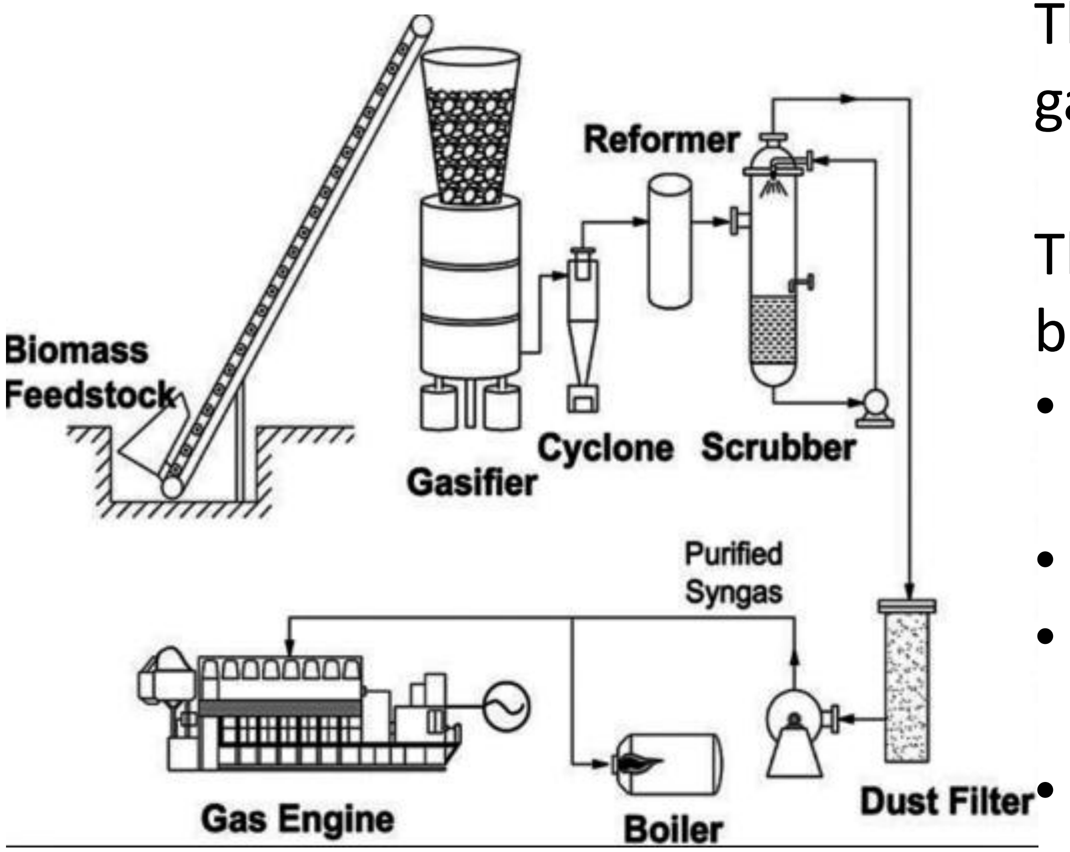
Biomass derived Power Project Identification I

OVERVIEW



The goal of the project is to implement the biomass gasifier engine and/or power generation system.

The brief presentation will entail the system breakdown in terms of

- End use of the gaseous fuel (biomass derived) in terms of power generation
- Instruments and controls
- Analytical measurements of parameters such as emissions
- Overall performance of the fuel source on the respective hardware.

