: Axonometric system plan (Author, 2017)

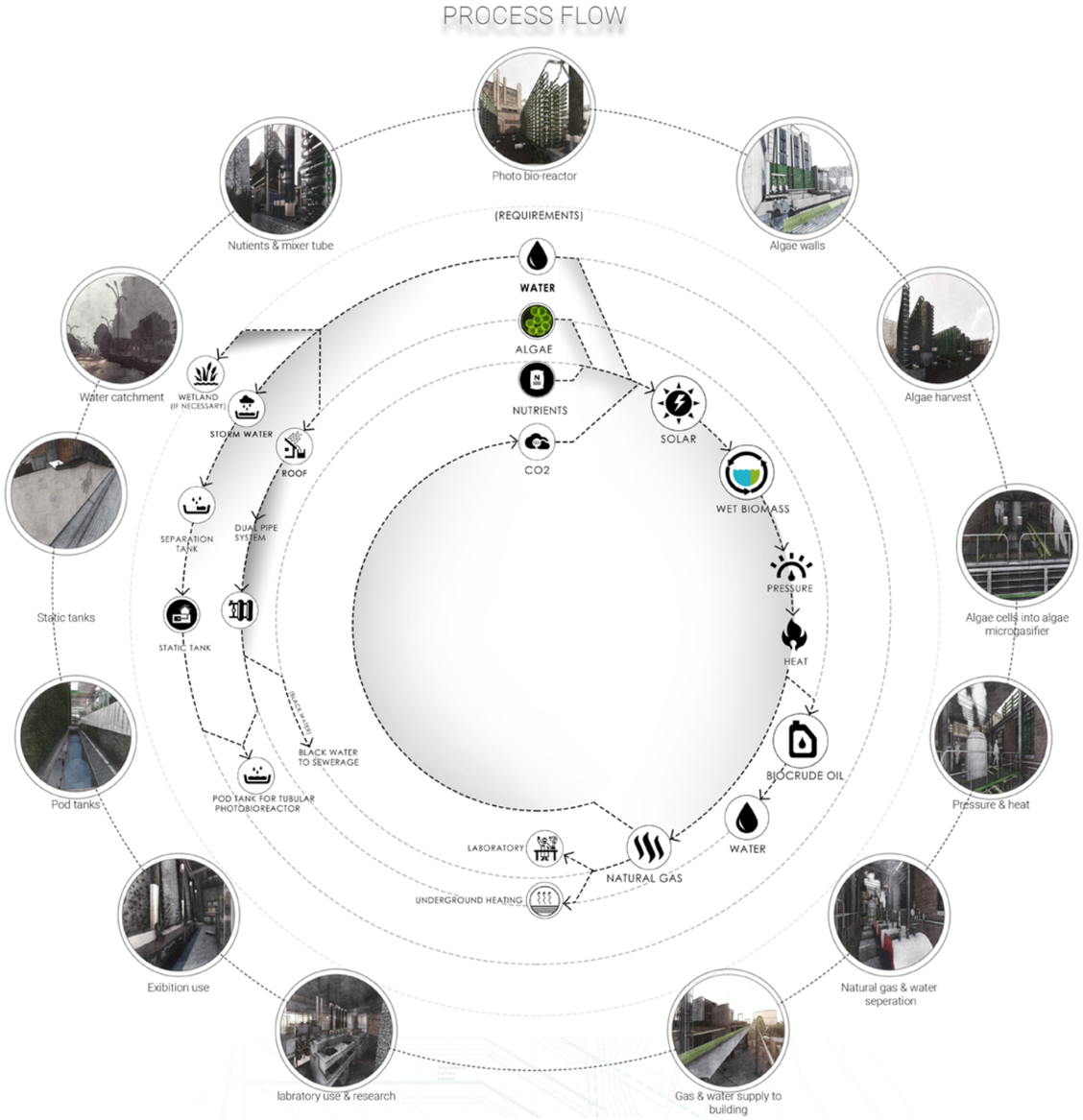


Fig 233: Systems flow (Author, 2017)

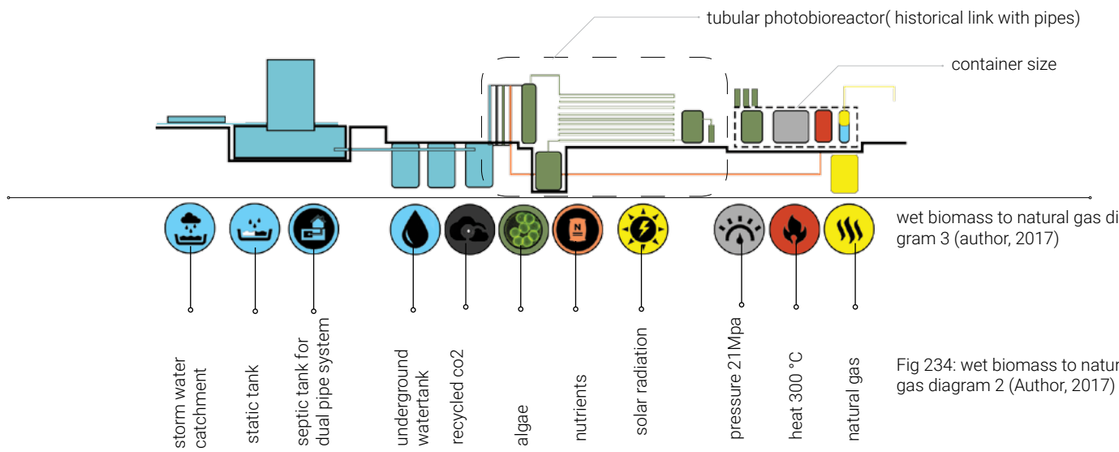


Fig 234: wet biomass to natural gas diagram 2 (Author, 2017)