SYSTEM BREAKDOWN FOR FUEL UTILIZATION

- There are 3 basic avenues via which the produced fuel can be tested

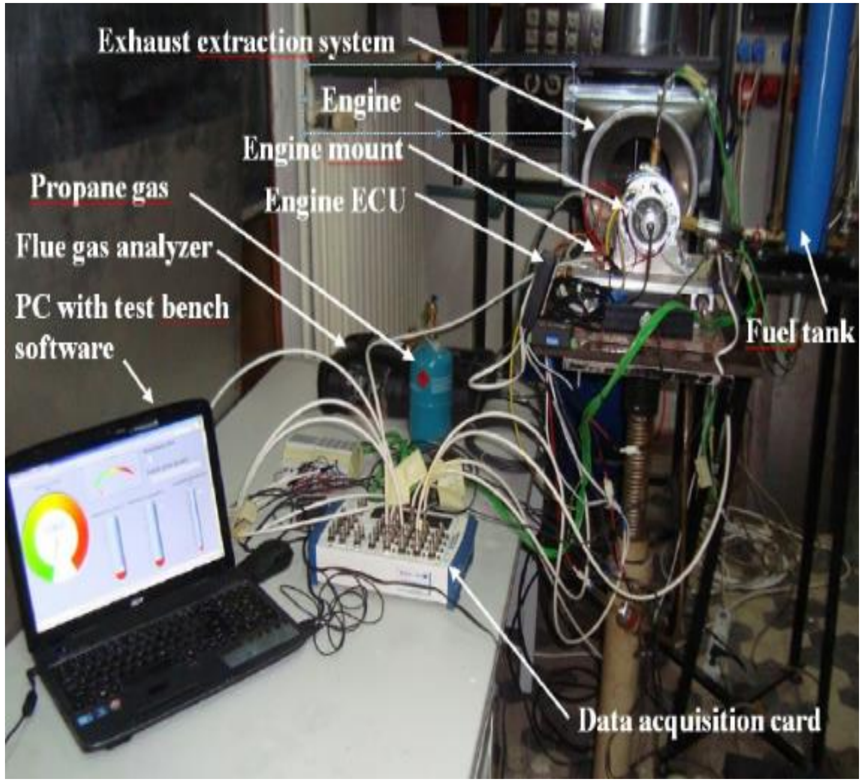
SI ENGINES	DIESEL ENGINES	GAS TURBINES
• SI engines can be used however the produced fuel gas would have low flame velocity with a higher octane value. • Suited for larger installations and would require extensive work in terms of figuring out lubrication for internal components. • Extensive modifications are a pre-requisite to mitigate power time-lag owing to the fuel mixture in the combustion chamber. • Ignition timing would also be needed to be tweaked in order to avoid knock. • High temp. spark plugs would also be essential to avoid fouling. • Fuel also could reduce equipment life. • A hydraulic break dynamometer can be used to ascertain peak power production.	• Similar large scale applications favorable since Syngas generally has a high percentage of Hydrogen. • This is difficult to burn in the IC engines because hydrogen burns very fast and hence getting a good flame prorogation is difficult. Some field conversions have been done using a diesel engine but the success rate is very low. • Extensive modifications are a pre-requisite in terms of reducing the high compression ratios associated with diesel fuels. Possibly pilot injection can be used. • Engine breathing improvements as well as forced induction can be used to maximize fuel utilization. • Fuel also could reduce equipment life. • A hydraulic break dynamometer can be used to ascertain peak power.	• Simplest solution in terms of implementation and efficiency. However, high intake pressures must be maintained for the combustor to intake the fuel for pre-ignition. • Gas must be filtered at multiple stages to establish an superior flow to the internals of the turbine to avoid damage and excess wear. • The turbine output in terms of power generation would be a good indicator of the fuels performance. • Heat generated could also be utilized further up the fuel production cycle (same applies to the rest of the methods) or to produce steam for use in piston or turbine steam engines.

Selection of micro-turbine

- Please see the links below for a few micro-turbines, that can be modified to suit our application needs.
- The end unit would need to satisfy project requirements, space restrictions and overall control homologation.
- There are existing 5 KW gas turbine generators that can be used and later switched if need be
- I would recommend this unit as it is easily modifiable and meets requirements (space, noise, safety)
- http://www.turbinetechnologies.com/educational-lab-products/turboshaft-engine-lab
- https://www.youtube.com/watch?v=FsIGWZr8WQs
- It also works on a platform (LabView) which can be easily synced with the rest of the systems.

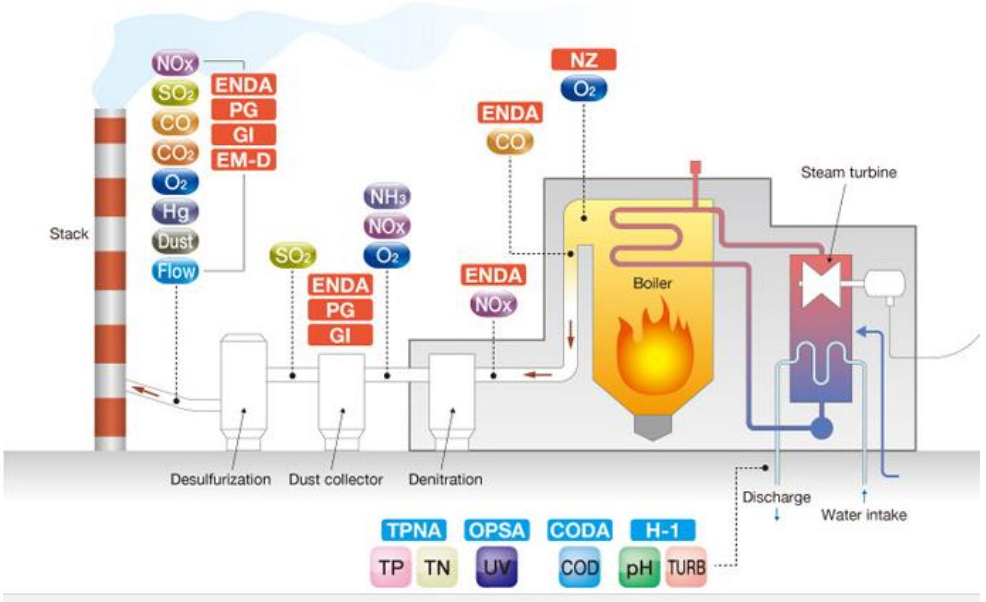
System measurements (Instruments and controls)