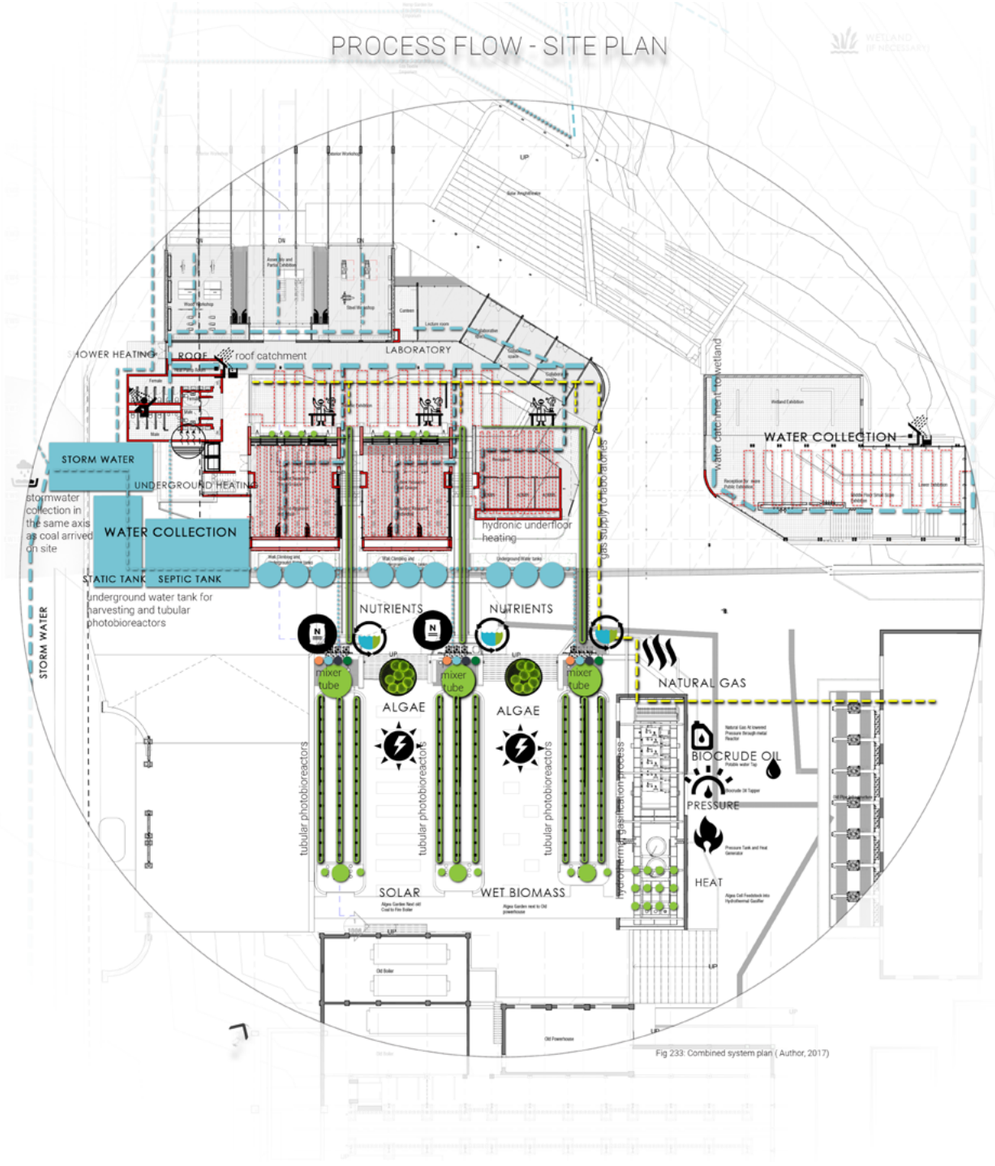


Fig 235: Combined system plan (Author, 2017)

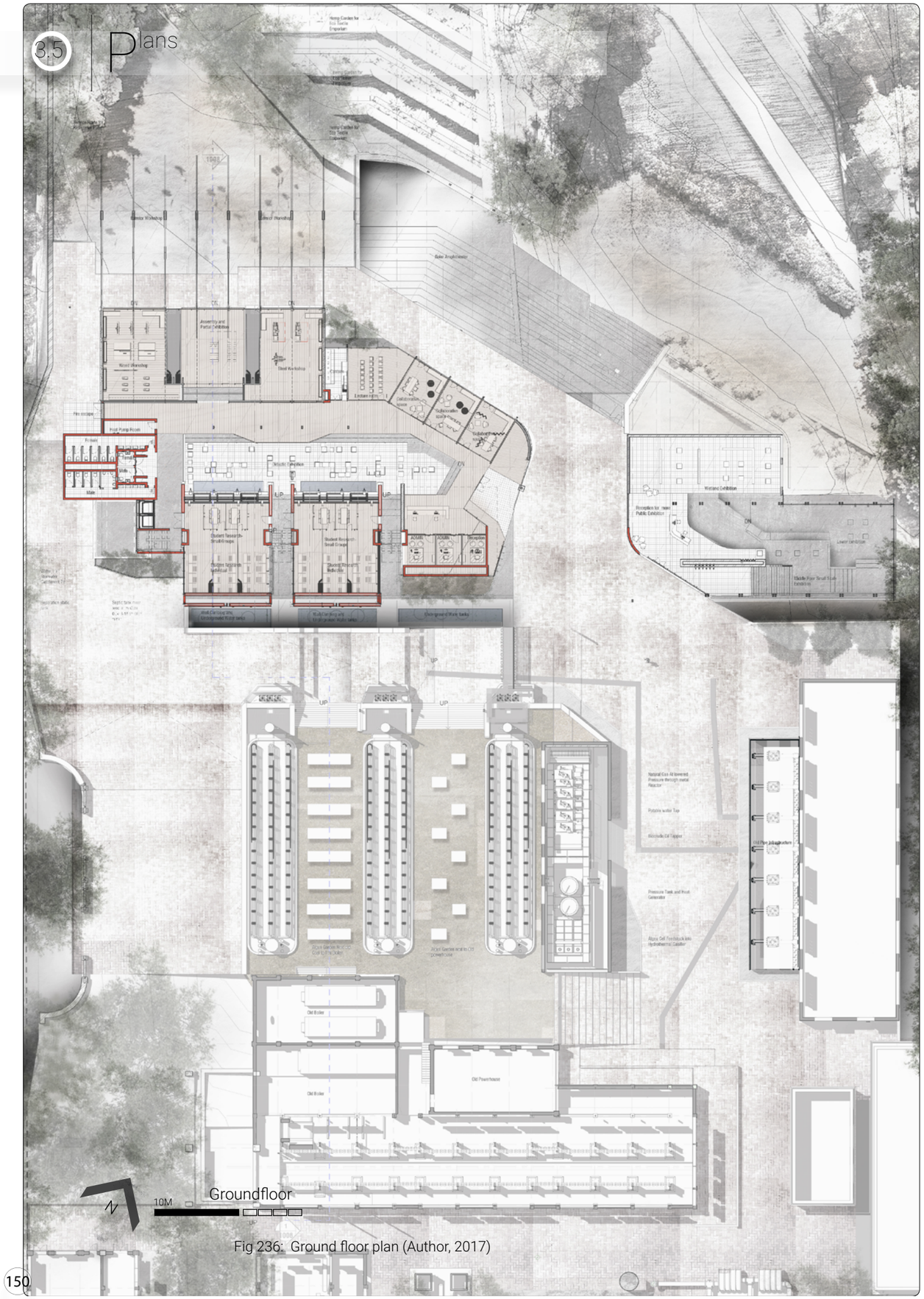


Fig 236: Ground floor plan (Author, 2017)

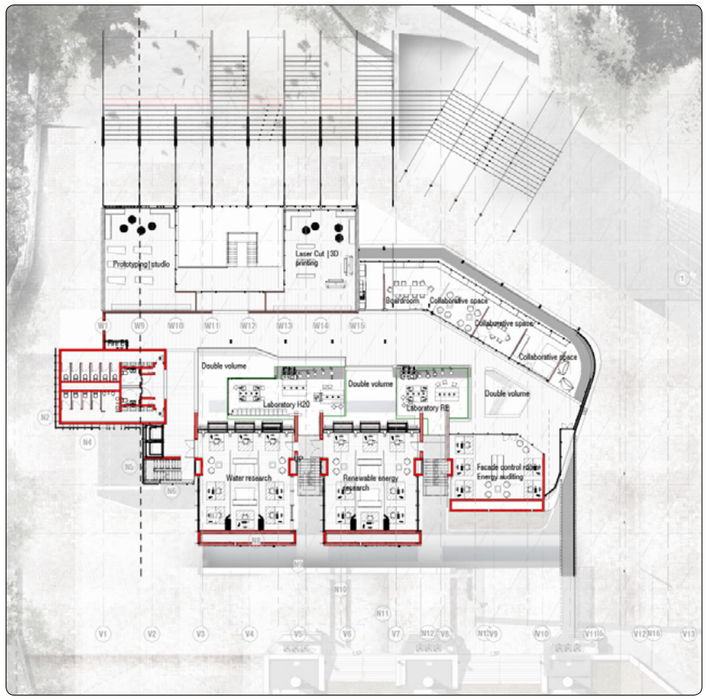


Fig 237: First floor plan (Author, 2017)

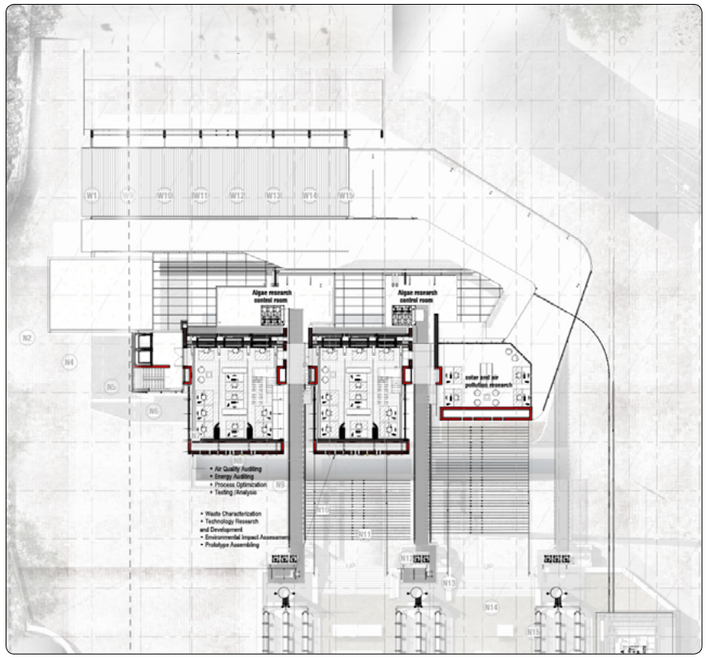
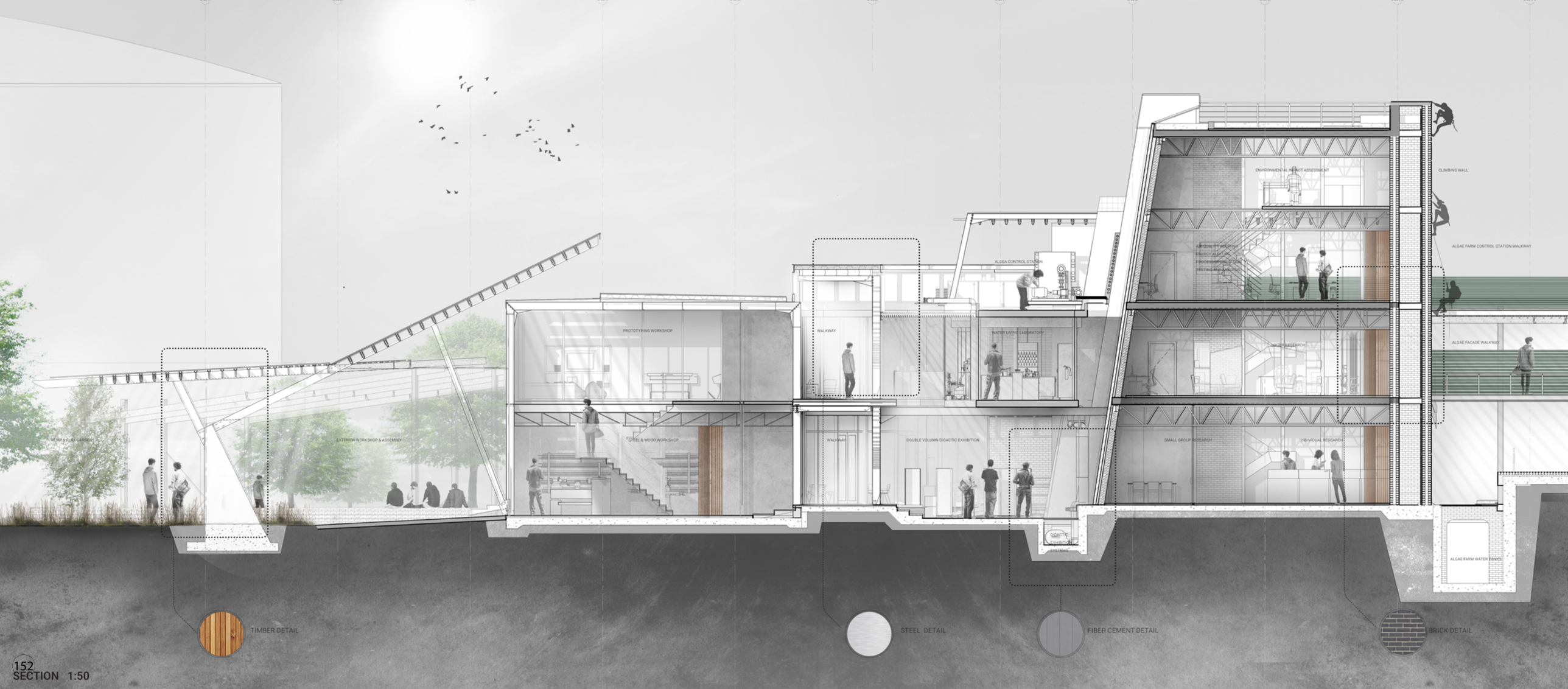


Fig 238: Second floor plan (Author, 2017)

5M

Fig 239: Section 1 (Author, 2017)