- Ideally having a central DAQ (data acquisition) hub to record data from the various sensors placed throughout the set-up would be essential to corroborate data and match it at the various stages of fuel production and utilization.
- As this is R&D many measurements are required to determine operating parameters and to determine where controls should be applied so it essential to map out all focal points (pressures, gas flows, temperatures etc…)
- The ranges of the key sensors would definitely be system specific; however, the placements as well as combination with the overall control scheme (in terms of feedback control for emergency shut-off and operational limitations) should be discussed.
- This would not only be limited to system level control but individual component control from one central location (eg. Controlling the turbine speed by controlling the gas flow whilst simultaneously logging emissions data).
- A list of such sensors can be made and relayed to our selected manufacturer in terms of project requirement and execution.



Emissions measurements

- Worked with emission benches extensively and existing models can be easily implemented to measure the output gases after combustion.
- However, it is as essential to get the composition of the fuel formed as well, but the focus would be more towards post-combustion in this brief.
- The image (right) is from the previous lab where the MEXA systems from HORIBA GmbH were used. The system is expensive but is widely used throughout the automotive industry (CO/CO_2, NO_x and THC analyzer). The system can be requested to have our own specified analyzers in combination (CH4, SO2, PM).
- I am including the links for the mentioned devices, my company contact will be contacted once we deem the product fit for the system for further talks.



http://www.horiba.com/process-environmental/products/process/details/va-5000-vs-5000-multi-component-gas-analyzer-31115/

http://www.horiba.com/process-environmental/application/randdlab/combustion-gas-appliances-evaluation-and-inspection/details/pg-300-portable-gas-analyzer-14647/

http://www.horiba.com/process-environmental/application/powerenergy/details/stack-gas-analyzer-gi-700-series-24881/

CO15 LAB SPACE BREAKDOWN – ________

Lab team

Lab Space breakdown

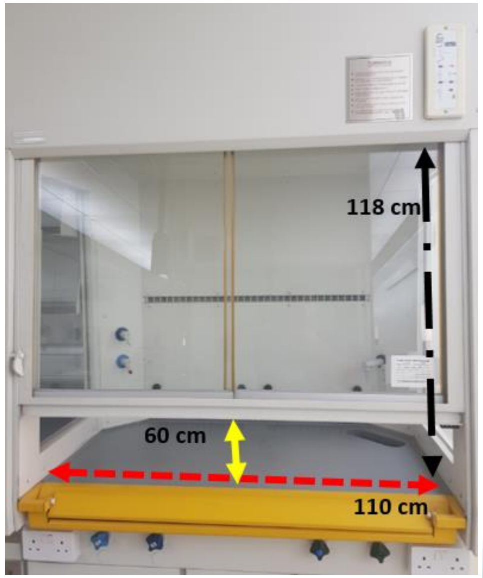
The proposed area in the lab C015 involves a work station compromising of –

- 3 Fume hoods
- 36 closing drawers
- 9 large closing drawers
- 8 open ended cabinets

The presentation entails the area space and volume breakdown of the proposed space in the lab for maximum utilization.

Please note that the displayed area is only chosen for a reference study.

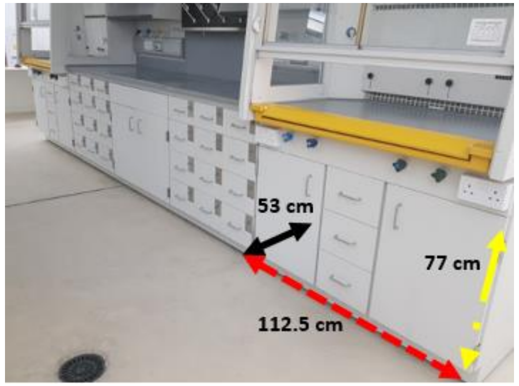
Fume-hoods



- ❖ Effective Volume: 2.336 m^3
- ❖ Floor Area: 1.98 m^2

Please note that there are three fume hoods allotted.

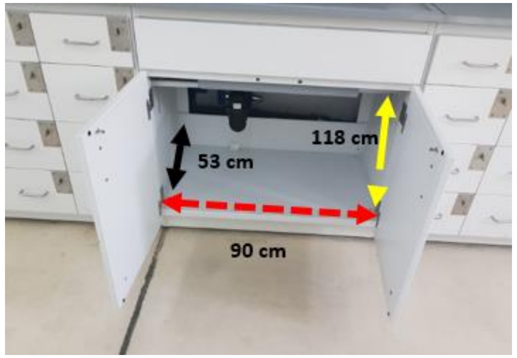
Storage space under the fume-hood



- ❖ Effective volume: 1.38 m^3

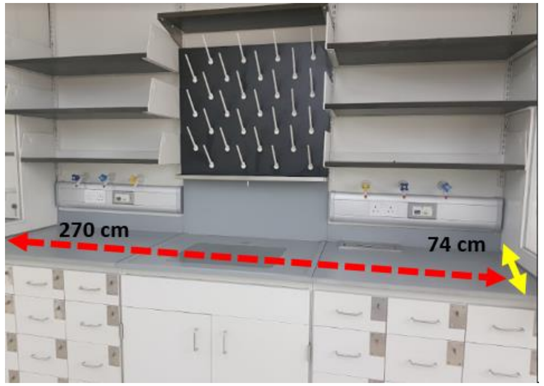
Please note that there are three closing drawer areas present in the allotted workspace area.