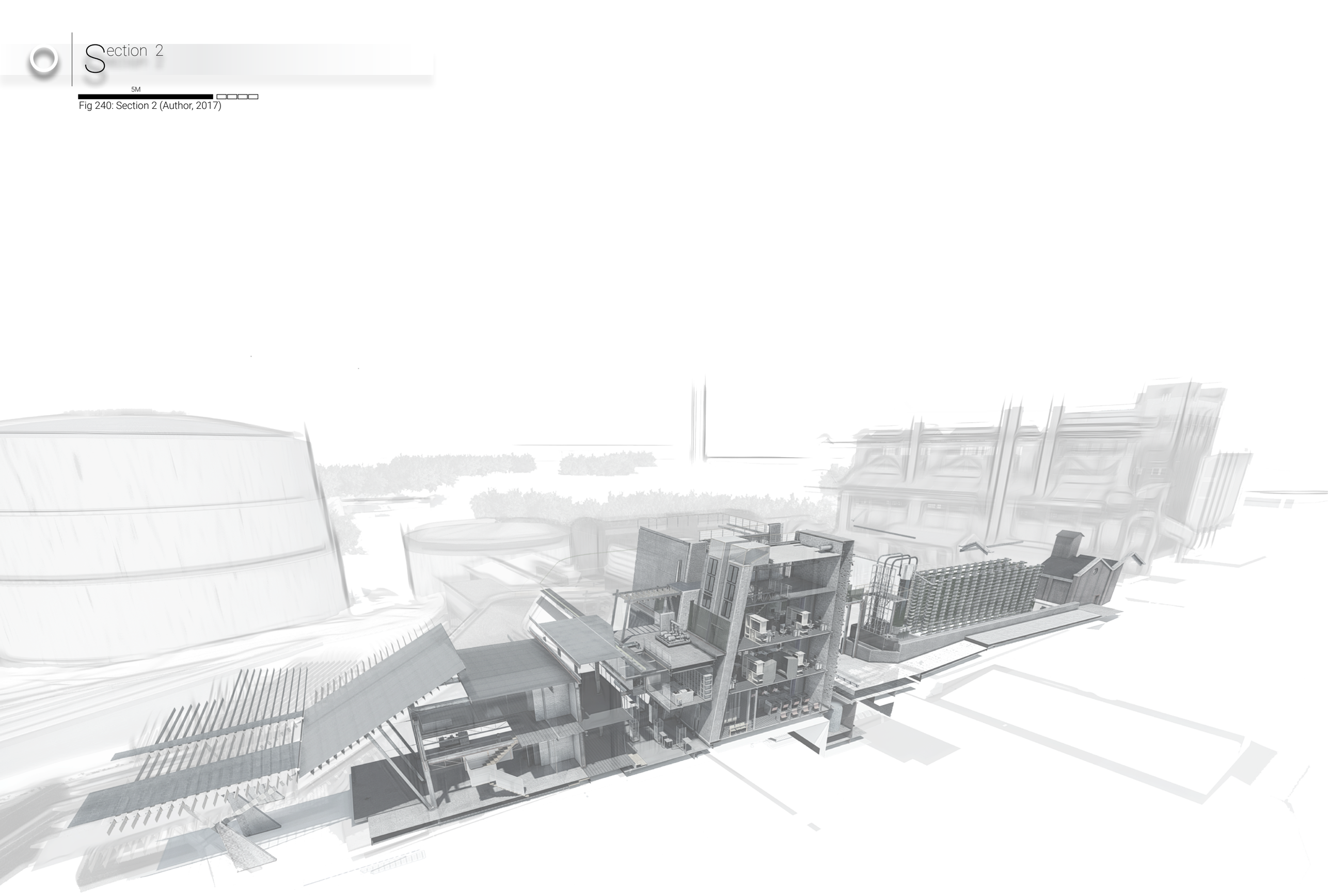


SECTION 1:50

Section 2

5M

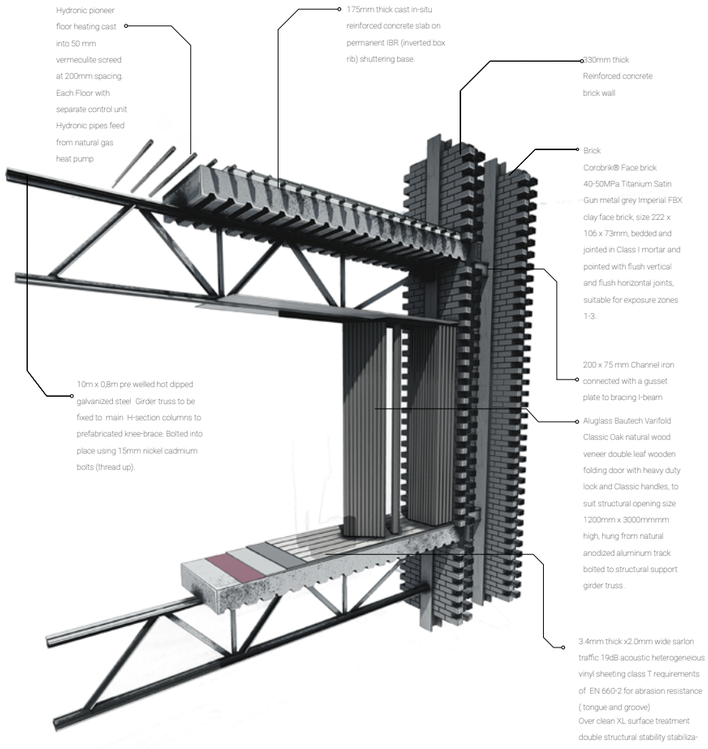
Fig 240: Section 2 (Author, 2017)

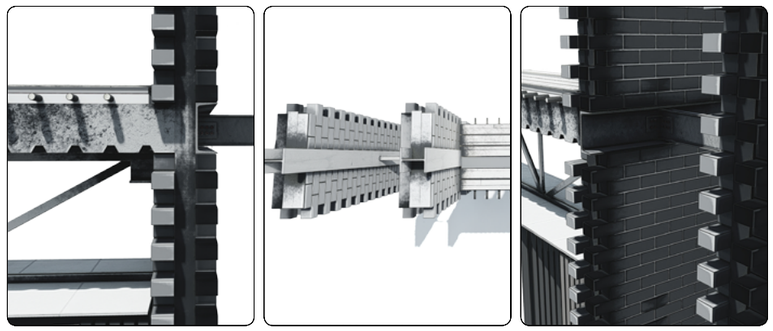


Section 3

Fig 241: Section perspective (Author, 2017)