Middle Cabinet space



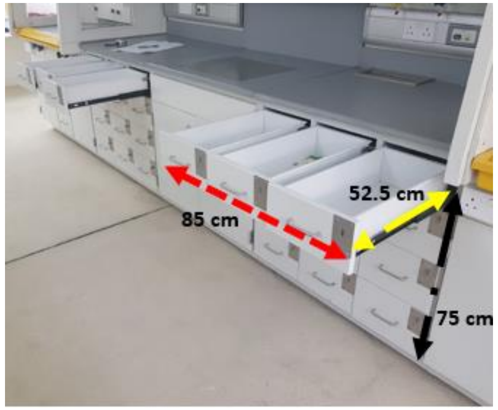
- ❖ Effective Volume: 0.562 m^3

Work-space area



- ❖ Effective Work-space Area: 2.997 m^2

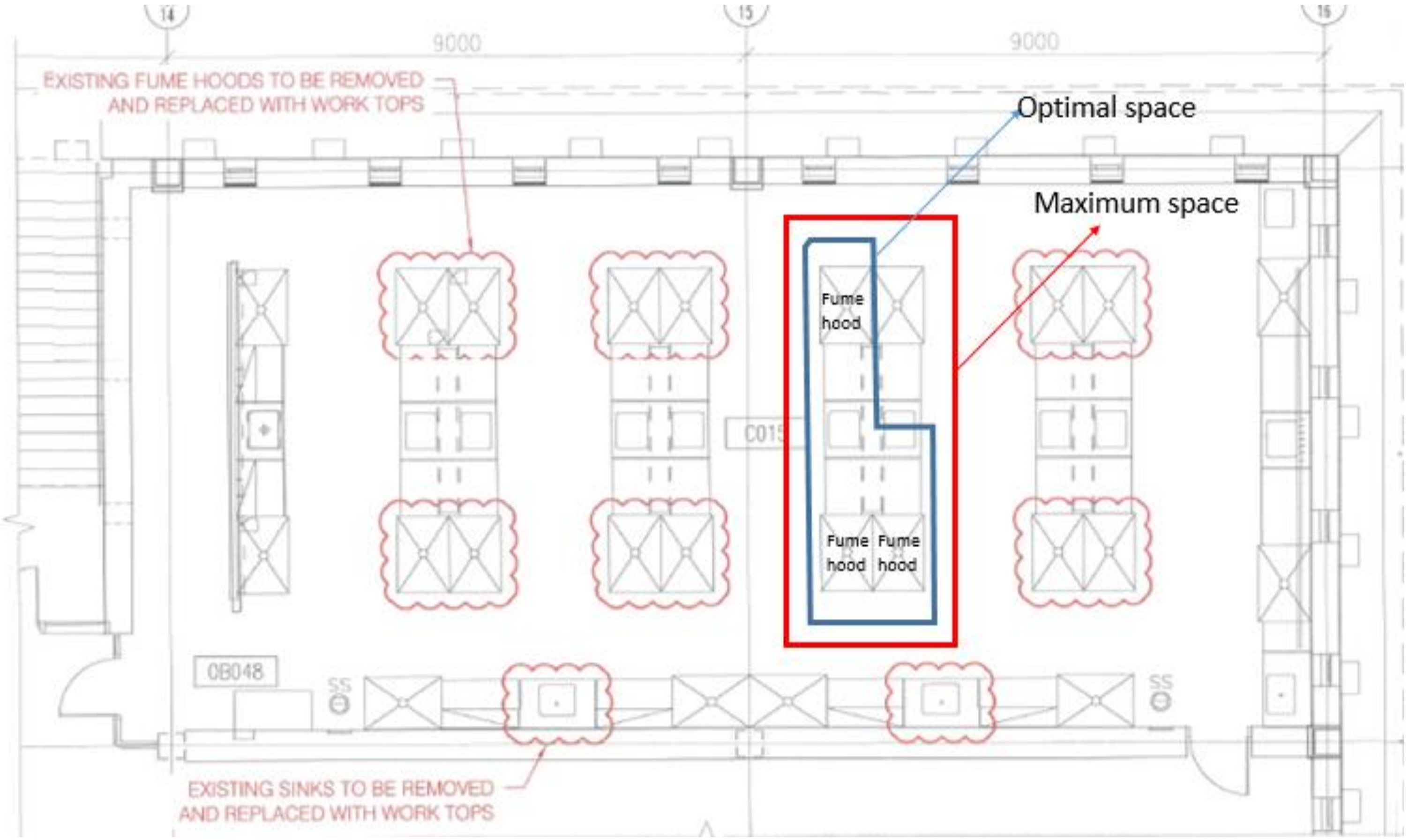
Closing Drawers



- ❖ Effective volume: 1.005 m^3

Please note that there are three closing drawer areas present in the allotted workspace area.

Lab floor plan and assigned work space



CO15 LAB SPACE BREAKDOWN

By: CSE – Lab team

Lab Space breakdown

The proposed area in the lab C015 involves a work station compromising of –

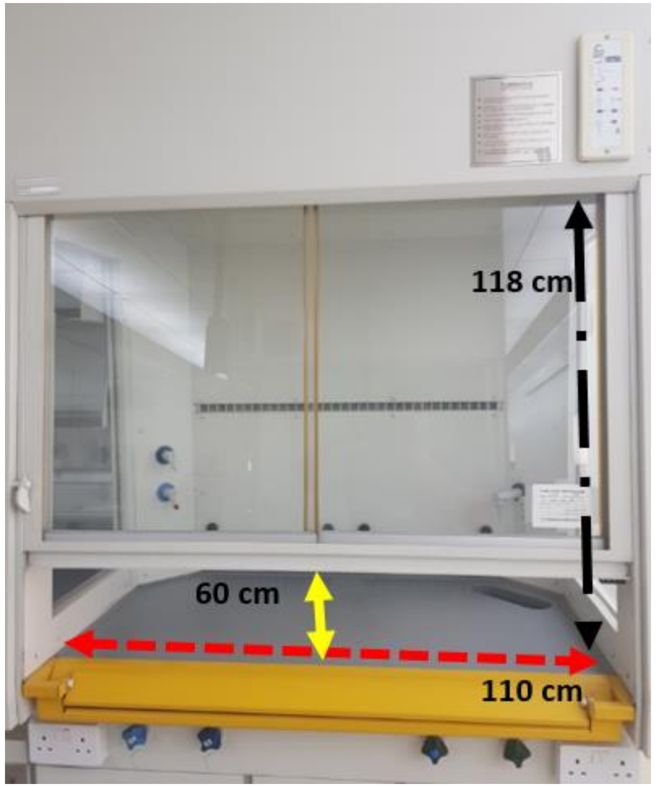
- 2 Fume hoods
- 24 closing drawers
- 6 large closing drawers
- 6 open ended cabinets

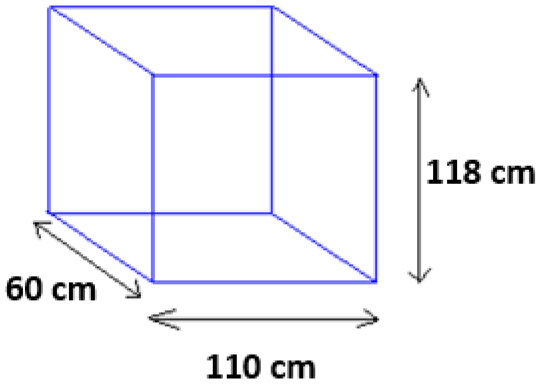
The presentation entails the area space and volume breakdown of the proposed space in the lab for maximum utilization.

Please note that the displayed area is only chosen for a reference study.

Fume Hoods

- The description and breakdown of the fume hoods in the lab is as follows:



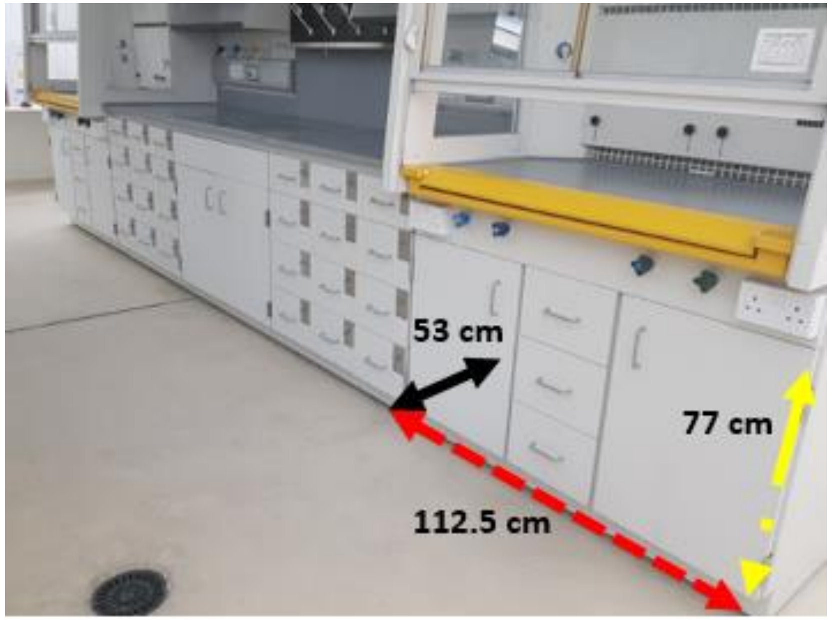


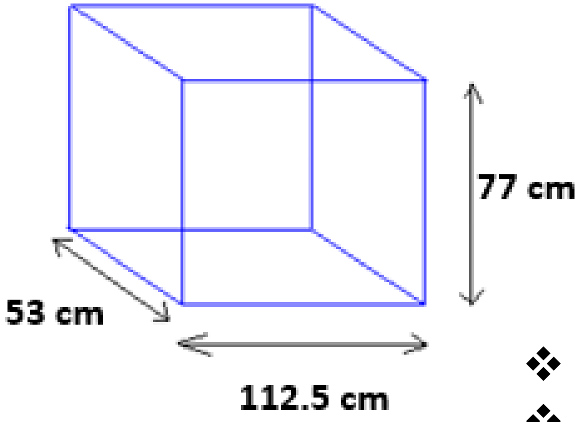
❖ Volume: 778,800 cm^3 = 0.779 m^3
❖ Floor Area: 6,600 cm^2 = 0.66 m^2

<u>Please note that there are two fume hoods present on the workspace area.</u>

Storage space under the fume-hoods

- There are two storage areas under the fume-hoods, the measurements are a gross approximation due to the limited access to the space inside.