PERSPECTIVE DETAIL | BRICK





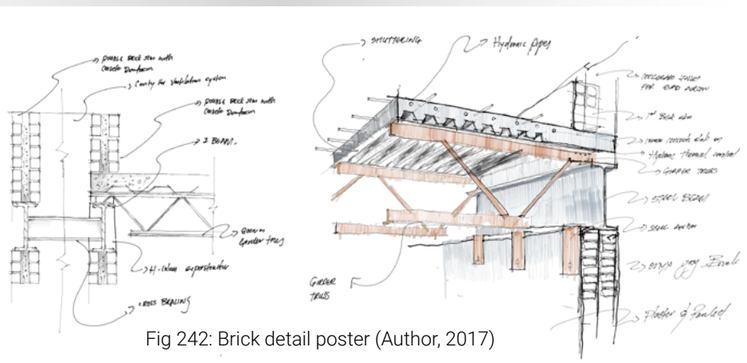
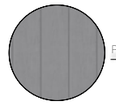
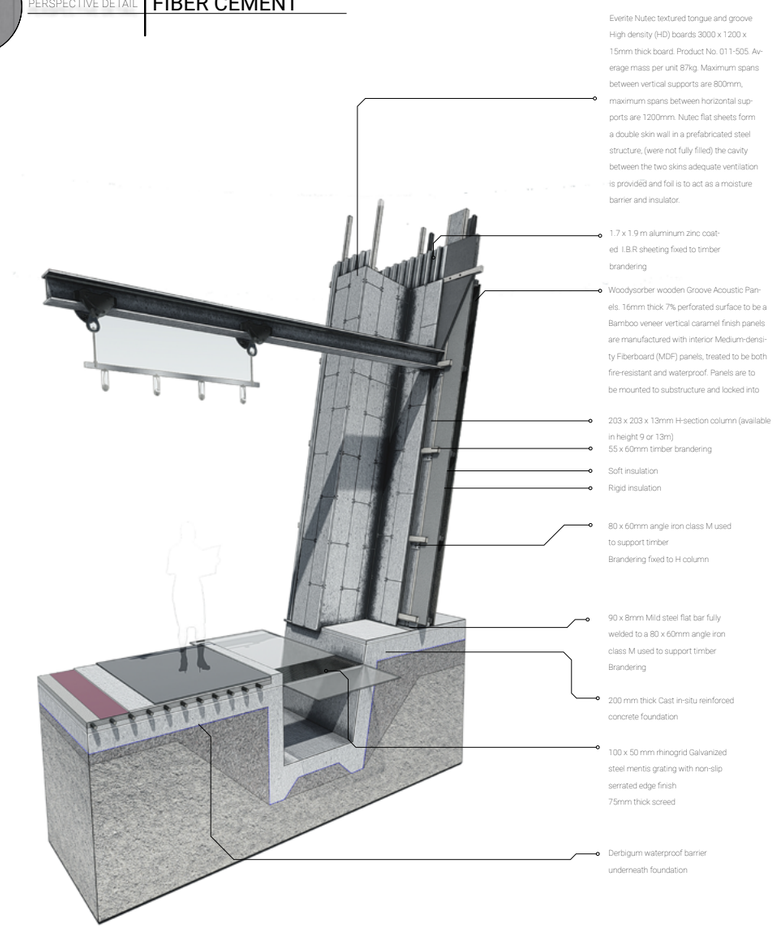
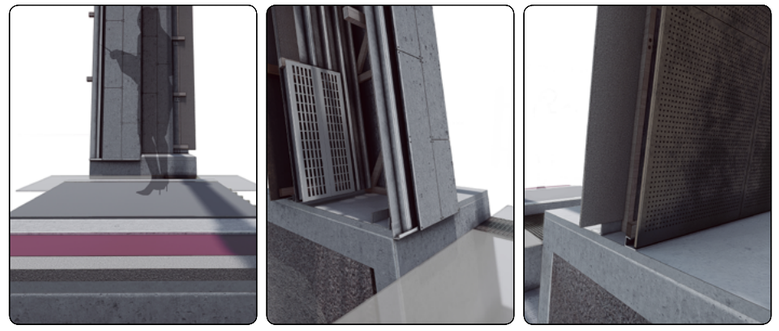


Fig 242: Brick detail poster (Author, 2017)



PERSPECTIVE DETAIL | FIBER CEMENT





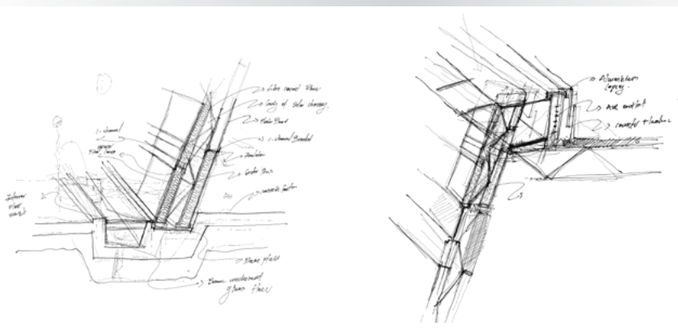


Fig 243: Fiber cement detail poster (Author, 2017)

PERSPECTIVE DETAIL | STEEL

1.7 x 1.9 m aluminum zinc coated I.B.R sheeting
fixed to cold rolled Lip channel purlin 100 x 50 x
20 mm 5mm thick cold rolled Lip channel purlin
5000 x 1200 x 135mm aerolite insulation
R-Value 3.5 Ceiling board fixed to cold rolled Lip
channel by means of a self drilling screw

152 X 152 X 6.1MM H-section beam

230 x 75mm C-section channel supports standard ex-
truded bar to support MODEK polycarbonate roof system

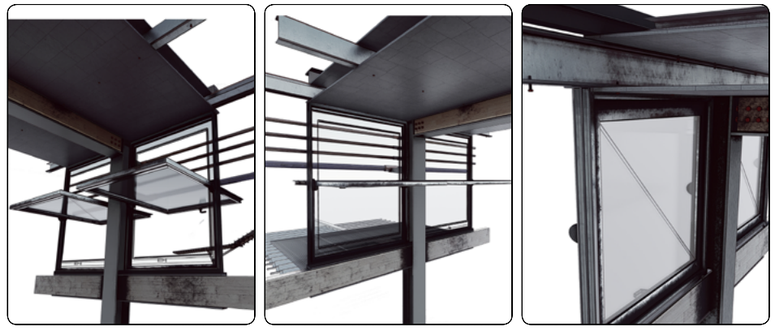
152 X 152 X 6.1MM H-section beam

152 x 152 x 6.1 mm H-section column

Gas pipe class 1 or 0,7mm
wall thickness. Where gas pipe
passing through or is embed-
ded in a wall, cement or ground
it must be protected with a
protective sleeve. In
accordance with SANS 10087.

Standard CORR-LINE steel roof
Powder coated adjustable louver
system

Openable window



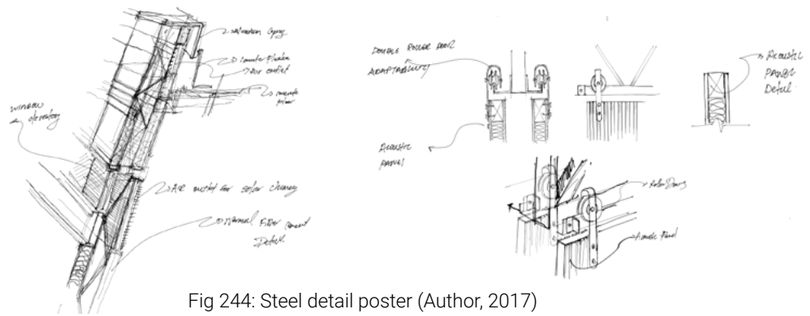


Fig 244: Steel detail poster (Author, 2017)