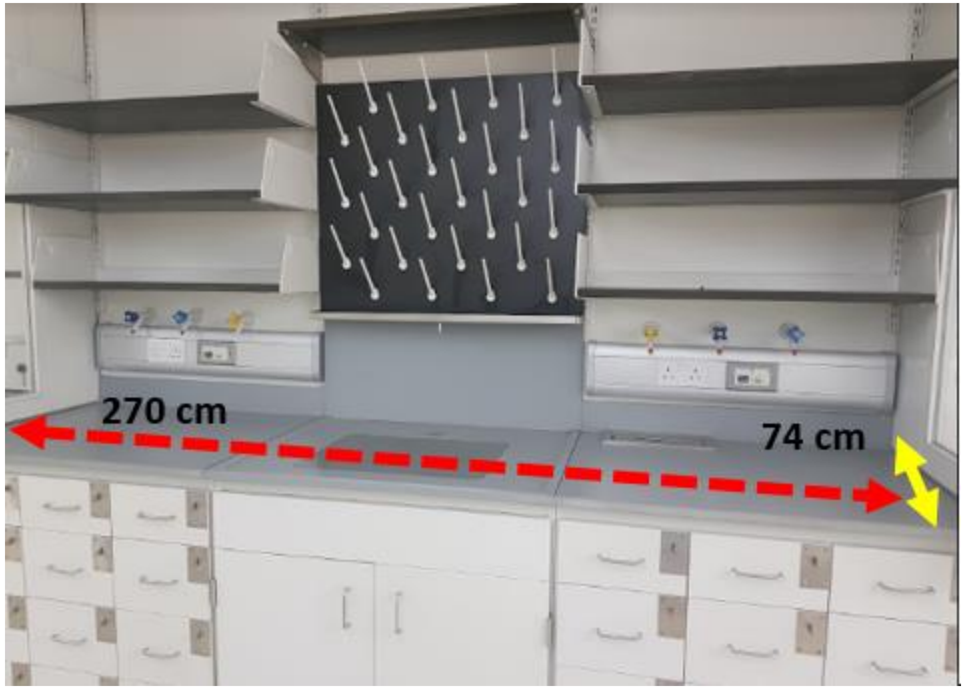


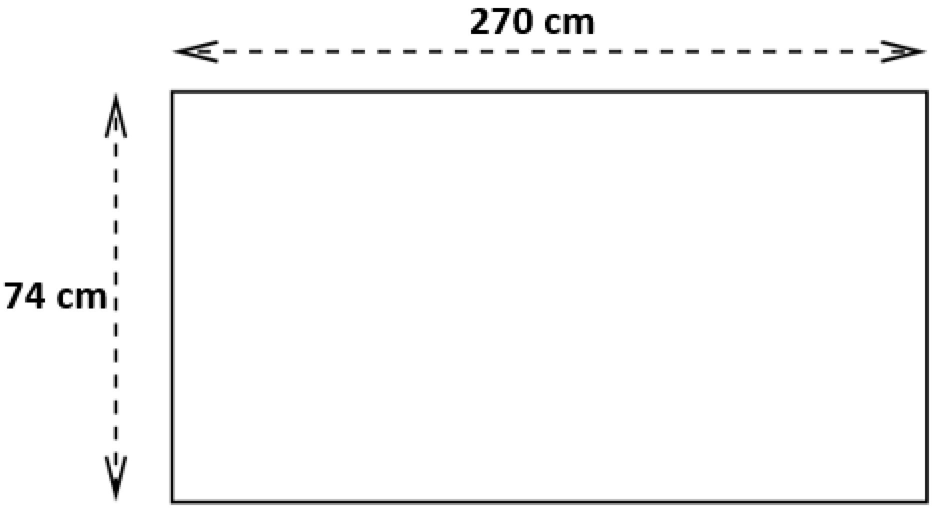
- Volume: 459,112.5 cm^3 = 0.46 m^3
- Effective volume: 0.92 m^3

Please note that there are two closing drawer areas present on the workspace area.

Work-space area

- The description and breakdown of the work-space area in the lab is as follows:

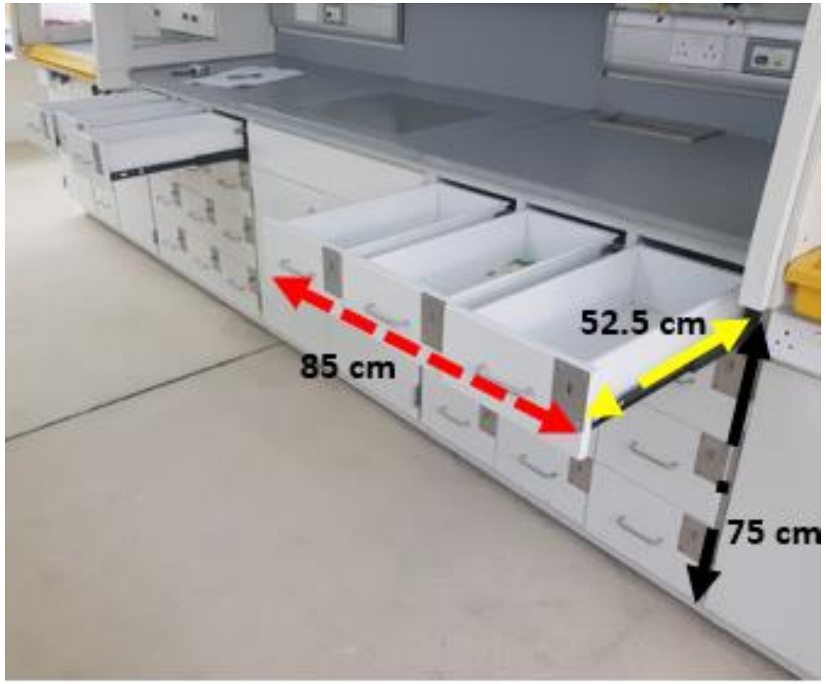


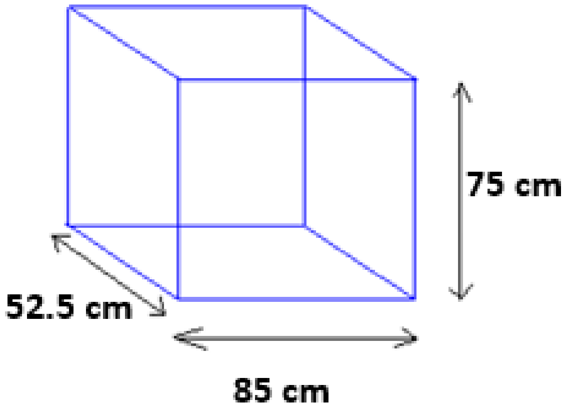


❖ Work-space Area: 19,980 cm^2 = 1.998 m^2

Closing Drawers

- There are a cumulative of 24 drawers in the designated work-space. These drawers are opened via slide mechanism and can be easily removed to free up space as per the calculations below:



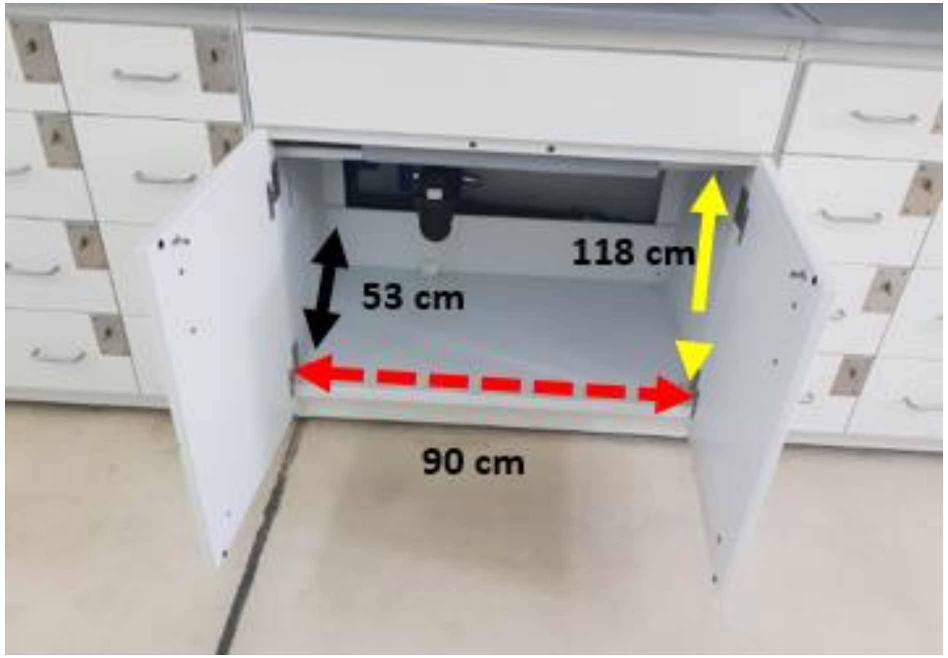


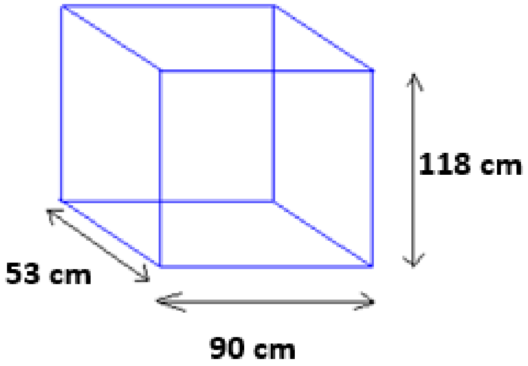
- ❖ Volume: 334,687.5 cm^3 = 0.335 m^3
- ❖ Effective volume: 0.67 m^3

Please note that there are two closing drawer areas present on the workspace area.

Middle Cabinet space

- There is one large cabinet present in the centre of the work station





❖ Volume: 562,860 cm^3 = 0.562 m^3

UTILITIES

- There are a total of 6 Power sources on the workstation (seen in red) , the power requirements for specific equipment can be added subsequently.