PERSPECTIVE DETAIL | TIMBER

Photovoltaic panel hybrid system
with battery station

1.7 x 1.9 m aluminum zinc coated I.B.R sheet-
ing

Corrugated polycarbonate roof

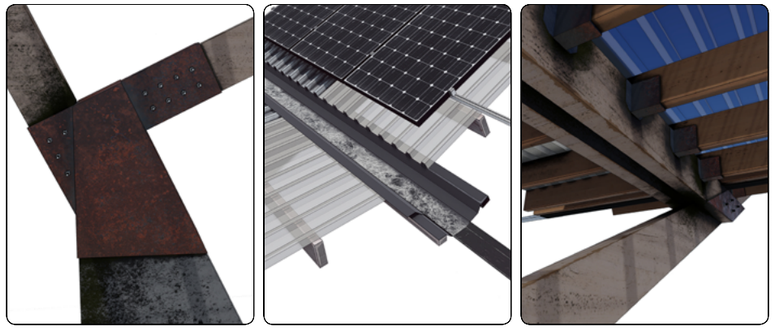
Fabricated corton steel capping
box with beam seats to suit
timber glue laminated beams

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

Box gutter

GLULAM 114 x 400 mm
Timber laminated beam
Grade 7 to civil engineer's
specification and detail to
suit climate conditions.

Reinforced Concrete anchor block to
civil engineer's specification and de-
tail to suit. Pre drilling required to fit
sleeves to prevent concrete cracking.
50mm Diameter bolts to be use to fix
concrete and corton steel together



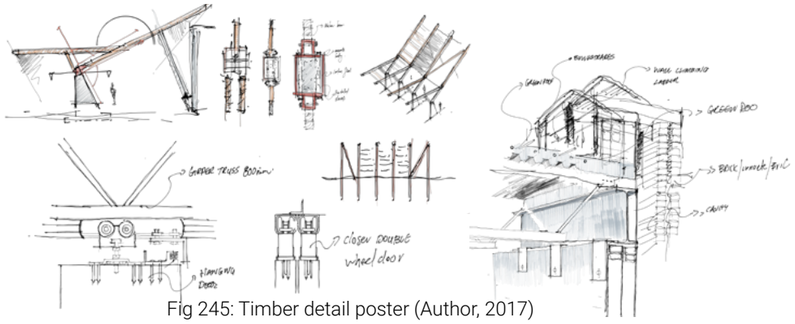
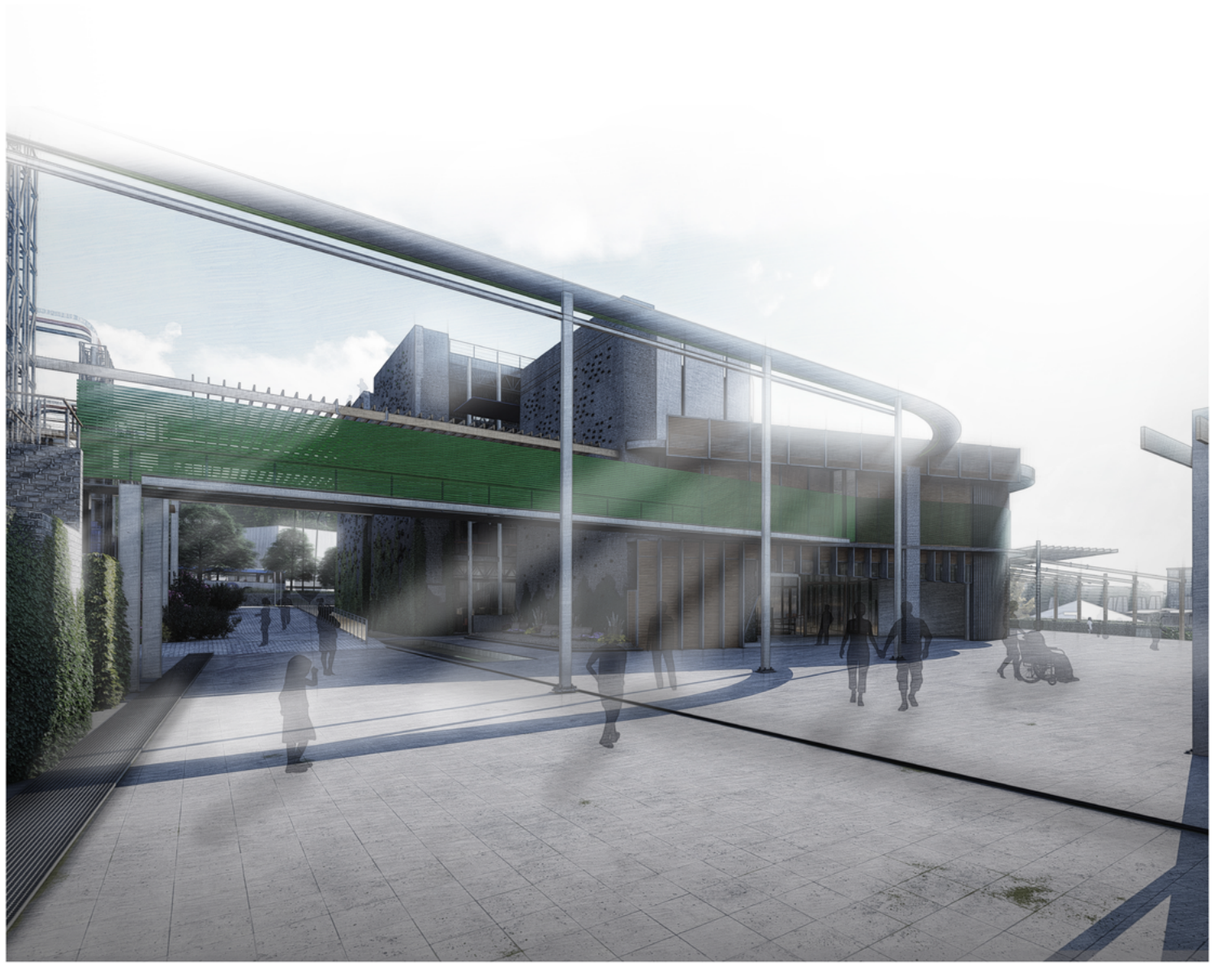
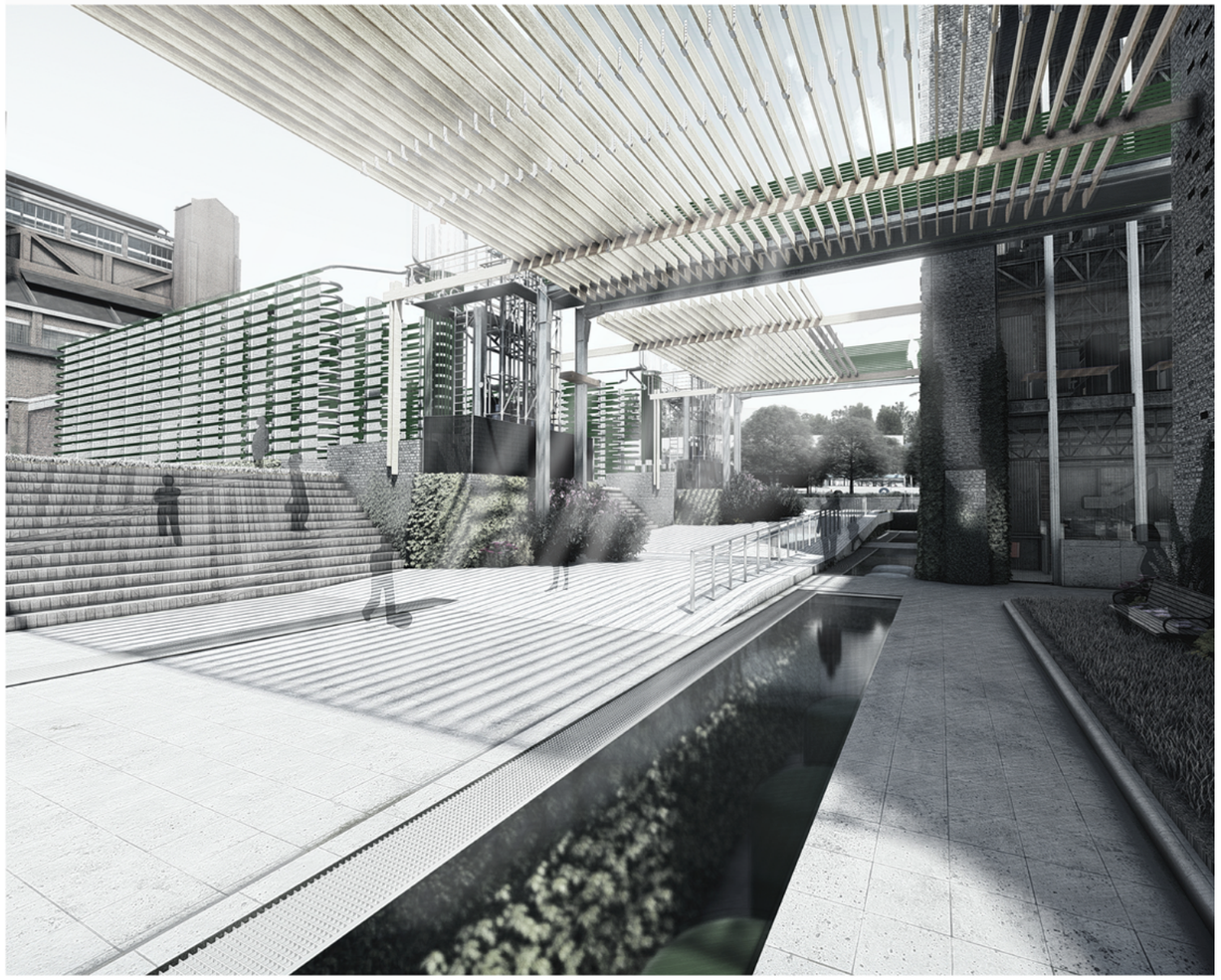


Fig 245: Timber detail poster (Author, 2017)



PERSPECTIVE
①

Fig 246: Perspective 1 poster (Author, 2017)

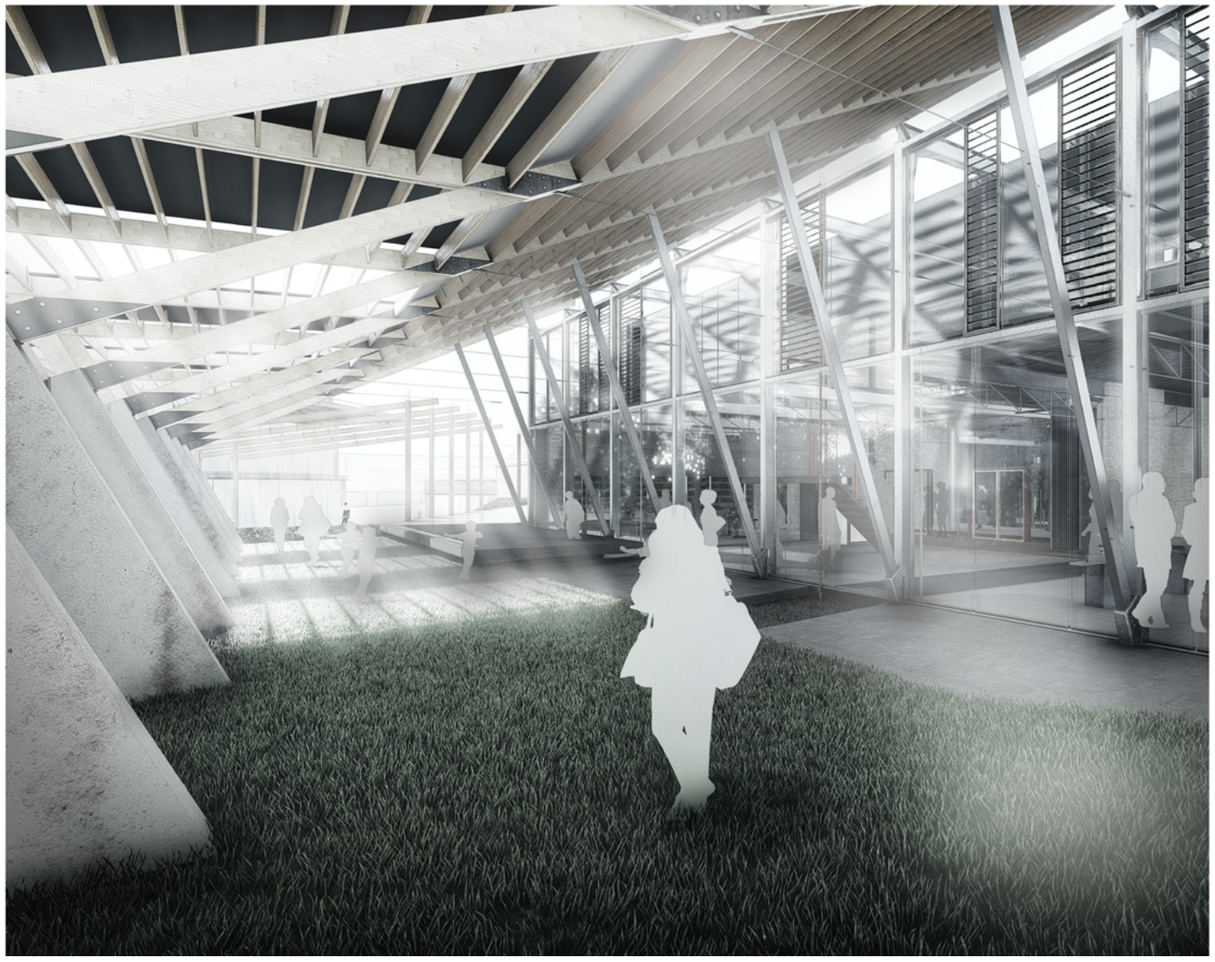


PERSPECTIVE
②

Fig 247: Perspective 2 poster (Author, 2017)

PERSPECTIVE
③

Fig 248: Perspective 3 poster (Author, 2017)



PERSPECTIVE
④

Fig 249: Perspective 4 poster (Author, 2017)

Fig 250: Render of algae farm (Author, October 2017)

Conclusion

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 that we experience space and give another layer of meaning to place. Didactic architecture proves that a new architecture typology can be created where process and architecture coincides 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

Fig 251: Render of Retort house 1 (Author, October 2017)

agency, T. i., 2010. PEETS Profile: PROCESS ENERGY AND ENVIRONMENTAL TECHNOLOGY STATION, Johannesburg: s.n. Akahin, 2013. Regenerative Architecture | Beyond Sustainability - Design to Actively Heal the Environment. [Online].

Alison Kwok, W. G., 2007. The Green Studio Handbook: Environmental Strategies for Schematic Design. Italy: Elsevier Inc..

Anon., 2011. Joburg 2040 is here. [Online] Available at: http://www.joburg.org.za/index.php?option=com_content&id=7334&Itemid=351[Accessed 19 March 2017].

Anon., 2015. Gold Mining Exploits And The Legacies Of Johannesburg's Mining Landscapes. Issue 05: Extraction.

Anon., 2016. Spatial Development Framework, City of Johannesburg: s.n.

Anon., 2016. Spatial Development Framework 2040, City of Johannesburg: s.n.

Anon., 2017. CSIR ENERGY CENTRE. [Online] Available at: https://www.csir.co.za/csir-energy-centre
Anon., 2017. Energy. [Online]

Available at: http://www.eie.wits.ac.za/research/energy

Anon., 2017. From power station to powerful symbol of regeneration. [Online]

Available at: http://www.southafrica.net/za/en/articles/entry/article-the-turbine-hall
[Accessed 2017].

Anon., 2017. Meteobue. [Online] Available at: https://www.meteoblue.com/en/ (Col. 1:15–19) weather/forecast/week/braamfontein_south-africa_8063420[Accessed July 2017].

Anon., n.d. [Online] Available at: http://www.corridorsoffreedom.co.za/attachments/article/1/corridors%20of%20freedom_s.pdf [Accessed 27 February 2017].
Anon., n.d. s.l.:s.n. Anon., n.d. Empire Perth Development corridor-Strategic Area Framework, Johannesburg: Johannesburg Develoment Agency.

Anon., n.d. HYSOLAR INSTITUTE BUILDING, UNIVERSITY STUTTGART. [Online] Available at: http://www.behnisch-partner.de/projects/civic-buildings/hysolar-institute

Anon., n.d. Ruins Of The Past: Industrial Heritage In Johannesburg. 10.2495/STR090471.

Anon., n.d. South Africa's mineral and industrial revolution. [Online] Available at: https://v1.sahistory.org.za/pages/hands-on-classroom/classroom/pages/projects/grade11/lesson8/01-minerals.htm
[Accessed March 2017].

Anon., n.d. The Gold Rush. [Online] Available at: http://www.sahistory.org.za/archive/gold-rush
[Accessed 18 March 2017]. Antonio, J., 2017. Tabula Rasa. [Online]
Available at: https://phdsymposiumetsaun.wordpress.com/abstracts-new/ Brown, J., 2012. Coffee with an architect. [Online] Available at: http://www.coffeewithanarchitect.com/2012/02/09/architecture-is-a-dialogue/
[Accessed 19 July 2017].

Bruno Monardo, L. D. B., 2007. "Urban Centre as a privelaged place for shaping shared urban vision. s.l., s.n., pp. 1,2,3,5,6,7.

Calvo-Sotelo, 2010. The concept of "Educational Campus" and its application in Spanish universities, Madrid: s.n.

Cammack, D., 1990. The Rand at War. London: University of Natal Press. Cammack, D., 1990. The Rand at War. London: University of Natal Press.

Claudio, A., 2008. INFORM. s.l.:s.n.

Designers, G. A. a. U., 2010. Precinct plan for a mixed use development., Johannesburg: s.n.

Elliot, D., n.d. Genifuel: developing technology producing clean energy. [Online] Available at: http://www.genifuel.com/gasification.html[Accessed July 2017].

Emmanuel, R., 2016. Urban Climate challenges in the tropics: Rethinking planning and deisgn opportunities. London: Imperial College Press.

Furuto, A., 2013. Archdaily. [Online]
Available at: http://www.archdaily.com/394395/gas-and-steam-power-plant-winning-proposal-henn
[Accessed 17 April 2017].

Giermann, H., 2015. Archdaily. [Online] Available at: http://www.archdaily.com/631048/gottlieb-paludan-architects-design-a-forest-inspired-biomass-unit-for-copenhagen [Accessed April 17 2017].
inc, G., 2017. Google Earth. [Online] Available at: www.googleearth.com [Accessed April 2017].
international, S., 2016. Coolerado-m50. [Online]

Available at: http://www.coolerado.com/m50-energy-efficient-air-conditioner/Johannesburg, U. o., 2017. PEETS Profile. [Online] Available at: https://www.uj.ac.za/Pages/Search.aspx?k=energy

Lavine, L., n.d. A Technology of Habitation. [Online] Available at: http://muse.jhu.edu/chapter/1261473[Accessed 2017].

Mavunganidze, M. L. L. R. a. J., 2015. The Johannesburg Gasworks. Johannesburg: Fourthwall Books.

Mercer, D., 2008. City of Johannesburg State of energy report, Johannesburg: s.n.

Pallasmaa, J., 2005. The eyes of the skin: architecture and the senses. West Sussex: Wiley-Academy.

Partner, B. &., 2005. Behnisch & Partner 1952-2005. [Online] Available at: http://www.behnisch-partner.de/projects/civic-buildings/hysolar-institute[Accessed 15 April 2017].

Quirk, V., 2013. BIG's Waste-to-Energy Plant Breaks Ground, Breaks Schemas, s.l.: s.n.

Restitution-park, 2017. Macro scale. Pretoria: s.n.

Rosenfield, K., 2016. Archdaiy. [Online] Available at: http://www.archdaily.com/781588/schmidt-hammer-lassen-and-gottlieb-paludan-to-design-worlds-largest-waste-to-energy-plant-in-shenzhen[Accessed March 2017].
Schumacher, E., 1989. Small is beautifull:Economics as if people mattered. New York: Harper & Row.
Tshumi, B., n.d. [Online] Available at: http://workgroups.clemson.edu/AAH0503_ANIMATED_ARCH/M.Arch%20Studio%20Documents/Tschumi_6_Concepts.pdf

tsica, 2011. Gas Works, s.l.: s.n.

Vee, S., 2010 . 15 facts you didn't know about Johannesburg. [Online] Available at: http://about-south-africa.com/home/cities/25-15-facts-you-didnt-know-about-johannesburg